Walka Water Works

Remedial Action Plan

Maitland City Council

19 November 2022

→ **The Power of Commitment**

GHD Pty Ltd | ABN 39 008 488 373
GHD Tower, Level 3, 24 Honeysuckle Drive
Newcastle, New South Wales 2300, Australia
T +61 2 4979 9999 | **F** +61 2 9475 0725 | **E** ntlmail@ghd.com | **ghd.com**

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Executive summary

GHD Pty Ltd (GHD) was engaged by Maitland City Council (Council) to prepare a Remedial Action Plan (RAP) for the remediation of contamination at Walka Water Works located off South Willards Lane, Oakhampton Heights NSW (the site). The site location is shown in Figure 1 in Appendix A2.

Previous investigations of the site were carried out by GHD in 2021 and 2022, as documented in GHD's reports '*Walka Water Works, Contamination Assessment'* (GHD 2022a) (Rev. 1 dated 11 February 2022) and '*Walka Water Works, Supplementary Site Investigations 2022'* (GHD 2022e) (Rev. 0 dated 25 August 2022). Council has engaged an independent site auditor (Lange Jorstad of Geosyntec) to review investigations and remediation with the ultimate aim of certifying whether the site is suitable for ongoing recreational use subject to implementation of an appropriate long term environmental management plan (LTEMP).

Council has engaged GHD to prepare this RAP in order to progress the remediation of asbestos impacted soils so that the site can be made suitable for ongoing recreational use.

On the basis of previous investigations carried out at the site, the following conclusions were made:

– Investigations do not indicate any significant contamination is present at the site as a result of historical use except for asbestos, including bonded ACM and friable asbestos materials. While some elevated concentrations of metals and TRH were identified in soil and sediment, these are limited to exceedances of ecological criteria and based on the concentrations and frequency of occurrence, are not considered to present any significant risk to the environment nor affect the suitability of the site for continue recreational use.
– Groundwater does not appear to have been impacted by former industrial use of the site. Metals concentrations exceeding groundwater investigation levels are considered likely to be representative of natural groundwater concentrations.
– Previous surface water sampling (GHD 2022a) and Council monitoring results do not indicate any significant contamination of surface water in the reservoir has occurred from contamination on the site (e.g. attributable to historical land use), however the water quality is not considered suitable for recreational use involving exposure to the water (e.g. swimming or wading), primarily due to biological contaminants. Current restrictions to use (i.e. no swimming or fishing) should continue, however the water quality is not considered to affect the suitability of the site for other recreational (non water-based) land use.
– Areas of significant asbestos contamination have been broadly delineated and appear to be primarily confined to the following areas:
    - Former power station footprint, including beneath soft-fall in the playground (separated by geotextile) and extending into the eastern embankment beyond the fence line[1]
    - Lawn to the east of the pump house
    - The beach area, extending into the reservoir sediments and isolated occurrences around the mini train station.
– One shallow hand excavation (HE368) located near to the former workmen's cottages identified asbestos in soil exceeding the adopted human health criteria of 0.001% w/w for recreation/open space (HIL C). No visible ACM was present at this location, but some building debris was present. Previous investigations identified asbestos cement sheet in this area, which was subsequently removed. Heritage restrictions prevented more detailed intrusive investigations in this area. This area is remote from the former power station, and given the likely construction materials based on the original buildings (c1890), absence of asbestos in other samples from this area and heritage restrictions to site disturbance, on a weight of evidence it is considered likely that asbestos contamination in this area would be isolated, most likely bonded ACM and of relatively low risk of disturbance.
– Asbestos containing debris was observed on the surface of filter beds J5 and J6. These areas could not be safely accessed for sampling, but ACM has previously been identified in other filter beds.

[1] Asbestos impact is not unexpected in the embankment as it is fill material, presumably from levelling of the former power station area. While adjacent land does not appear to be filled, and hence has a lower potential for contamination, investigations have not been carried out to confirm the absence of asbestos impact to adjoining land.

– Areas of soil impacted with asbestos have been outlined on figures provided within Appendix A.
– Remediation and/or management of the areas with identified asbestos contamination will be required for the site to be suitable for use as a recreational facility.
– No asbestos has been identified outside of the above areas by inspections and soil sampling undertaken in these Supplementary Site Investigations, although isolated occurrences of asbestos contamination have been observed in previous investigations. The risk of exposure to airborne asbestos fibres from potential soil contamination in these broader site areas (including identified asbestos in soil near the former workmen's cottages) is considered low for normal use and maintenance of the site, and it is considered these broader areas of the site are suitable for recreational use subject to ongoing management under the provisions of the site-specific asbestos management plan, including provision of an unexpected finds protocol to address any contamination that may be identified during future use of the site.

The specific remediation goals for contamination to be remediated or managed at the site are as follows:

– Areas of identified contamination exceeding health investigation screening levels are capped or contained so that future site use (including routine maintenance activities) will not reasonably foreseeably result in exposure to contamination.
– Capping materials meet assessment criteria for recreational land use as described in Section 7.
– Any unexpected finds encountered during remediation are addressed in a manner consistent with this RAP.
– Remediation works are documented in sufficient detail to allow long term management of the site and maintain its suitability for recreational land use.

It is noted that this RAP has been developed on the basis of continued recreational site use consistent with the current use and configuration of the site. Any future development of site areas would require consideration of the nature of the proposed development, and appropriate investigations, assessment and (if required) remediation or management would need to be conducted to suit the specific development.

A remediation options assessment (ROA) was undertaken in consultation with Council and applicable site stakeholders. A detailed evaluation of remediation options was undertaken, and is included in Appendix B.

An ROA workshop was held with Council on 18 August 2022. As a result of the workshop, the preferred remediation approach determined in consultation with Council and relevant stakeholders consisted of the following:

– Staged approach to long term remediation of the site, taking into account funding availability, priorities for site use and details of future site configuration.
– On-site capping and containment of identified asbestos contaminated soils, including containment within existing water treatment structure voids and in-situ capping depending on available volumes for containment and feasibility of excavation (including heritage restrictions and physical constraints).
– Minor cut of soils impacted with asbestos where required to tie in to heritage features or to preserve existing mature trees, and emplacement of excavated soils beneath capped areas or within existing water treatment structure voids located on-site.
– Long term management of the on-site containment cells, capped areas and low-risk areas via a site-specific LTEMP and asbestos management plan.

Interim management of the site is required between the date of the RAP and commencement of remediation activities, as well as between stages of remediation if the site is re-opened to the public. The site is currently closed to public access. Interim site management should be conducted in accordance with the site AMP (GHD 2022h, dated 17 June 2022 or as updated in consultation with Council).

This RAP provides a summary of identified site contamination issues and description of the proposed remediation and soil management programs, procedures and standards which can be followed during the course of the remediation, to ensure the successful remediation of the site and consequently the protection of the environment and human health. It is expected that these will be supplemented by detailed design and technical specifications, and that the Contractor will prepare an appropriate detailed work plan based on the requirements of this RAP and the technical specifications.

This RAP presents a concept design of capping and containment at the site. Final design shall be developed prior to remediation in consultation with Council, heritage consultant and environmental consultant design team. It is recommended that the Site Auditor be consulted during the preparation of final design documents (i.e. prior to final

review), to facilitate appropriate interpretation of the contamination remediation or management requirements. These documents shall be reviewed by the Site Auditor prior to the commencement of remediation to confirm that they are consistent with the principles of this RAP.

A LTEMP will be required to record the placement of any contaminated material on site (including existing contaminated material remaining in situ), and provide procedures to be used in the event that it may be disturbed. The LTEMP would include measures to prevent exposure to contaminated materials under normal site use, including management of low-risk potential contamination which is not capped as part of the remediation. Specific procedures would need to be developed for any intrusive works which would result in potential exposure to contaminated materials.

As per NSW EPA 2017 the LTEMP will succinctly describe the nature and location of contamination remaining on-site and state what the objectives of the plan are, how contaminants will be managed, who will be responsible for the plan's implementation and over what time frame actions specified in the plan will take place.

GHD considers that the site can be made suitable for the proposed use by implementation of this RAP, and subject to implementation of an appropriate LTEMP.

This report is subject to, and must be read in conjunction with, the limitations set out in Section 18 and the assumptions and qualifications contained throughout the Report. No excerpts are taken to be representative of the findings of this Report.

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List of abbreviations

ACL	Added Contaminant Limit
ACM	Asbestos Containing Materials
AF	Asbestos fines
AHD	Australian Height Datum
ALS	Australian Laboratory Services
BTEXN	Benzene, Toluene, Ethyl Benzene, Xylenes and Naphthalene
CEC	Cation Exchange Capacity
CLM	Contaminated Land Management (Act 1997)
COC	Chain of Custody
CoPC	Contaminants of Potential Concern
Council	Maitland City Council
CRS	Certified Reference Standard
CRC Care	Cooperative Research Centre for Contamination Assessment and Remediation of the Environment
CSA	Contamination Site Assessment
CSM	Conceptual Site Model
DBYD	Dial Before You Dig
DQI	Data Quality Indicators
DQO	Data Quality Objectives
DGV	Default guideline value
EIL	Ecological Investigation Level
EMP	Environmental Management Plan
EPA	Environment Protection Authority
ESL	Ecological Screening Level
FA	Fibrous asbestos
FOP	Field Operating Procedure
GHD	GHD Pty Ltd
GV	Guideline value
HEPA	Heads of EPAs Australia and New Zealand
HIL	Health Investigation Level
HSL	Health Screening Level
JSEA	Job, Safety and Environmental Analysis
LCS	Laboratory Control Spike
LOR	Limit of Reporting
LTEMP	Long term EMP
m bgl	Metres below ground level
mg/L	Milligrams per litre (generally equivalent to parts per million for water)
µg/L	Micrograms per litre (generally equivalent to parts per billion for water)
NATA	National Association of Testing Authorities of Australia
NEPC	National Environment Protection Council

NEPM	National Environment Protection Measure
OCP	Organochlorine Pesticide
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated biphenyls
PFAS	Per-and poly-fluoralkyl substances
PFOS	Perfluoro-octanesulfonate
PID	Photoionisation Device
POEO	Protection of the Environment Operations (Act 1997)
QA	Quality Assurance
QC	Quality Control
RAP	Remedial Action Plan
ROA	Remedial Options Assessment
RPD	Relative Percent Difference
SAQP	Sampling and Analysis Quality Plan
SOP	Standard Operating Procedure
TCLP	Toxicity Characteristic Leachate Procedure
TRH	Total Recoverable Hydrocarbons
UCL	Upper Confidence Limit
USCS	Unified Soil Classification System
VOC	Volatile Organic Compound
WA DoH	Western Australia Department of Health

1. Introduction

1.1 Background

GHD Pty Ltd (GHD) was engaged by Maitland City Council (Council) to provide various consultancy services associated with assessment and management of contamination at the Walka Water Works located off South Willards Lane, Oakhampton Heights NSW (the site). The site location is shown in Figure 1 in Appendix A2. The site is made up of one parcel of land totalling approximately 64.23 hectares (ha). Within this, a site audit area has been nominated as illustrated on Figure 15 in Appendix A2, which encompasses the main areas of former industrial use which are considered to require remediation to be suitable for ongoing recreational land use.

Previous investigations of the site were carried out by GHD in 2021 and 2022, as documented in GHD's reports '*Walka Water Works, Contamination Assessment'* (GHD 2022a) (Rev. 1 dated 11 February 2022) and '*Walka Water Works, Supplementary Site Investigations 2022'* (GHD 2022e) (Rev. 0 dated 25 August 2022). Council has engaged an independent site auditor (Lange Jorstad of Geosyntec) to review investigations and remediation with the ultimate aim of certifying whether the site is suitable for ongoing recreational use subject to implementation of an appropriate long term environmental management plan (LTEMP).

Council has engaged GHD to prepare this remedial action plan (RAP) in order to progress the remediation of asbestos impacted soils so that the site can be made suitable for ongoing recreational use.

1.2 Objectives

The overall objectives of the RAP are to:

- Set out remediation goals so that the site can be made suitable (from a contamination perspective) for ongoing recreational use subject to implementation of an appropriate LTEMP.
- Evaluate the range of remediation options available to address the existing contamination issues at the site and thereby reduce risks to acceptable levels.
- Document the preferred remediation techniques and procedures.
- Establish the various safeguards required to complete the remediation work in a safe and environmentally acceptable manner.
- Establish a framework for interim management of the site prior to the commencement of long term remediation.
- Identify the necessary approvals and licences required by regulatory authorities in order to enable the remediation works to proceed.
- Enable an independent accredited site auditor to certify that the site can be made suitable for the proposed use, if the site is remediated and managed in accordance with this RAP, and subject to implementation of an appropriate LTEMP.

1.3 Scope of Work

The scope of work comprised:

- Liaison with Council / stakeholders as required
- Collate and review existing data and identify any data gaps to be addressed during remediation
- Identify the remediation areas within the site
- Document the relevant guidelines
- Set remediation goals
- Evaluate remediation options
- Outline the preferred remediation strategy
- Develop remediation procedures
- Document a validation process

– Identify appropriate licence and approvals required to undertake the remediation works
– Outline relevant health, safety and environmental management requirements
– Outline contingency and emergency response measures

1.4 Anticipated audit outcome

The ultimate objective of this RAP and the associated investigation reports is to support Site Audit Statements from the site auditor as follows:

– Suitability of the historical industrial land use area (including former power station, pump house, water treatment infrastructure and associated facilities encompassed by the nominated site audit area shown on Figure 15 in Appendix A2) for recreational land use subject to the provisions of an appropriate LTEMP. This is anticipated to result in a Section A2 Site Audit Statement for this area following appropriate remediation and validation. Pending remediation and validation, Interim Audit Advice or a Section B2 Site Audit Statement may be issued regarding the appropriateness of the RAP to achieve this objective.
– Appropriateness of the LTEMP (anticipated to be a single LTEMP for the overall site, with appropriate management provisions for each area of the site) to manage potential contamination that may be encountered during future use of the site in "low risk" areas outside the historical industrial use area. This is anticipated to be a Section B2 Site Audit Statement (i.e. appropriateness of the LTEMP for managing potential contamination) for this area following completion of the LTEMP.

The Auditor's role and related requirements are further discussed in Section 12.6 of this RAP.

1.5 Assumptions and limitations

The works described within this report are intended to be read in conjunction with GHD (2022a) *Walka Water Works, Contamination Assessment*, 11 February 2022 and GHD (2022e) *Walka Water Works, Supplementary Site Investigations 2022* dated 25 August 2022.

Constraints to intrusive investigations are present over the Walka Water Works and former power station portions of the site, due to the presence of historic structures (including underground remnants of structures), as discussed in Casey & Lowe (2021), *Walka Water Works Oakhampton Heights, Historical Archaeological Assessment* and Public Works Advisory (2021), *Walka Water Works Industrial Archaeological Resources – Managing perceived risks for visitors to the Walka Water Works Historic Landscape*.

Soil investigations within the broader area of the site were primarily limited to shallow soils within the nominated areas, for the presence and condition of asbestos containing materials, both bonded and friable. The general purpose of this particular aspect of the investigations was to assess the presence of asbestos in near-surface soils most subject to exposure and therefore in these areas soil sampling was generally limited to 0.1 m bgl. These investigations are not intended to delineate the full depth of potential contamination. In addition, asbestos contamination in soils is commonly discrete and highly heterogeneous, and conditions between sampling locations may be significantly different than those found at any particular location.

The levels of investigation undertaken at the site are proportional to the likelihood of contamination and level of risk in each segment of the site, considering factors such as the historical land use, nature, frequency and intensity of proposed site use, accessibility, ground cover, potential for exposure and likelihood of asbestos being present given site history and investigation results to date, and do not comprise a comprehensive investigation of the entire site. Notwithstanding, it is considered that sufficient understanding is available for preparation of this RAP and for development of an appropriate LTEMP based on the anticipated audit outcomes described in Section 1.4.

This RAP has been developed to address identified contamination at the site in order to meet the remediation objectives in Section 1.2. The RAP does not include detailed design and specification of the remediation works. It is assumed that detailed design and specifications will be completed on the basis of this RAP, following review and agreement by relevant stakeholders including the Site Auditor, and that remediation works will be implemented in accordance with the detailed design and specifications (as also reviewed and agreed to by relevant stakeholders) to meet the intent of this RAP.

This RAP is subject to and must be read in conjunction with the Limitations in Section 18.

1.6 Roles and responsibilities

The roles and responsibilities of the various parties involved in the remediation and validation of the site are outlined within Table 1.1 below.

Table 1.1 Roles and responsibilities

Role	Responsibilities
Principal Contractor Project Manager	Responsible for overall direction of civil and environmental work (including any management or remediation) associated with the earthworks contract.
Principal Contractor Design Team	Responsible for taking the requirements of this RAP into account in preparation of final earthworks design and configuration and relevant design documents and specifications, including consultation with the Environmental Consultant and Site Auditor.
Earthworks / Remediation Contractor (Contractor)	Responsible for: – Required civil works (i.e. any physical management, remediation or associated works), including all measures required to protect worker and public health and the environment during the works. – Preparing a detailed work plan for implementing the works. – Undertaking material inspections and clearances in accordance with this RAP, the approved Construction Quality Assurance (CQA) program, final design and specifications. – Preparing / obtaining and providing all relevant supporting documentation to the Environmental Consultant in relation to any remediation works carried out.
Environmental Consultant	Responsible for: – Review of detailed design to confirm the intent of the RAP has been addressed. – Providing technical guidance to the earthworks / remediation contractor in appropriately implementing the requirements of the RAP. – Verifying the Contractor's adherence to the RAP, relevant aspects of the CQA program, final design and specifications. – Monitoring of work areas for environmental purposes, collection and analysis of validation and characterisation samples, and advising the Principal Contractor of appropriate actions on the basis of observations, sampling and analysis. – Preparing a Remediation and Validation Report at the completion of remediation.
NSW EPA Accredited Site Auditor	Responsible for: – Reviewing the RAP to determine if it is appropriate to meet the remediation objectives. – Reviewing the CQA plan and other relevant documentation to be developed as part of the final design and specifications, for consistency with the intent of this RAP. – Reviewing the work of the Environmental Consultant including the Remediation and Validation Report and LTEMP. – Providing a Site Audit Statement regarding the suitability of the site at the completion of remediation and validation.

2. Site information

2.1 Site identification

Site identification and environmental setting information is summarised in Table 2.1.

Table 2.1 Site identification

Process	Response
Site Owner	Crown Lands (Maitland City Council appointed as Corporation Manager of the Walka Trust by Government Gazette)
Site Address	South Willards Lane, Oakhampton Heights NSW
Lot/DP	Lot 445 DP 722263
Local Government Area	Maitland City Council
Site Area	Approximately 64.23 hectares, of which the nominated site audit area shown in Figure 15 in Appendix A2 is approximately 4.55 ha.
Current Zoning	RE1 – Public Recreation
Previous Land Use	Former water treatment facility and power station.
Site Location and Layout Plan	Refer to Figure 1 and Figure 2, Appendix A2.
Surrounding Land Uses	– North coast railway line, former abattoir land and residential subdivision to the west – Small acreage/residential land to north – Farming land and the Hunter River to the east – Poultry and dairy farm to the south
Topography	Site elevation ranges from 35 – 37 m AHD to the north of the dam, to the west approximately 36 m AHD, 4 m AHD south east of the reservoir wall in the flood plain. The area of the former power station and pump house is between approximately 10 – 16 m AHD.
Soils and Geology	Reference to the 1:250 000 Newcastle Geology Sheet Series indicates the site is mainly underlain by the Branxton Formation and Mulbring Siltstone comprising sandstone, siltstone and conglomerate. Minor Quaternary alluvial “Waterloo Rocks” comprising gravels, sands, silts and clay may underlay the eastern edge of site. According to GHD, 2008, soil conditions identified in the Management and Concept Plan (Suters et al) include Rutherford red podzolic soils with alluvial in low-lying areas and flood plain with large areas of fill material. Generally natural material was identified as having a shale parent rock with podsolic soil profile that was fairly acid. Acid sulphate soil is not identified on the site within the Department of Planning and Environment Acid Sulphate Soil Risk Mapping tool ESpade V2.2 accessed on 12 July 2022. An area of Acid Sulphate Soil probability category L4 Low probability, >3m below ground surface is identified in the area to the immediate south of the site.
Hydrology / Hydrogeology	The description of hydrology in GHD, 2008 identifies the Walka reservoir as a small natural lagoon with a Ravensworth sandstone dam wall constructed across a broad shallow valley to flood approximately 18 Ha. It has a maximum depth of 7.5 m below the spillway with only small areas less than 1 m depth due to steep slopes into the reservoir. The area west of the North Coast Railway is identified as having low permeability soils. Low permeability increases lateral surface water flow, erosion potential and the collection of pollution through runoff into the water body (Suters et al). The majority of the site is below the 1% flood standard and subject to flood and is designated as *Floodway*. The area south-east of the reservoir wall is affected by 1 in 20 and 1 in 50 year flood events. The derelict farm building (south-east of the reservoir wall) and reservoir itself are possibly affected by a 1 in 100 year flood event (anecdotal evidence indicates that they were affected by the 1955 Maitland flood). The low lying area to the east of the site is included in the Oakhampton Floodway, and access to the site is hindered during a flood situation (GHD, 2008). The Hunter River passes approximately 500 m east of the site, where it flows generally in a southern direction before flowing to the east through multiple bends to the junction with the Williams River, eventually discharging into the Pacific Ocean at Newcastle, NSW.

Process	Response
	No registered groundwater bores were listed on the WaterNSW database within 1000 m of the Site as of 2 July 2021. The surface topography of the Site suggests that the groundwater flow direction is towards the reservoir and towards the Hunter River to the east. GHD installed six groundwater monitoring bores during these supplementary investigations. Depth to groundwater was found to be within five to seven metres below ground level (m bgl) during the sampling event undertaken in June 2022. Groundwater flow direction at the time of investigations was inferred to be from the former water treatment and former power station areas east towards adjoining low lying land and the Hunter River, and west towards the reservoir, as discussed in Section 10.5 of GHD (2022e). There is no known current use of surface water and groundwater at the site with the exception of passive use of the reservoir e.g. for bird watching, model boats and potential for unauthorised uses such as fishing.

2.2 General site description

Reference should be made to the *Walka Water Works, Contamination Assessment* (GHD, 2022a) and *Walka Water Works, Supplementary Site Investigations (GHD 2022e)* for site observations from previous reports. A summary is provided below. Key site features are shown in Figure 2, Appendix A2.

The Site generally slopes to the east and south, draining into the large lagoon (reservoir) which was created as part of the water treatment works. The Site can be considered to generally comprise four sections:

– The west and north-western section which comprises relatively undeveloped native woodland.
– A well grassed area to the north of the reservoir containing the caretaker's residence and maintenance building.
– The reservoir in the centre of the site and a small area of adjoining land to the south.
– The eastern section of the site comprises the buildings and infrastructure associated with the original Walka Water Works. This section also includes the site of the former power station, which has now been cleared and is well grassed.

The western section of the site is relatively undeveloped, with only the mini train railway line and access tracks in this area. The majority of the mini train railway line, which is approximately 3.5 km in length, is constructed on southern bank of the cooling water channel (described below), with some of the mini train railway line and part of the main access track around the reservoir located on the cutting of the former rail spur, which was used to transport coal to the former power station.

The eastern section of the Site comprises the Walka Water Works buildings and infrastructure, which includes the former pumping station (pump house), settlement tank, seven filter beds (of which five have been filled) and the former clear water tank. Some bald patches within areas of grass cover are present near filter beds 3 and 4, with coal chitter the predominant visible ground surface in these bald patches.

A former cooling water channel runs east-west to the north of the Walka reservoir. To the east of the pump house is a flat well-grassed area, which was previously used for coal stockpile storage. To the south of the pump house is a flat well-grassed area formerly occupied by the power station. This area contains a number of barbeque facilities, picnic seats, toilet facilities and a playground. Council has advised that original treated timber playground was located between the current playground and the fence on the eastern side. When Council took over management of the site circa 2006 it was identified that the playground was on the transpiration area, and hence the playground was moved to its current area. The site of the current playground was levelled, possibly using asbestos contaminated soils. The playgrounds are inspected quarterly and the soft-fall mulch is 'topped-up' as required, typically every 3 – 5 years and includes 50 – 75 mm of topping directly to the existing soft fall. The existing see-saw was removed and replaced about 5 years ago, involving an excavation approximately 1.5 m x 1.5 m x 1 m deep.

The road surrounding the former power station footprint is capped with gravel, as is the road to the south of the pump house and the road to the caretaker's residence. The access road to the site is paved with concrete or asphalt in the section to the east of the pump house.

GHD staff and Council representatives met at the site on 1 February 2022 to observe site conditions and discuss remediation or management requirements for particular areas of the site. During this meeting, the lawn next to the pump house appeared in good condition. Previous test pit locations were not evident (the turf was removed and replaced at the time of test pit investigations in 2021), and only isolated areas were noted without good cover (a small area with sparser grass cover near the centre of the southern portion of the lawn, and mulched areas around shrubbery to the south-west). Grass cover on the former power station footprint was also good, noting the summer of 2021/2022 had been relatively wet and a good growing season. The area of the playground had been fenced off by Council in 2021, and grass was overgrown within the fenced area.

The area around previous sampling location HE101 (a flat area immediately to the north of the "beach") had areas of bare soil. The bank leading down to a gravelly beach area at the north-east end of the reservoir was partly covered by weeds, with bare ground on the western and eastern sides and much of the beach. A number of fragments of highly weathered potential ACM were observed in this area, and a partially exposed piece of suspected ACM lagging material was observed near the top of the bank leading to the beach. Laboratory analysis confirmed these materials contained asbestos.

2.3 Site use and maintenance

As described in Council's *Project Brief, Walka Water Works Recreation & Wildlife Reserve Grounds Maintenance* (MCC, 2021), the Walka Recreation & Wildlife Reserve is a Council managed facility open to the public 7 days a week between the hours of 7am and 5pm (7am to 7pm during daylight savings). The Site historically housed a 19th century water pumping station, drinking water reservoir, filtration beds and other supporting buildings and infrastructure. Many of these features are listed on the NSW heritage register and the entire site was incorporated into the Recreation and Wildlife Reserve site in the 1990's.

The Site now offers a variety of settings, which include:

– Heritage listed pump house building and structures
– Open reserves and parkland
– Large reservoir with sandstone dam wall
– Ornamental lawns and gardens
– Picnic areas with barbeques and tables
– Playground
– Serviced amenities
– Walking and biking trails
– Miniature train
– Model boat club platform and shelter
– Bird watching hide

The entire Site attracts a variety of users, including walkers, tourists, school groups, special interest groups, Park Run [for the last 7 years, averaging 300 participants per week[2]], and Council organised special events. The pump house building and lawn area adjacent also host weddings every weekend, and the site has been featured in several national television series.

Typical recreational uses as advised by Council (pers comms, Scott Warner, March 2022) are generally consistent with the above, and also include a children's playground, and impromptu small scale games (e.g. cricket, soccer, rugby etc.).

Details of site use and maintenance are provided in Sections 2.3 and 2.4 of GHD (2022e).

[2] https://www.parkrun.com.au/maitland/

2.4 Site history

Based on the documents reviewed, the eastern portion of the Site has previous been used as a water treatment facility and former power station. The former water treatment facility with heritage value remains at the site as well as the alignment of the former rail spur that was used in conjunction with the former power station.

A brief summary of the site history is provided below.

Walka Water Works is a well-preserved 19 century industrial complex, one of the largest in the Hunter Valley. It is particularly valued for the evidence of late 19th and early 20th century water treatment features. The site history is summarised below:

- 64.23 Ha of Crown Land is reserved for the “Preservation of Historical Sites and Buildings” under the Crown Lands Act 1989 and the Crown Lands Amendment Act 2005.
- The Site was used as a water treatment facility between 1885 and 1931.
- The Site was used as a temporary power station between 1951 and 1976, with the power station and rail spur removed in 1978.
- The Site has been recognised by the National Trust and Heritage Council for its heritage significance.
- The Site was declared Crown Land in November 1982 and reserved for “Preservation of Historical Sites and Buildings – Reserve No 97511”.

A review of historical aerial photographs between 1961 and 2006 indicated that in 1961 the power station was situated on the area to the south of the main pump house building, with associated coal stockpiles on land immediately to the east and on the filled in filter beds to the west of the pump house. Two cooling towers could be seen west of the pump house on former filter beds. The engineer’s residence and former caretaker’s residence could also be seen to the north and northwest of the pump house. On the western side of the reservoir, a large cleared section, possibly excavation, could be seen. No building was present on the southern side of the weir, where footings were sighted during a previous site inspection. Signs of possible construction activity, possibly associated with the outlet channel, were apparent at the southern end of the weir. The cooling water return channel could be seen on the northern side of the lagoon. The northwest section appeared to be absent of any activities.

Aerial photographs between 1961 and 1965 indicate the cooling water outlet channel was more defined, and water was present in the settling tank. The excavation scarring on the western side of the lagoon had diminished slightly.

Aerial photographs from 1965 supplied by Council show the power station infrastructure to the south with coal stockpiles and above ground storage tanks (suspected to have been used for oil storage) on the sand filter beds to the west of the pump house. The main coal conveyor was adjacent to the east of the pump house. The settling tank was north of the sand filter beds.

In the 1976 aerial photograph that coal stockpiles had been removed and the engineer’s residence and caretaker’s residences were not present immediately to the north of the pump house.

In the 1993 photograph, the power station buildings had been removed, including associated infrastructure. The cooling towers were still present immediately to the west of the pump house, and small acreage residential development was present to the north of the Site. The scarring present on the western side of the lagoon is still present but further diminished in size.

The 2006 photograph shows that the former power station site, the coal stockpile site to the east of the pump house and the filter bed areas were well grassed. A new caretaker’s residence and a maintenance building had been erected to the west of the former building and the cooling water channel was poorly defined. The scarring present in previous photographs on the western side of the lagoon was still present, although it had diminished significantly.

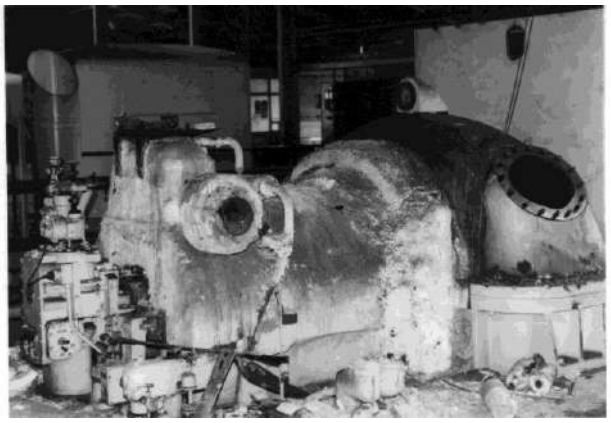
GHD 2008 notes that ash was reported to have been disposed of into the eastern corner of the dam, and subsequently removed and used as fill under the existing model train shed. Further, GHD 2008 outlines that interviews with a former power station engineer indicated that ash and ‘construction material’ was dumped to the west of the former power station site.

More detailed site history is available in Casey & Lowe (2021) *Walka Water Works, Oakhampton Heights, Historical Archaeological Assessment*.

A brief review of water treatment methods utilised at the Walka Water Works site was undertaken. Given that the site involved sand filtration methods, with the site operational from 1887-1929, chlorination for disinfection or other forms of chemical treatment are not believed to have been utilised at the site. No significant use or storage of chemicals is known to have occurred at the site except for oil or fuel storage as part of the former power station.

Historical photographs provided by Council suggest that the main source of asbestos contamination in soils at the site is likely to be attributable to demolition of the former power station and subsequent regrading of the site. While no records of site works following demolition are available, the photographs (see selection in Table 2.2 below) show extensive asbestos containing materials were present in the power station, and demolition at the time was apparently not subject to strict standards of control as would have been the case in later years.

Table 2.2 Historical photographs of power station



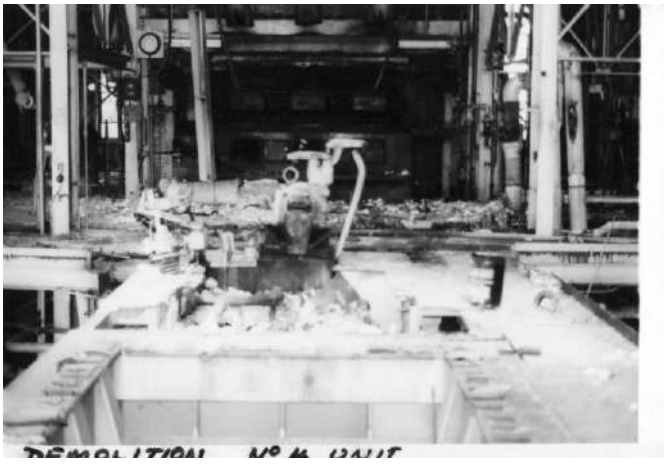
Apparent friable lagging, January 1978

Power station demolition, January 1978

Power station demolition, January 1978

Power station demolition, January 1978

Power station demolition, January 1978



Power station demolition, January 1978

2.5 Historical off-site potential sources of contamination

Most adjoining land uses (residential, agricultural – grazing) are considered to have a low potential for contamination impact to the site, although agricultural use may contribute nutrients and bacteriological impacts to surface water. Most agricultural land use is down-gradient (topographically) of the site.

GHD 2008 reported that the reservoir at the Walka Water Works site once received run-off from adjacent grazing and marshalling land associated with the Maitland Abattoir located to the west of the site. An historical aerial image from 1961 shows drainage lines from the abattoir to the west of the site. A limited sampling program was undertaken by GHD in 2008, to close data gaps in possible contamination risks at the Walka Water Works site from the adjacent grazing and marshalling land associated with the abattoir.

A Maitland City Council City Wide Development Control Plan No. 16, Former Rutherford Abattoir site and adjoining land, dated 24 January 2006 was reviewed. The plan's purpose was to give detailed guidance to people wishing to carry out development within the specified area. The plan also indicates Council's objectives and policies for the area which can form a basis for negotiation should a departure from the provisions of this plan be sought.

No plans regarding any remediation conducted at the abattoir site have been observed.

Current aerial images indicate the area formerly occupied by the abattoir site has been largely developed for housing.

Given the overall distance to the site from the former abattoir, surface water sampling results and the overall time since abattoir was in operation, its historical presence is not considered a source of contamination at the site.

The north coast rail line is located to the west of the site, running generally north-south, between the site and the former abattoir. The north coast rail line is not currently known to be a source of contamination within the site.

3. Summary of previous investigations and remediation

3.1 Previous investigations

3.1.1 GHD 2022a

Results of previous investigations completed by GHD (in 2008 and 2021) and Practical Environmental Solutions (PES) (2013 and 2020) are presented in GHD 2022a. Key findings are summarised below.

The results were compared to the health and environmental criteria for recreational/open space as well as commercial industrial land use (further discussed in Section 7). The contamination assessment found that chemical contaminants do not present any significant harm to health or the environment for the proposed land use, but a number of areas were identified where the presence of asbestos presents a potential risk to recreational users or maintenance workers. The Site was considered suitable for recreational use subject to appropriate management of asbestos in these areas.

Recommendations for management were provided, including selection of a preferred remediation / management strategy in consultation with relevant stakeholders, with consideration of factors such as heritage constraints, sensitivity of proposed land use, ongoing liability and maintenance requirements, WHS regulations and NSW EPA policies relating to remediation.

A risk-based approach was taken to investigations of asbestos in soil at the Site, given the size of the Site, varied nature of historical land use, and heritage constraints to intrusive investigations around remaining and former historical infrastructure. Locations where significant asbestos in soil was discovered were subject to additional investigations (as part of the above-mentioned contamination assessment) to attempt to delineate the extent of contamination and better define management or remediation requirements. The extent of asbestos contamination has not been fully defined, and hence the whole Site is subject to management requirements, with the degree of management proportionate to the relative risk of impact and exposure.

Areas of previously identified asbestos contamination relating to the site are illustrated on Figures 5.1 and 5.2 from GHD (2022a), included in Appendix A1.

3.1.2 GHD 2022e

The investigation was conducted to minimise data gaps pertaining to contaminated land at the Walka Water Works property to inform future management and remediation approaches to make the site suitable for public use as a recreational facility. Key findings are summarised below.

– Asbestos concentrations in or on soil exceeding the adopted human health criteria are present within the areas nominated as:
    - The former power station footprint
    - The lawn to the east of the pump house
    - The beach area
    - Broader areas of the site including at the former workmen's cottages
– Historical information suggests most asbestos contamination in soils at the site, particularly friable asbestos materials, is likely to have resulted from demolition and removal of the former power station and ancillary structures, and regrading of the site at that time. Conversely, heritage structures such as the former workmen's cottages constructed of brick c1890 (Casey & Lowe 2021) have a low potential for friable asbestos materials, with any related asbestos contamination likely associated with minor outbuildings or additions from a later stage using bonded asbestos cement products.
– Some (minor) aesthetic impacts were observed in the fill materials across the Site, including glass, brick, concrete and asbestos fibre cement within the former power station and water treatment facilities.

– Concentrations of TRH F3 fraction exceeded the ecological screening level criteria in several locations within the sand filter beds and water treatment infrastructure. The exceedances were likely attributed to residual coal from previous land use and are not considered to affect the suitability of the site for its proposed use.
– Concentrations of several metals (arsenic, copper, nickel and zinc) and TRH (>C10-C40 and >C10-C3) within sediment samples within the former cooling water channel (SED101 – SED103), and within the reservoir (SED104) were above the sediment toxicant default guideline value (SQGV) low value but were below the SQGV high value and are not considered to affect the suitability of the site for its proposed use or present a significant risk to the environment. TRH exceedances identified at SED101 and SED102 were reported above the SQGV-high value, however following silica gel clean up analysis, concentrations were below the limit of reporting (LOR).
– Concentrations of arsenic, cadmium, chromium, copper, lead, nickel and zinc were reported above the adopted freshwater trigger values for 95% species protection level and the health (drinking water) criteria in surface water samples from the cooling water channel. However, based on the site's current use and there being no exceedances within the reservoir, the reported concentrations do not impact the site's suitability for the current recreational land use.
– Despite anecdotal evidence that mercury was historically used in vacuum equipment at the site and that spills had occurred, there were no elevated concentrations of mercury in the soil, sediment or surface water samples analysed as part of this assessment. This does not preclude the potential for isolated areas of mercury contamination to be present on the site but indicates an absence of widespread impact from potential mercury contamination.

The following conclusions were made:

– Investigations do not indicate any significant contamination is present at the site as a result of historical use except for asbestos, including bonded ACM and friable asbestos materials. While some elevated concentrations of metals and TRH were identified in soil and sediment, these are limited to exceedances of ecological criteria and based on the concentrations and frequency of occurrence, are not considered to present any significant risk to the environment nor affect the suitability of the site for continue recreational use.
– Groundwater does not appear to have been impacted by former industrial use of the site. Metals concentrations exceeding groundwater investigation levels are considered likely to be representative of natural groundwater concentrations.
– Previous surface water sampling (GHD 2022a) and Council monitoring results do not indicate any significant contamination of surface water in the reservoir has occurred from contamination on the site (eg. attributable to historical land use), however the water quality is not considered suitable for recreational use involving exposure to the water (e.g. swimming or wading), primarily due to biological contaminants. Current restrictions to use (i.e. no swimming or fishing) should continue, however the water quality is not considered to affect the suitability of the site for other recreational (non water-based) land use.
– Areas of significant asbestos contamination have been broadly delineated and appear to be primarily confined to the following areas:
    - Former power station footprint, including beneath soft-fall in the playground (separated by geotextile) and extending into the eastern embankment beyond the fence line[3].
    - Lawn to the east of the pump house.
    - The beach area, extending into the reservoir sediments and isolated occurrences around the mini train station.

[3] Asbestos impact is not unexpected in the embankment as it is fill material, presumably from levelling of the former power station area. While adjacent land does not appear to be filled, and hence has a lower potential for contamination, investigations have not been carried out to confirm the absence of asbestos impact to adjoining land.

- One shallow hand excavation (HE368) located near to the former workmen's cottages identified asbestos in soil exceeding the adopted human health criteria of 0.001% w/w for recreation/open space (HIL C). No visible ACM was present at this location, but some building debris was present. Previous investigations identified asbestos cement sheet in this area, which was subsequently removed. Heritage restrictions prevented more detailed intrusive investigations in this area. This area is remote from the former power station, and given the likely construction materials based on the original buildings (c1890), absence of asbestos in other samples from this area and heritage restrictions to site disturbance, on a weight of evidence it is considered likely that asbestos contamination in this area would be isolated, most likely bonded ACM and of relatively low risk of disturbance.
- Asbestos containing debris was observed on the surface of filter beds J5 and J6. These areas could not be safely accessed for sampling, but ACM has previously been identified in other filter beds.
- Areas of soil impacted with asbestos have been outlined on figures provided within Appendix A2.
- Remediation and/or management of the areas with identified asbestos contamination will be required for the site to be suitable for use as a recreational facility.
- No asbestos has been identified outside of the above areas by inspections and soil sampling undertaken in these Supplementary Site Investigations, although isolated occurrences of asbestos contamination have been observed in previous investigations. The risk of exposure to airborne asbestos fibres from potential soil contamination in these broader site areas (including identified asbestos in soil near the former workmen's cottages) is considered low for normal use and maintenance of the site, and it is considered these broader areas of the site are suitable for recreational use subject to ongoing management under the provisions of the site-specific asbestos management plan, including provision of an unexpected finds protocol to address any contamination that may be identified during future use of the site.
- The CSM was updated, and the assessment of source-pathway- receptor linkages indicates chemical contaminants do not present any significant risk to human health or the environment for the proposed land use, but the following possible or potentially complete linkages are present in relation to asbestos:
    - Potential for inhalation of asbestos fibres from disturbance of asbestos contaminated soil, sediments or surface ACM for recreational uses or maintenance workers.
- It is considered that sufficient understanding of site contamination is available to prepare a remediation options assessment for the site and subsequently a remediation action plan.

Based on the findings of investigations carried out at the site, the following recommendations were made:

- Maintain appropriate interim asbestos control measures at the site to control asbestos exposure risks until such time that long term remediation at the site is conducted. These include restricting access to areas of the site with significant identified asbestos contamination; maintaining good grass cover, periodic inspections of site conditions and implementing appropriate asbestos control measures during site maintenance activities.
- The water level within the reservoir should be maintained to limit exposure to asbestos contamination within sediments adjacent to the beach area. Should the water level become lower in the future, additional management and/or remediation may be required in this area.
- The preferred remediation approach should be selected in consultation with relevant stakeholders, with consideration of factors such as heritage constraints, sensitivity of proposed land use, ongoing liability and maintenance requirements, WHS regulations and NSW EPA policies relating to remediation. A remediation options assessment (ROA) should be used for initial stakeholder consultation, followed by preparation of a remedial action plan (RAP) to implement the agreed remediation strategy.
- Update the site's AMP and asbestos register with results of the latest assessments undertaken. The area of the former workmen's cottages known to contain asbestos in soil exceeding the adopted human health criteria should have specific procedures within the site AMP for ongoing use and management. Sediments containing asbestos adjacent to the beach area should be noted within the site AMP.

3.2 Interim asbestos removal and management

3.2.1 Caretaker's cottage asbestos removal

GHD 2022a identified asbestos fibre cement debris to the ground surface within two separate areas of the site which were recommended as a priority for removal. The two areas included:

– The site caretaker's residence driveway area
– The former filter bed footprint area

GHD report 12553096-LET_Caretakers Cottage Clearance Letter dated 31 March 2022 outlines the asbestos removal works undertaken and provides a clearance certificate for the asbestos removal works in these areas.

3.2.2 Asbestos management plan and interim site management

GHD prepared a site-specific asbestos management plan (AMP) for the site (GHD Ref: 12553096-REP-1 *Walka Water Works Asbestos Management Plan* dated 17 June 2022 – GHD 2022h) outlining interim management approaches to identified asbestos containing materials within structures and identified asbestos in soil at the site.

The AMP includes procedures developed in consultation with Council to carry out grounds maintenance activities at the site.

Since issue of the AMP, Council has closed and fenced the Walka Water Works site to restrict access pending implementation of interim remediation measures and long-term remediation of the site.

4. Site contamination status

Details of site contamination identified through investigations carried out to date are described within GHD 2022a and GHD 2022e. A conceptual site model and assessment of source, pathway receptor linkages is provided below in Section 5. As outlined in Section 3.1.2, investigations do not indicate any significant contamination is present at the site as a result of historical use except for asbestos, including bonded ACM and friable asbestos materials. On this basis the site contamination requiring active remediation or management is limited to that associated with asbestos concentrations in or on soil exceeding the adopted human health criteria located within areas nominated as:

– The former power station footprint including beneath soft-fall in the playground (separated by geotextile) and extending into the eastern embankment beyond the fence line
– The lawn to the east of the pump house
– The beach area, extending into the reservoir sediments and isolated occurrences around the mini train station.

As noted in Section 3.1.2, it is considered the broader areas of the site areas (including identified asbestos in soil near the former workmen's cottages) are suitable for recreational use subject to ongoing management under the provisions of a LTEMP incorporating the site-specific asbestos management plan, including provision of an unexpected finds protocol to address any contamination that may be identified during future use of the site.

As noted in Section 3.1.2, water quality in the reservoir is not considered suitable for recreational use involving exposure to the water (e.g. swimming or wading), primarily due to biological contaminants. Current restrictions to use (i.e. no swimming or fishing) should continue, however the water quality is not considered to affect the suitability of the site for other recreational (non water-based) land use.

4.1 Former power station footprint

Bonded and friable asbestos containing materials were identified within fill materials during sampling activities in the forms of ACM, asbestos fines (AF) and fibrous asbestos (FA). Materials containing asbestos were identified to include weathered (friable) fibre cement products, non-friable fibre cement products and friable rope/lagging materials.

Asbestos in soil impacts were identified at surface to at least 0.6 m bgl within the area former power station area.

Large fragments of ACM in the form of non-friable fibre cement products were also identified to the east of the access road near the north east corner of the power station area at HE311.

Refer to Figure 5.2 (from GHD 2022a) and Figure 12 (from GHD 2022e) provided within Appendix A, outlining the former power station footprint area, and information regarding exceedances of assessment criteria.

4.2 Lawn to the east of the pump house

Bonded and friable asbestos containing materials were identified within fill materials during sampling activities in the forms of ACM, AF and FA. Materials containing asbestos were identified to include weathered (friable) fibre cement products and non-friable fibre cement products.

Asbestos in soil impacts were identified at surface to at least 0.2 m bgl within the lawn to the east of the pump house.

Refer to Figure 5.2 (from GHD 2022a) and Figure 12 (from GHD 2022e) provided within Appendix A, outlining the lawn to the east of the pumphouse area, and information regarding exceedances of assessment criteria.

4.3 Beach area

4.3.1 Landside

Bonded and friable asbestos containing materials were identified within fill materials during sampling activities in the forms of ACM, AF and FA, including friable asbestos materials on the ground surface. Materials containing asbestos were identified to include weathered (friable) fibre cement products, non-friable fibre cement products and friable rope/lagging materials.

Asbestos in soil impacts were identified at surface to at least 1.5 m bgl which was the extent of investigations below ground level within the beach area.

Refer to Figure 5.2 (from GHD 2022a) and Figure 12 (from GHD 2022e) provided within Appendix A, outlining the beach area, and information regarding exceedances of assessment criteria.

4.3.2 Sediments

Bonded and friable asbestos containing materials were identified within sediments during sampling activities completed in the forms of ACM, AF and FA. Materials containing asbestos were identified to include weathered (friable) fibre cement products and loose fibre bundles.

Sediments containing asbestos are present at least approximately 10 – 15 m from the shoreline (shoreline at the time of the assessment), and the lateral and vertical extent of asbestos within sediment is unknown.

Refer to Figure 5.2 (from GHD 2022a) and Figure 12 (from GHD 2022e) provided within Appendix A, outlining the beach area, and information regarding exceedances of assessment criteria.

4.4 Broader areas of site including former workmen's cottages

Visible suspected asbestos containing fibre cement debris were observed on a ramp at the entrance to the J06 Filter beds.

In addition, friable asbestos containing materials were identified by the laboratory at one location (HE368 in the former workmen's cottage area) within fill materials during sampling activities. No visible asbestos was observed at this location, although there were metal and glass fragments in the soil. Further investigations (e.g. by test pitting) were not possible in this area due to heritage restrictions. This area is remote from the former power station, and given the likely construction materials based on the original buildings (c1890), absence of asbestos in other samples from this area and heritage restrictions to site disturbance, on a weight of evidence it is considered likely that asbestos contamination in this area would be isolated, most likely bonded ACM and of relatively low risk of disturbance.

Refer to Figure 5.1 (from GHD 2022a) and Figure 12 (from GHD 2022e) provided within Appendix A, outlining broader areas of the site including the former workmen's cottages, and information regarding exceedances of assessment criteria.

4.5 Estimated extent of remediation

Based on the information outlined above, the estimated extent of remediation (i.e. areas requiring active remediation such as capping or containment) is as shown in Table 4.1. It should be noted that due to the discrete nature of asbestos contamination, the absence of identified contamination at any individual sampling point should not be taken as evidence that the immediately surrounding areas are not contaminated – rather each area of identified impact (as described above) should be considered on a weight of evidence, which suggests whether the overall area is likely to be contaminated. It should also be noted that depths of contaminated fill are not well defined, and were variable based on investigations undertaken; hence the volumes should be considered approximations. The power station area has the greatest uncertainty in depths and overall volumes. Volumes of asbestos impacted sediment are unknown, but an allowance has been included below based on Section 4.3.2.

Table 4.1 Estimated extent of remediation

Location	Approximate area (m^2)	Estimated depth (mbgl)	Estimated volume (m^3)
Power station area	10,000	0.5 – 1.5	5,000 – 15,000
Pump house lawn	2,300	0.6	1,400
Beach area (extending north to access road)	1,000	0.8 - 1.5	800 – 1,500
Sediments	1,000	0.5 – 1.0	500 – 1,000
Estimated Total	12,500	NA	7,700 – 19,000

5. Conceptual site model

5.1 Contaminants of concern

Based on the previous investigations undertaken at the site as described in GHD 2022a and GHD 2022e, the identified contaminants of concern (i.e. presenting a potential unacceptable risk to human health or the environment for continued recreational use of the site) are limited to the following:

– Asbestos contamination in soils
– Metals in groundwater
– Metals, biological contaminants and nutrients in surface water (reservoir)

5.2 Source-pathway-receptor CSM

A CSM based on the findings of the previous investigations is presented in Table 5.1.

Table 5.1 Conceptual site model

Sources	Pathways	Receptors	Pathway Present?
Contaminated soils on site including: – impacts from former electrical generation activities, water treatment and hazardous building materials, including ACM – Volatile organic compounds (VOCs) associated with former site use, including fuel tanks. – Contaminants associated with coal use, disposal and storage. – Potential contaminants associated with rail spur relating to use of pesticides / herbicides and asbestos from train braking – Off-site sources including adjacent former Abattoir	Inhalation of contaminated particles/dust/ asbestos fibres	On or offsite intrusive maintenance workers	<u>Industrial use area</u> Possible for recreational users and maintenance workers –asbestos debris and friable asbestos have been identified in soils within the former power station footprint, in the lawn east of the pump house and the "beach" area. Although there is grass cover over the main areas of asbestos contaminated soils in the pump house and former power station areas, some other areas particularly the beach) were observed with ACM on the soil surface and there is potential for recreational users and maintenance workers to come in contact with impacted soils through direct exposure and inhalation if soils are disturbed. Friable asbestos poses a higher risk as it is not bound by a matrix. Access to these areas should be restricted on an interim basis, and the areas should be remediated to avoid potential exposure during future land use. <u>Remaining site area</u> Unlikely – only isolated instances of asbestos impact to soils were observed in remaining areas of the site, and the likelihood of historical sources of impact is much lower. It is considered these areas can be managed under the provisions of a long-term EMP, without active remediation.
		Recreational users	
	Direct contact (including ingestion and dermal exposure) with contaminated soil (chemical contaminants)	On or offsite intrusive maintenance workers,	Unlikely – No soil samples reported concentrations above the HIL/HSL. Soil sampling has been limited in some portions of the site, however the general absence of contamination across the site, and absence of historical sources of impact outside the industrial use area indicates the potential for undiscovered contamination is low.
		Recreational users	
		Offsite receptors	Unlikely – No significant contamination was identified near site boundaries and off-site receptors are unlikely to come into contact with onsite soils.

Sources	Pathways	Receptors	Pathway Present?
		Ecological receptors	Unlikely– Soil samples reported TRH F3 fraction concentrations above the ESL during the investigation. TRH concentrations are likely linked to coal chitter that has been used as fill at the Site.
Contaminated surface water including: – Contaminants potentially associated with the former power station or water treatment – Off-site sources including adjacent former Abattoir	Direct contact (including ingestion and dermal exposure) with contaminated water	Recreational users and visitors including unauthorised use for fishing	Unlikely – Whilst contamination exceeding recreational exposure criteria in the reservoir water was identified in review of the MCC surface water monthly sampling data, there is no known current use of surface water and groundwater at the site with the exception of passive use of the reservoir e.g. for bird watching, model boats and potential for unauthorised uses such as fishing. Restrictions should remain in place.
		On or offsite intrusive maintenance workers	
		Ecological receptors	Unlikely – while metals concentrations exceeded aquatic guidelines in the former cooling water channel, this water was stagnant and the channel heavily vegetated, and concentrations did not exceed aquatic guidelines in the reservoir.
Contaminated ground water including: – Per- and poly-fluoroalkyl substances (PFAS) potentially associated with the former power station – Soil contaminants associated with historical use of the site	Leaching of contaminants into groundwater Extraction of groundwater for use Migration of groundwater to ecological receptors	On or offsite intrusive maintenance workers Recreational users and visitors Ecological receptors	Unlikely. Groundwater is not extracted for use at the site, and nearby residential properties have reticulated water. Groundwater is relatively deep and is unlikely to be encountered during excavations at the site. No significant impact to groundwater was apparent, and metals concentrations exceeding GILs are considered likely to be representative of natural groundwater conditions.
Contaminated sediments	Inhalation of contaminated particles/dust/ asbestos fibres	On or offsite intrusive maintenance workers Recreational users and visitors	Possible – asbestos has been identified in sediments adjoining the beach area. If water levels in the reservoir drop and sediments become exposed, or if sediments are removed and dried out, there is a potential for airborne fibres.
	Direct contact (including ingestion and dermal exposure) with contaminated sediments	Recreational users and visitors	Unlikely – exposure to contaminated sediments unlikely by users of community area, given restrictions to active use of the reservoir and thick vegetation present in the former cooling water channel. Sediments localised to reservoir and former cooling water channel and will not move off site.
		On or offsite intrusive maintenance workers	Unlikely – sediment concentrations were below the SQGV high value for metals and TRH following silica gel clean up analysis.
		Ecological receptors	Unlikely– Sediment exceedances were below the SQGV high value criteria. Sediment mobilisation into the surface water body is unlikely and the reservoir is not connected to offsite receptors.

5.1 Complete SPR Linkages

The identified SPR linkages are considered to be complete or partially complete for the following scenarios:

– Concentrations of asbestos in soil in the former industrial areas of the site could lead to inhalation of harmful concentrations of airborne asbestos fibres through disturbance during current and future use of the site by receptors including:
  - Recreational users
  - Maintenance workers
– Should the water level in the reservoir drop and sediments be exposed and dry out, concentrations of asbestos in sediments could lead to inhalation of harmful concentrations of airborne asbestos fibres to current and future users of the site including:
  - Recreational users
  - Maintenance workers

6. Relevant legislation and guidelines

6.1 State legislation and guidelines

NSW has a comprehensive suite of guidelines relating to assessment and management of contamination, administered by the EPA[1] under the *Contaminated Land Management Act* (CLM Act) 1997 and the *Protection of the Environment Operations Act* (POEO Act) 1997. These include the following:

– NSW EPA (1995). *Contaminated sites: Sampling Design Guidelines*. New South Wales Environment Protection Authority, 1995 (recently superseded by NSW EPA 2022, listed below, however the EPA has advised the 1995 guidelines may be utilised for projects that were already in progress).
– NSW EPA (2022). *Contaminated Land Guidelines: Sampling design part 1 – application* and *Sampling design part 2 – interpretation.* NSW Environment Protection Authority, August 2022.
– NSW EPA (2014). *Waste Classification Guidelines, Part 1: Classifying Waste*. November 2014.
– NSW EPA (2015). *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*. New South Wales Environment Protection Authority, 2015.
– NSW EPA (2017). *Contaminated Sites: Guidelines for NSW Site Auditor Scheme (3rd ed.)*. New South Wales Environment Protection Authority, 2011.
– NSW EPA (2020) *Guidelines for consultants reporting on contaminated land*, NSW EPA, 2020. New South Wales Environment Protection Authority, August 2020.
– NSW DEC (2007). *Guidelines for the Assessment and Management of Groundwater Contamination*. NSW Department of Environment and Conservation, 2007.
– NSW EPA (2015). *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*. NSW Environment Protection Authority, 2015.
– NSW EPA (2014). *Waste Classification Guidelines Part 1: Classification of Waste*. NSW Environmental Protection Authority, 2014.

Guidelines approved under the CLM Act also include:

– NEPC (2013). *National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 1999.* National Environment Protection Council, as amended in May 2013.
– NHMRC/NRMMC (2011). *Australian Drinking Water Guidelines.* National Health and Medical Research Council and Natural Resource Management Ministerial Council of Australia and New Zealand, 2011 (updated November 2016).
– ANZG (2018). *Australian and New Zealand Guidelines Fresh and Marine Water Quality*. The Australian and New Zealand Governments, 2018.
– Friebel, E and Nadebaum, P (2011). *Health screening levels for petroleum hydrocarbons in soil and Groundwater. CRC CARE Technical Report no. 10*. CRC for Contamination Assessment and Remediation of the Environment, Adelaide, Australia, 2011.
– CRC CARE (2017) *Technical Report No. 39, Risk-based management and remediation guidance for benzo(a)pyrene*. CRC for Contamination Assessment and Remediation of the Environment, January 2017.

Other guidelines used in the framework for assessment of asbestos contamination include:

– Western Australian Department of Health (WA DoH) *Guidelines for Remediation and Management of Asbestos Contaminated Sites in Western Australia* (WA DoH 2009).
– WA DoH (2021), *Guidelines for the assessment, remediation and management of asbestos contaminated sites in Western Australia*, WA Department of Health.

It is noted that the WA DoH guidelines are not officially endorsed by the NSW EPA, although the 2009 guidelines are extensively referenced in the NEPM (NEPC 2013). As noted in Section 6.1.2 below, the NSW EPA has issued a position statement on the updated WA DoH (2021), which is not a legal requirement but has been taken into account in this RAP. It is further noted that the EPA's position statement was subject to significant comment from the consulting industry, and is currently under review by the EPA.

6.1.1 CLM Act

At this time the site is not subject to a Notice or Declaration under the Contaminated Land Management Act 1997 (CLM Act). However, the remediation works are subject to site audit, which is being carried out in accordance with relevant requirements of the CLM Act. As discussed in Section 4.5.3 of the ROA in Appendix B, the EPA's recent Position Statement on WA DoH (2021) indicates the CLM Act is the appropriate legislation (together with relevant planning and assessment legislation) for regulation of historical asbestos contamination.

6.1.2 POEO Act

The Protection of the Environment Operations (POEO) Act 1997 administers a wide range of environmental requirements including pollution offences as well as waste regulatory requirements. Particularly relevant to this site are the following.

The POEO (Waste) Regulation 2014 introduced an amendment to Schedule 3 of the POEO (General) Regulation 2009, to the definition of "land pollution", which "*for the purposes of paragraph (b) of the definition of **land pollution** or **pollution of land** in the Dictionary to the Act, the following matter is prescribed:….(c) more than 10 tonnes of asbestos waste…"*

This is present as subclause 1 under Section 148 of the POEO (General) Regulation 2021.

Subclause 2 states:

> *Matter referred to in subclause (1) is excluded from the definition of land pollution or pollution of land in the Dictionary to the Act if the matter is placed in or on, or otherwise introduced into or onto, land on which the matter was generated—*
>
> *(a) in accordance with an approved voluntary management proposal, management order or ongoing maintenance order under the Contaminated Land Management Act 1997 or a public positive covenant or restriction imposed under section 29 of that Act, or*
>
> *(b) as part of category 1 remediation work carried out under State Environmental Planning Policy No 55—Remediation of Land.*

As discussed in Section 6.1.4 below, the remediation is expected to be category 1 remediation, which would therefore be excluded from this prescribed pollution of land offence.

The EPA provided a position statement in April 2022 relating to the WA DoH *Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia* (WA DoH 2021) (Position statement — WA guidelines for the assessment, remediation and management of asbestos contaminated sites (nsw.gov.au)). It should be noted that this position statement is currently under review by the EPA, following substantial response from practitioners. While a number of the positions taken by the EPA in this statement are contentious, these generally do not relate to the proposed remediation of the Walka Water Works site; rather EPA's position is generally supportive of the nature of the proposed remediation, as indicated by the following extracts:

- Land that is significantly contaminated as a result of poor historical on-site management of asbestos materials is generally regulated by the EPA under the CLM Act and Contaminated Land Management Regulation 2013.
- The asbestos and the contaminated soil are most commonly disposed of to a landfill licenced to accept asbestos waste. If they have not been imported to the site, it may be possible to bury them on site in an approved containment cell.
- Guidance for design and construction of containment cells is found in the Contaminated Land Management Guidelines for the NSW Site Auditor Scheme **(PDF 998KB)** and the **Environmental Guidelines - Solid waste landfills (PDF 1.18MB)**. [Note, the EPA has since verbally acknowledged that the Environmental Guidelines – Solid waste landfills are not necessarily applicable to design of containment cells].
- In NSW, asbestos contaminated soil can be contained/buried elsewhere on the same site, but only if:
  - it has not been imported to the site
  - the site has appropriate development consent and/or complies with relevant planning legislation
  - it does not trigger s142A of the POEO Act in relation to pollution of land
  - it does not trigger s144AAB of the POEO Act

- containment is the most appropriate remediation strategy and is supported by a remedial action plan and an ongoing Environmental Management Plan
- it meets any other relevant requirements.

– The EPA also strongly recommends that a notation be placed on the relevant section 10.7 planning certificate and/or a notation on the land title.

Any off-site disposal of material would need to comply with the requirements of the POEO (Waste) Regulation 2014.

6.1.3 EP&A Act 1979

The Environmental Planning and Assessment Act 1979 (EP&A Act) provides the framework for environmental planning and development approvals and includes provisions to ensure that the potential environmental impacts of a development are assessed and considered in the decision-making process.

Parts 4 and 5 of the EP&A Act contain requirements for environmental assessment and approval.

Part 4 provides for control of development that requires development consent from a consent authority (typically a local council, but sometimes a regional planning panel or some other public body).

Within Part 5 of the Act, Division 5.1 provides for control and assessment of 'activities' that do not require development consent under Part 4. Division 5.2 provides for environmental assessment and approval of State Significant Infrastructure.

The need or otherwise for development consent is regulated by environmental planning instruments made under this Act – primarily State Environmental Planning Policies (SEPPs) and Local Environmental Plans (LEPs).

6.1.4 SEPP (Resilience and Hazards) 2021

The State Environmental Planning Policy (Resilience and Hazards) incorporates the former SEPP 55 – Remediation of Land. Chapter 4 of the Resilience and Hazards SEPP aims to promote the remediation of contaminated land to reduce the risk of harm to human health or any other aspect of the environment.

Section 4.8 of Chapter 4 in this SEPP outlines remediation works which are considered to be category 1 remediation and therefore requires development consent. Remedial works fall within category 1 where any of the following apply to those works:

(a) designated development, or

(b) carried out or to be carried out on land declared to be a critical habitat, or

(c) likely to have a significant effect on a critical habitat or a threatened species, population or ecological community, or

(d) development for which another State environmental planning policy or a regional environmental plan requires development consent, or

(e) carried out or to be carried out in an area or zone to which any classifications to the following effect apply under an environmental planning instrument:

(i) coastal protection,

(ii) conservation or heritage conservation,

(iii) habitat area, habitat protection area, habitat or wildlife corridor,

(iv) environment protection,

(v) escarpment, escarpment protection or escarpment preservation,

(vi) floodway,

(vii) littoral rainforest,

(viii) nature reserve,

(ix) scenic area or scenic protection,

(x) wetland, or

(f) carried out or to be carried out on any land in a manner that does not comply with a policy made under the contaminated land planning guidelines by the council for any local government area in which the land is situated (or if the land is within the unincorporated area, the Western Lands Commissioner).

Based on the available information, GHD understands that the planning pathway for the proposed works will be Section 4.8 – Category 1 remediation work: work needing consent, that is work:

> *– (e) carried out or to be carried out in an area or zone to which any classifications to the following effect apply under an environmental planning instrument—*
>
> *(ii) conservation or heritage conservation.*

Walka Water Works is listed on the State Heritage Register (Heritage item I222, Maitland LEP 2011):

> *– …a person cannot carry out any development in relation to the land on which the building, work or relic is situated, the land that comprises the place, or land within the precinct, except in pursuance of an approval granted by the approval body under Subdivision 1 of Division 3.*

6.1.5 Protection of the Environment Operations Act

Activities requiring an EPA license under Schedule 1 of the POEO Act include contaminated soil treatment works for on-site or off-site treatment (including in either case incineration or storage of contaminated soil but excluding excavation for treatment at another site) that:

– Handle more than 1,000 m^3 per year of contaminated soil not originating from the site on which the works are located; or

– Handle contaminated soil originating exclusively from the site on which the works are located and:

- Incinerate more than 1,000 m^3 per year of contaminated soil.
- Treat otherwise than by incineration and store more than 30,000 m^3 of contaminated soil.
- Disturb more than an aggregate area of 3 hectares (30,000 m^2) of contaminated soil.

As indicated by the estimated extent of remediation discussed in Section 4.5, it is not anticipated that any of these thresholds will be exceeded by the proposed remediation works, and hence licensing would not be required under the POEO Act.

6.1.6 NSW Heritage Act

As noted in Casey & Lowe (2021), the main legislation governing heritage, including relics, is the NSW Heritage Act 1977. The Walka Water Works is listed on the NSW State Heritage Register as an item of cultural significance. This means the item is of Stage heritage significance and warrants conservation into the future for the State, and is managed under s.57 of the NSW Heritage Act. According to s.57, any potential disturbance to the heritage infrastructure is prohibited except pursuant to an approval granted under Subdivision 1 of Division 3.

According to Casey & Lowe (2021), impacts within the identified curtilage of the Walka Water Works SHR area which may lead to the disturbance and removal of relics require an approval from the Heritage Council of NSW under s.60 of the Heritage Act 1977. This requires the writing of an Archaeological Research Design for the application, specifying the methodology to undertake any excavation and field recording, and identifying suitably qualified archaeologists to undertake this work.

A number of policies are recommended in Casey & Lowe (2021) which are relevant to proposed remediation works that have the potential to disturb any of the heritage infrastructure.

The management of site heritage will need to be considered in preparation of final design and during project environmental planning.

6.1.7 Work health and safety act, asbestos removal regulations and codes of practice

The Principal Contractor has a legal obligation under the Work Health and Safety Act 2011, and prescribed in the Work Health and Safety Regulations 2017, to ensure the work health and safety of its workers, subcontractors and visitors.

As asbestos will be encountered within fill at the site, the primary legislative requirements and Codes of Practice detailing the Principal Contractor's obligations regarding the presence of asbestos on the site are listed as follows:

– Work Health and Safety Act 2011 (NSW)
– Work Health and Safety Regulations 2017 (NSW)
– How to Manage and Control Asbestos in the Workplace, 2019 SafeWork NSW
– How to Safely Remove Asbestos, 2019 SafeWork NSW

6.2 Local Council requirements

Maitland City Council does not have a specific policy related to contaminated land. The requirements of SEPP (Resilience and Hazards) 2021 would apply in relation to notification of remediation works.

It is considered that Maitland City Council will address any particular concerns relating to site contamination as part of the development approval process.

6.3 Commonwealth legislation

The principal Commonwealth environmental legislation potentially relevant to the site is the Environment Protection and Biodiversity Act 1999 (EPBC Act). The EPBC Act provides that the Commonwealth is to be involved in matters of "National Environmental Significance" (NES).

Under the environmental assessment provisions of the EPBC Act, actions that are likely to have a significant impact on a matter of NES are subject to an assessment and approval process.

The EPBC Act identifies seven matters of NES:

– World Heritage properties
– National Heritage places
– Ramsar Wetlands of international significance
– Nationally listed threatened species and ecological communities
– Listed migratory species
– Commonwealth marine areas
– Nuclear actions (including uranium mining)

When there are habitats or species of national significance (as listed under the schedules of the Environment Protection and Biodiversity Conservation Regulation 2000) within the project remediation area likely to be impacted negatively upon by the proposed remediation works, then preparation and lodgement of an EPBC Act referral to the Commonwealth for the assessment would need to be considered and addressed accordingly.

Such requirements will presumably be addressed in planning and approval documentation for redevelopment of the site, and have not been further considered in this RAP.

7. Remediation assessment criteria

7.1 Relevant guidelines

The framework for the remediation made herein, was developed with reference to relevant guidelines including:

– *Contaminated Sites: Sampling Design Guidelines* (EPA, 1995)
– *Contaminated Land Guidelines: Sampling design part 1 – application* and *Sampling design part 2 – interpretation*. (EPA, 2022a)
– *Consultants reporting on contaminated land: Contaminated Land Guidelines* (EPA, 2020)
– *Practice note: Preparing environmental management plans for contaminated land (EPA, 2022b)*
– *Contaminated Land Management: Guidelines for the NSW Site Auditor Scheme* (3rd edition), (EPA, 2017)
– *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*, (EPA NSW, 2015)
– *National Environment Protection (Assessment of Site Contamination) Measure 1999* as amended 2013 (NEPC 2013)
– WA DoH (2021), *Guidelines for the assessment, remediation and management of asbestos contaminated sites in Western Australia*, WA Department of Health.

7.2 National Environmental Protection (Assessment of Site Contamination) Measure 1999

The *National Environment Protection (Assessment of Site Contamination) Measure 1999* (referred to herein as the NEPM) was produced by the federal National Environmental Protection Council (NEPC) in 1999 and was revised and updated in 2013 by way of the *National Environmental Protection (Assessment of site Contamination) Amendment Measure 2013*. The NEPM provides a national framework for conducting assessments of contaminated sites in Australia.

The purpose of the NEPM is to *"establish a nationally consistent approach to the assessment of site contamination to ensure sound environmental management practices by the community which includes regulators, site assessors, environmental auditors, landowners, developers and industry."*

The desired environmental outcome for the NEPM is to *"provide adequate protection of human health and the environment, where site contamination has occurred, through the development of an efficient and effective national approach to the assessment of site contamination".*

The NEPM addresses assessment of contamination, and does not provide specific guidance for remediation or management of risk.

The NEPM includes two Schedules: Schedule A comprises a flowchart of the recommended general process for the assessment of site contamination and its relationship to the management of site contamination and Schedule B consists of technical guidelines about site assessment criteria, site investigation procedures, laboratory analyses, human health risk assessment, ecological risk assessment, derivation of investigation levels, groundwater risk assessment, community engagement and risk consultation and competencies and acceptance of environmental auditors and related professionals.

In broad terms, the assessment process can be described as:

– Tier 1 Preliminary investigation, laboratory analysis and interpretation, development of a conceptual site model (CSM) and assessment of results with reference to investigations or screening levels. The need for risk-based remediation assessment to derive response levels and/or the need for remediation is evaluated.
– Where required, Tier 1, Tier 2 or 3 detailed investigation / Site specific risk assessment, laboratory analysis and interpretation is completed, and the requirement for remediation is evaluated.

The NEPM (NEPC 2013) includes a range of ecological investigation and screening levels, health investigation levels and health screening levels for a range of contaminants and for a range of land use and exposure scenarios.

The NEPM (Schedule B1, Section 2.1.2) states that investigation and screening levels are not clean-up or response levels nor are they desirable soil quality criteria. Investigation and screening levels are intended for assessing existing contamination and to trigger consideration of an appropriate site-specific risk-based approach or appropriate risk management options when they are exceeded. The use of these levels in regulating emissions and application of wastes to soil is inappropriate.

The use of investigation and screening levels as default remediation criteria may result in unnecessary remediation and increased development costs, unnecessary disturbance to the site and local environment, and potential waste of valuable landfill space. Similarly, the inclusion of an investigation and screening level in this guidance should not be interpreted as condoning discharges of waste up to these levels.

However, as noted in Schedule B4 Section 2.4.1 of the NEPM, under some circumstances further assessment of contaminants exceeding Tier 1 criteria [investigation or screening levels] may not be conducted, e.g. where the extent of the exceedance and cost of remediation is small and further assessment is not cost effective.

In relation to asbestos, the NEPM notes that a detailed site investigation (DSI) may not be necessary although this will depend on the site-specific circumstances and the proposed remediation approach. Conservative management of presumed asbestos contamination may avoid the need for a DSI.

The NSW EPA has indicated in their position statement on WA DoH (2021) that they do not readily accept site-specific criteria for asbestos in soils, and the concentrations of asbestos contamination encountered are likely to still exceed any site-specific criteria. Therefore, it is considered that a conservative approach to management of the identified contamination will be more acceptable to the regulators than a site specific-risk assessment to derive clean-up levels, which would also be unlikely to change the remediation requirements for this site.

7.3 Validation and assessment criteria – soils

The NEPM includes a range of ecological investigation and screening levels, health investigation levels and health screening levels for a range of contaminants and for a range of land use and exposure scenarios. The selection of the assessment criteria has been based on the following site-specific characteristics:

– The current land use for the Site is open space and recreation
– Subsurface generally expected to be clay, sandy clays and clayey sands (fill and natural)
– There is a potential for direct contact with contaminated soils
– There is a potential for inhalation of asbestos fibres
– There is a potential for ecological impacts from contaminated soils

The methodology used when assessing contamination levels in soils at the Site will be to use the relevant HSLs, HILs, EILs and ESLs as cut off points to classify soils either as:

– Soils not contaminated, which pose no risk to the environment or human health and warrant no further action, i.e. concentrations less than or equal to the relevant HILs/HSLs or EILs/ESLs.
– Soils containing elevated concentrations of contaminants, which may pose a risk to the environment (in particular plant species or terrestrial ecosystems) but pose no risk to human health under the proposed land use scenario i.e. concentrations greater than the ecological values and less than the adopted HILs or HSLs. A qualitative risk assessment may be sufficient to evaluate the potential impact for the proposed land use.
– Soils significantly contaminated which pose a risk to both the environment and human health, i.e. concentrations significantly greater than relevant health investigation or screening levels. Soils in this category would likely require remediation or management, or site-specific health and/or ecological risk assessment carried out as appropriate for the proposed land use. This will usually require the collection of additional site data. Alternatively, a conservative management approach may be adopted, depending on the likely cost effectiveness of further assessment when compared with the cost of conservative management.

7.3.1 Health based criteria

Health investigation levels have been developed for a broad range of metals and organic substances and are applicable for assessing human health risk via all relevant pathways of exposure. The HILs are generic to all soil types. Site specific conditions determine the depth to which HILs apply for land uses other than residential (generally to depth of 3 m).

Given that the land use of the Site is open space/ recreational land use, Health Investigation Levels (HIL) for recreation/open space (HIL C) assessment criteria sourced from Schedule B1 of the NEPM, has been considered as the principal basis for assessing land use suitability. The recreational/open space assessment criteria are also considered a conservative basis to assess potential exposure to construction or maintenance workers (including landscaping maintenance) based on consideration of the following factors:

– Assuming a “non-controlled” site (i.e. where personal protective equipment is not mandatory), dermal contact and ingestion rates may be higher than the NEPC (2013) assumptions for open space / recreational land use; however this is off-set by not having the childhood exposures as part of the exposure scenario for construction and maintenance workers.
– Only a portion of the duration by construction or maintenance workers will be spent in areas with more significant contamination.
– During intrusive activities, standard workplace hygiene practices can be expected to reduce exposure to contaminated soil or dust. (Particularly in the case of asbestos, WHS obligations require elimination or reduction of risk to the extent practical, so appropriate measures can be expected to be used where asbestos contamination is present).

No single summary statistic will fully characterise a site and appropriate consideration of relevant statistical measurements should be used in the data evaluation process and iterative development of the CSM.

Where assessment criteria are exceeded, the preferred approach is to examine a range of summary statistics including the contaminant range, median, arithmetic/geometric mean, standard deviation and 95% upper confidence limit (UCL).

At the very least, the maximum and the 95% UCL of the arithmetic mean contaminant concentration should be compared to the relevant Tier 1 screening criteria. However, where there is sufficient data available, and it is appropriate for the exposure being evaluated, the arithmetic mean (or geometric mean in cases where the data is log normally distributed) should also be compared to the relevant Tier 1 investigation or screening level. The implications of localised elevated values (hotspots) should also be considered. The results should also meet the following criteria:

– The standard deviation of the results should be less than 50% of the relevant investigation or screening level.
– No single value should exceed 250% of the relevant investigation or screening level.

Statistical assessment will be based on sample populations from similar soil profiles (e.g. fill material will be not be assessed with samples of underlying natural soils), and if appropriate, for similar or localised areas of the Site (i.e. expected to be subject to the same impact).

In statistical assessments, only one result will be used per sample ID, with the greater of the primary or duplicate sample used where applicable. Where the analytical result is less than the laboratory LOR, the LOR will be used for the statistical assessment.

7.3.2 Asbestos screening criteria

The NEPM provides guidance relating to the assessment of known and suspected asbestos contamination in soil and addresses both friable and non-friable forms of asbestos. The health screening levels for asbestos in soil have been adopted from the Western Australian Department of Health (WA DoH) *Guidelines for Remediation and Management of Asbestos Contaminated Sites in Western Australia* (adopted from WA DoH 2009; HSLs remain unchanged in WA DoH 2021). The adopted assessment criteria are outlined in Table 7.1.

GHD notes that these HSLs do not necessarily equate to requirements under the WHS Regulation or Codes of Practice, which may impose requirements regardless of the concentration or proportion of asbestos in soil.

Table 7.1 Adopted soil criteria – HSLs asbestos contamination in soil – recreational use (HSL-C)

Form of asbestos	Health Screening Level (w/w)
	Recreational C
Bonded ACM	0.02%
FA and AF (friable asbestos)	0.001%
All forms of asbestos	No visible asbestos for surface soil

7.3.3 Ecological investigation levels and ecological screening levels

Ecological investigation levels (EILs) have been developed for selected metals and organic substances and are applicable for assessing risk to terrestrial ecosystems. EILs depend on land use scenarios and generally apply to the top 2 m of soil. EILs have been derived for As, Cu, Cr III, DDT, naphthalene, Ni, Pb and Zn. EILs have been developed for three generic land use settings including areas of ecological significance, Urban residential areas and public open space, and Commercial and industrial land uses.

The application of some EILs is also dependent on site specific soil characteristics including pH and cation exchange capacity (CEC). Selected samples from across the Site have been analysed as part of previous investigations (GHD 2022a) for pH and CEC to characterise soil.

Ecological Screening Levels (ESLs) have been developed for selected petroleum hydrocarbon compounds and total petroleum hydrocarbon (TPH) fractions and are applicable for assessing risk to terrestrial ecosystems. ESLs also depend on land use scenarios (identical to EILs) and broadly apply to coarse- and fine-grained soils and various land uses. They are generally applicable to the top 2 m of soil.

Given the historic use of most of the Site, and that site investigations will focus on the Site's current use as park land/open space, the assessment criteria that have been considered are:

– EILs for Urban Residential/Public Open Space
– ESLs for Urban residential/Public Open Space (coarse soil textures will be applied as a conservative measure)

7.3.4 Aesthetics

Assessment of aesthetic issues will be undertaken as outlined in Schedule B(1) of the NEPM (1999) which states that 'there are no specific numeric aesthetic guidelines, however site assessment requires balanced consideration of the quantity, type and distribution of foreign material or odours in relation to the specific land use and its sensitivity'.

General assessment considerations include:

– That chemically discoloured soils or large quantities of various types of inert refuse, particularly if unsightly, may cause ongoing concern to site users.
– The depth of the materials, including chemical residues, in relation to the final surface of the Site.
– The need for, and practicality of, any long-term management of foreign material.

The NEPM notes that in some cases, documentation of the nature and distribution of the foreign material may be sufficient to address concerns relating to potential land use restrictions.

7.3.5 Airborne fibre monitoring

Air monitoring will be necessary during remediation due to the presence of friable asbestos in accordance with *SafeWork NSW (2019) Code of Practice How to Safely Remove Asbestos*.

The workplace exposure standard for airborne asbestos fibres provided within SafeWork Australia, *Workplace Exposure Standards for Airborne Contaminants* (2018) is 0.1 fibres/mL of air. The SafeWork NSW *Code of Practice, How to Safely Remove Asbestos* provides action levels for control air monitoring during asbestos removal works as follows:

– <0.01 fibres/mL. **Action**: Continue with control measures.
– Between 0.01 fibres/mL and 0.02 fibres/mL. **Action**: Review control measures.
– Greater than or equal to 0.02 fibres/mL. **Action**: Stop work, notify SafeWork NSW and only recommence works when the cause of the elevated concentrations is remedied.

In line with the requirements outlined within the SafeWork NSW *Code of Practice, How to Safely Remove Asbestos*, during friable asbestos remediation works, control and clearance airborne fibre air monitoring is required to be undertaken by a SafeWork NSW Licenced Asbestos Assessor.

During control monitoring the air monitoring devices should be placed on the boundaries of the nominated works area and air monitoring should be conducted for the full duration of the works. The locations will be based on:

– Location of excavation works;
– Weather conditions (monitors shall be placed downwind where possible to assess for off-site migration of fibres); and
– Proximity to neighbouring properties.

Clearance airborne fibre monitoring shall be conducted within the works area in support of clearance inspections. Results of clearance airborne fibre monitoring shall be <0.01 fibres/mL. Should exceedances be identified, additional remediation works and subsequent clearance inspection and clearance air monitoring would be required to be undertaken.

The sample collection and analysis shall be conducted in accordance with *the guidance note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres 2nd edition (NOHSC 3003:2005)*. The analysis will be performed by a NATA registered laboratory and reported on endorsed certificates.

Air monitoring results shall be issued to Council and the Remediation Contractor as soon as air monitoring results become available.

7.3.6 Waste classification criteria

Materials that may require offsite disposal as part of site remediation will be classified using the Waste Classification Guidelines – Part 1: Classification of Waste (NSW EPA 2014). In accordance with NSW EPA 2014, the following six-step guide to the classification of waste and waste classification principles apply:

– Step 1: establish if the waste should be classified as a special waste.

  'Special waste' is a class of waste that has unique regulatory requirements. The potential environmental impacts of special waste need to be managed to minimise the risk of harm to the environment and human health. Special wastes are:

  - Clinical and related waste
  - Asbestos waste
  - Waste tyres

  Asbestos waste means any waste that contains asbestos. If asbestos is mixed with other waste to form asbestos waste, the waste must continue to be assessed in accordance with the guidelines to enable the disposal of the asbestos waste at an appropriate waste facility. Asbestos waste must be managed to meet the management and disposal requirements of both asbestos and the other class of waste with which it is mixed (if any).
– Step 2: If not a special waste, establish whether the waste should be classified as a liquid waste.

– Step 3: If not special waste or liquid waste, establish whether the waste is of a type that has already been pre classified. A number of commonly generated wastes have been pre-classified.
– Step 4: If the waste is not a special waste, liquid waste or is not suitable for pre classification, establish whether it has certain hazardous characteristics and should therefore be classified as hazardous.
– Step 5: If the waste does not possess hazardous characteristics, chemically assess to determine what class of waste.
– Step 6: The first test used to chemically assess waste is the Specific Contaminant Concentration (SCC) test, which determines the total concentration of each contaminant in the waste sample. The guidelines set different maximum levels for the total concentration of each contaminant in order for waste to be classified as either general solid waste or restricted solid waste.

  The toxicity characteristic leaching potential (TCLP) test estimates the potential for waste to release chemical contaminants into a leaching liquid. The guidelines set different maximum levels of the leachable concentration of each contaminant in order for waste to be classified as general solid waste, restricted solid waste or hazardous waste.

The following principles must be applied at all times when using the step-by-step waste classification process:

– If special waste is mixed with another class of waste, the waste must be managed to meet the requirements of both the special waste and the other class of waste.
– If asbestos waste is mixed with any other class of waste, all the waste must be classified as asbestos waste. For example, asbestos waste mixed with building and demolition waste must be managed as asbestos waste.
– If liquid waste is mixed with a hazardous or solid waste and retains the characteristics of liquid waste, the waste remains liquid waste.
– Two or more classes of waste must not be mixed in order to reduce the concentration of chemical contaminants. Dilution of contaminants is not an acceptable waste management option.
– Where practicable, it is desirable to separate a mixture of wastes before classifying them separately. For example, if waste tyres (a special waste) are mixed with lead acid batteries (a hazardous waste) it would be desirable to separate the wastes so that only the hazardous component needs to be managed as hazardous waste.

8. Remediation goals

The specific remediation goals for contamination to be remediated or managed at the site are as follows:

– Areas of identified contamination exceeding health investigation screening levels are capped or contained so that future site use (including routine maintenance activities) will not reasonably foreseeably result in exposure to contamination.
– Capping materials meet assessment criteria for recreational land use as described in Section 7.
– Any unexpected finds encountered during remediation are addressed in a manner consistent with this RAP.
– Remediation works are documented in sufficient detail to allow long term management of the site and maintain its suitability for recreational land use.

It is noted that this RAP has been developed on the basis of continued recreational site use consistent with the current use and configuration of the site. Any future development of site areas would require consideration of the nature of the proposed development, and appropriate investigations, assessment and (if required) remediation or management would need to be conducted to suit the specific development.

9. Remediation options assessment

A remediation options assessment (ROA) was undertaken in consultation with Council and applicable site stakeholders. A detailed evaluation of remediation options was undertaken, and is included in Appendix B.

A ROA workshop was held with Council on 18 August 2022. As a result of the workshop, the preferred remediation approach determined in consultation with Council and relevant stakeholders consisted of the following:

– Staged approach to long term remediation of the site, taking into account funding availability, priorities for site use and details of future site configuration.
– On-site capping and containment of identified asbestos contaminated soils, including containment within existing water treatment structure voids and in-situ capping depending on available volumes for containment and feasibility of excavation (including heritage restrictions and physical constraints).
– Minor cut of soils impacted with asbestos where required to tie in to heritage features or to preserve existing mature trees, and emplacement of excavated soils beneath capped areas or within existing water treatment structure voids located on-site.
– Long term management of the on-site containment cells, capped areas and low-risk areas via a site-specific long term environmental management plan (LTEMP) and asbestos management plan.

Use of existing water treatment structure voids (i.e. settling tank, filter beds, clear water tank) was considered a preferred strategy to remove safety hazards and enable more productive use of the former water treatment area. Preliminary advice from heritage consultants (Casey & Lowe) indicated this approach would likely be acceptable provided interpretation of heritage structures was maintained, e.g. by photograph and survey documentation and retaining a surface expression of the structures. Further advice is to be provided in this regard.

The preferred strategy for the specific site areas derived as an outcome of the ROA and workshop is summarised in Table 9.1 below. Future land use is based on consideration of current land use, as described in Section 2.3, and future land use as described in Council's prospectus *Priority Destination Hub: Walka Water Works*, included in Appendix C.

It should be noted that redevelopment of any managed areas for future land use would require further investigations and assessment and consideration of appropriate remediation or management measures specific to the findings of those investigations and the nature of the proposed land use.

Table 9.1 Preferred remediation strategy as agreed with stakeholders

Site area	Future land use	Preferred remediation strategy
Pump house lawn	Future land use should consider that this space would be suitable for events, activities, markets, and outdoor functions with connectivity to the pump house via the eastern annex. It could also be used to test commercial activities through pilot initiatives, using temporary infrastructure and pop-up activities like Street Eats. Note: An understanding of sub-surface functionalities for final land use may affect the assessment of remediation options. For example, requirements to disturb soil during for temporary structures, for power or plumbing, deep root landscaping all may contribute toward comparison of options with varied capping thicknesses, inclusion of clean service trenches, in-situ planter boxes etc	Excavation of all contaminated soils and containment within existing voids in the former water treatment area preferred for this area, to allow for future use without restriction. Capping in-situ may be required for any impacted soils unable or not feasible to remove to the extent required to achieve validation requirements.
Former power station area	Future land use should consider the area as an outdoor function or event space, potential a bespoke adventure play area. Outdoor function or event space per the pump house lawn above. Note: A more detailed understanding of the future landform may improve projections for volumes of contaminated material that can be contained above the current surface level (noting GHD's preliminary advice that spoil excavated from around the edges of main areas to facilitate tie-ins to roads, road-side drainage etc may result in future surface level in the middle of the power station lawn one metre higher than current levels; however this could be off-set by containing excavated material within existing voids in the water treatment area). The area is also noted to include a future shared pathway entry point – the continuation of this feature offsite is not understood though preliminary results from recent contamination assessment identify asbestos in the embankment adjacent this proposed feature (offsite on Council land adjacent eastern site boundary). It is noted however that potential remediation of adjacent offsite embankment will likely be separate to remediation of the Walka site and if so, will not likely affect the remediation planning described in this RAP.	Capping in-situ preferred for majority of area to minimise disturbance. Capping will need to allow for future use, and tie in to heritage structures. Design to allow for permanent facilities and underground service requirements. Excavation of service corridors and lining with marker layer and clean fill may be required. Consideration should be given to a possible future road along the eastern site boundary, with provision for access to the site immediately north of the former power station area, and/or at the northern entrance of the site. Containment in former water treatment area preferred for soil which must be excavated to allow capping, to minimise area of exposed contaminated soil during remediation.
Access road and parking areas	Future use outlined as access road and parking areas. Future provisioning of services to supply the proposed future commercial accommodation reticulating through the carpark/roadway needs to be considered.	Capping in-situ preferred for majority of area to minimise disturbance. Capping will need to allow for future use, and tie in to heritage structures. Design to allow for permanent facilities and underground service requirements. Excavation of service corridors and lining with marker layer and clean fill may be required. Containment in former water treatment area preferred for soil which must be excavated to allow capping, to minimise area of exposed contaminated soil during remediation.

Site area	Future land use	Preferred remediation strategy
Beach area, extending to access road to the north	Future use to consist of a passive play space and potential launch area for small non-motorised watercraft such as kayaks – noting currently that recreational use of the reservoir for activities such as Kayaks and catch and release fishing is not feasible.	Capping in-situ preferred for majority of area to minimise disturbance. Capping will need to allow for future use, and tie in to heritage structures. Regrading of the land-side beach area may be undertaken to facilitate future access. Design to allow for permanent facilities and underground service requirements. Sediments would be difficult to remediate except by in-situ capping. Containment in former water treatment area preferred for soil which must be excavated to allow capping, to minimise area of exposed contaminated soil during remediation. Potential for beach material to be excavated and contained in other areas, but not preferred due to extensive underground heritage structures in this area.
Mini train station area	Future use to continue to consist of the miniature railway experience, a mini train ride through the reserve.	Capping in-situ preferred for area directly to north of beach area, to minimise disturbance of contaminated soils and underground heritage structures. Containment in former water treatment area or other site areas for soil which must be excavated to allow capping. Management approach appropriate for areas to the west of the area to be capped, based on investigation findings showing a general absence of asbestos contamination, and the lower intensity use of area. Paved access ways may be incorporated to facilitate use and maintenance.
Former water treatment area	No detail of planned future use of the former water treatment area is provided within the prospectus. An area to the west of the former treatment area is noted for commercial accommodation, which may include eco cabins, glamping, RVs, and caravans.	Subject to acceptability from a heritage perspective, the preferred approach is infilling of former water treatment structures to allow containment of excavated contaminated soil from other areas and remove safety hazards, allowing more productive use of this area.
Former workmen's cottages	Future use of this area could include use for medium to large scale events, either independently or as an extension of the eastern lawn.	Management approach preferred for these areas based on investigation findings showing only isolated and low concentrations of asbestos impact, subject to a long term management plan, inspection and maintenance protocols to maintain adequate grass cover and minimise potential risk to grounds maintenance staff, and an unexpected finds procedure to identify, record and remove or manage any potential asbestos contamination that may be encountered during future use and maintenance of the site.

Site area	Future land use	Preferred remediation strategy
Broader areas of the site	Future land use of broader areas of the site may include: **Education Centre noted as opportunity 9 on the prospectus** – this may represent a more sensitive land use than currently contemplated and may require more stringent assessment and remediation requirements. This would be assessed and (if required) remediated as part of a separate future project. **Walking trails noted as opportunity 10 on the prospectus** – these are consistent with existing land use and management requirements. **Snake Gully junction noted as opportunity 11 on the prospectus** – contamination has not been identified in this area so extension of the miniature railway does not affect the current scope of remediation planning. Contamination assessment in this area appears limited however so potential for unexpected finds during any proposed development may be greater. Any further assessment/remediation would be completed as part of a separate future project. **Commercial accommodation noted as opportunity 12 on the prospectus** – contamination has not been identified in this area so a single cabin does not affect the current scope of remediation planning. Further assessment of contamination may be warranted as part of a separate future project as accommodation could represent a more sensitive land use. **Commercial accommodation noted as opportunity 13 on the prospectus** – as above noting that limited historic assessment in this area (one test pit - TP119) identified shallow fill but did not identify contamination. Further assessment of contamination may be warranted as part of a separate future project as accommodation could represent a more sensitive land use. **Shared pathway entry point noted as opportunity 14 on the prospectus** - contamination has not been identified in this area so a shared pathway does not affect the current scope of remediation planning. Further, the future land use appears consistent with current land use and management requirements. **Pontoon noted as opportunity 15 on the prospectus** – existing monitoring indicates use of the reservoir should be restricted. Assessment of measures required to improve or manage water quality to allow recreational use of the lagoon is outside the scope of this RAP.	Management approach preferred for these areas based on investigation findings showing a general absence of asbestos contamination, subject to a long term management plan, inspection and maintenance protocols to maintain adequate grass cover and minimise potential risk to grounds maintenance staff, and an unexpected finds procedure to identify, record and remove or manage any potential asbestos contamination that may be encountered during future use and maintenance of the site.

9.1 Existing water treatment structure void capacity

Council has undertaken a survey of the site including void capacities of existing water treatment structures via their subcontractor Monteith & Powys, as outlined in drawings (file reference 220336A, Ref No: 22/0336 dated 24 August 2022) and email dated 2 September 2022. Monteith & Powys' site survey drawings are provided in Appendix F. The upper and lower void estimates provided by Council are summarised in Table 9.2 and Table 9.3 below. (Volumes have been rounded from Council's calculations to better reflect the level of accuracy, GHD's understanding of the subject structures has been added in square brackets). Council noted the upper estimate ("Best case") is where everything that has been measured / assumed is accurate. The lower estimate is based on adjustments for uncertainties as noted in Table 9.3.

Table 9.4 provides an estimate (calculated by GHD) for containment of contaminated soil, based on Council's Upper estimate ("Best case") and subtracting 0.2 m for a drainage layer and 0.5 m for a capping layer from the overall depth.

Table 9.2 Upper estimate of existing water treatment structure void capacity

Area (m^2)	Assumed Average Depth (m)	Volume (m^3)	Note
2118	3.3	6,990	Large rectangular [Settling tank]
1991	1.5	2,986	Medium rectangular [Filter beds No. 5 and 6]
780	3.6	2,808	Circular [Clear water tank]
470	0.8	376	Irregular Hexagon [Filter bed No. 2]
		13,160	Total m^3

Table 9.3 Lower estimate of existing water treatment structure void capacity

Area (m^2)	Assumed Average Depth (m)	Volume (m^3)	Note	Adjustment
1906	2.7	5,147	Large rectangular [Settling tank]	Depth reduced 0.6m, area reduced 10%
1792	0.9	1,613	Medium rectangular [Filter beds No. 5 and 6]	Depth reduced 0.6m, area reduced 10%
702	2.7	1,895	Circular [Clear water tank]	Depth reduced 0.9m, area reduced 10%
423	0.4	169	Irregular Hexagon [Filter bed No. 2]	Depth reduced 0.4m, area reduced 10%
		8,824	Total m^3	

Table 9.4 Estimate of existing water treatment structure void capacity to contain contaminated soil

Area (m^2)	Net depth for containment (m)	Volume (m^3)	Note
2118	2.6	5,500	Large rectangular [Settling tank]
1991	0.8	1,600	Medium rectangular [Filter beds No. 5 and 6]
780	2.9	2,260	Circular [Clear water tank]
470	Negligible	0	Irregular Hexagon [Filter bed No. 2]
		9,360	Total m^3

9.2 General heritage constraints and approaches

Preliminary advice from heritage consultants (Casey & Lowe) indicated the preferred remedial approach would likely be acceptable provided interpretation of heritage structures was maintained, e.g. by photograph and survey documentation and retaining a surface expression of the structures. This may include geophysical assessment to record location and depth to footings of historical structures.

As the remediation involves extensive works on a site which is listed on the State Heritage Register, a S60 application will be required, clearly detailing the proposed works and why the remediation is necessary [i.e. to protect public health from potential exposure to asbestos contamination]. The main document can be in the form of a Heritage Impact Statement, which should include the following:

– Detailed plans, the majority of which can be in an appendix. The basic plans in the body of the report should show the testing done to date, the known and extrapolated extent of contamination. Plans will need to include where new services will be introduced.
– A description of the methodology to be used in the remediation, and the reasons for excavation or capping. This information is contained in this RAP.
– The documentation shall include historical plans showing the known below ground services that will preferably be avoided, or may be subject to disturbance, such pipework running from the pumphouse buildings.

The above information is to demonstrate that the remediation takes into account the heritage aspects of the site and that it has been designed as much as possible to avoid impacting these values. Where possible, the depth of excavation should be kept to a minimum to avoid disturbing archaeological remains and relics, and vistas. A shallow depth of excavation to the east of the pumphouse building would avoid disturbance of archaeological features belonging to the water works.

Where the remediation involves major changes, such as filling of the existing water treatment infrastructure, this will be mitigated by retaining the outline of the structures and detailed interpretation describing their function. Filling of the structures will enable safe public access, but their basic outlines will remain visible to facilitate an understanding their function.

Where the contamination is to be capped, the change in elevation will be minimised so as to avoid changing the ‘look’ of the site or the particular location, such as the site of the power station. For example, the capping will be a relatively thin layer which will retain the current look of the power station site. The locations of the footings that are visible on aerial photographs will be recorded so that future interpretation of the area can take place.

The potential archaeological remains in each area include pipes and other services running to and from the main pumphouse buildings, and remains of buildings that have no longer have any aboveground evidence. There may also be deposits of broken or otherwise discarded equipment that were used in the water works or power station.

Areas which have a high potential to expose remains will be subject to monitoring or regular inspection by the archaeologist. An Unexpected Finds Protocol will be implemented whereby the archaeologist is at call to assess the remains’ significance and whether a site visit is required. In most instances, photos of the remains to the archaeologist will help to determine this.

The results of the archaeological recording will be subject to a detailed report at the end of the program.

10. Preferred remediation strategy

10.1 Summary of remediation requirements

10.1.1 Excavation of impacted soils

10.1.1.1 Excavation of soils around trees

Excavation of soils around trees shall be undertaken such that the integrity and viability of the tree shall not be compromised. Specific assessment and guidance from an arborist will be required to inform excavation methodology for trees which are to be retained. This is likely to include hand excavation around the tree, if capping with clean material is required and cannot extend up the trunk. The capping considerations discussed in Section 10.1.2.1 below shall also be taken into account when planning excavation around trees.

10.1.1.2 Pump house lawn

Remediation of the pump house lawn will comprise excavation of all soils known to contain asbestos within the pump house lawn area for containment within voids provided by former water storage and settling tanks within the former water treatment area. Except in areas of heritage restrictions or other physical constraints, it is considered excavation will continue to natural undisturbed soils. If fill thickness exceeds 1 m depth, consideration may be given to validating underlying fill and/or capping and managing remaining materials (if contaminated). Investigations have not shown asbestos contamination in the landscaped areas to the north and east of the lawn. It is anticipated excavations will taper out to natural soils in these landscaped areas, which slope up from the lawn.

Detailed design will need to give consideration to proposed future landuse, future installation of new services, removal and replacement of current site amenities and services, site trees and protection of heritage structures such as historical underground services and kerbs and gutters. Final landscaping design should be completed in consultation with Council as part of final design for remediation works.

10.1.1.3 Former power station area

Investigations indicate it is likely that asbestos contaminated soils extend across the entire former power station area, encompassing the eastern embankment which extends past the existing site fence to the eastern site boundary. There is a potential for asbestos contamination of the lower lying areas adjoining the site boundary, which should be taken into account in planning for future use of that land (which is owned by Council).

Depending on available capacity for containment in the water treatment area voids, it may be beneficial to excavate all contamination from certain parts of the former power station area to eliminate future management requirements. Such areas should be identified in consultation with Council as part of final design.

Excavation of soils from edges of areas behind verges and kerbs will be required to allow for future capping of asbestos impacted soils to tie into existing site features. This excavated material should be contained in the water treatment area voids, to minimise exposure to contaminated material during remediation.

Concept design of excavations and capping is provided within Section 10.1.2. Detailed design will need to give consideration to proposed future landuse, future installation of new services, removal and replacement of current site amenities and services, site trees and protection of heritage structures such as historical services and kerbs and gutters. Final landscaping design should be completed in consultation with Council as part of final design for remediation works.

10.1.1.4 Beach area and adjoining sediments

Friable asbestos has been identified in soils in the beach area. Due to extensive underground heritage features in this area (see Figure 4.3 in the ROA in Appendix B) excavation of all contaminated soils is not considered feasible. However, regrading of the beach area may be required to facilitate future land use. Regrading should be considered in consultation with Council and heritage consultants as part of final design.

Stormwater discharge from underground historical services has occurred in the past, causing erosion of areas near the beach. Drainage issues should be identified and rectified as part of detailed design and remediation of this area, possibly in conjunction with drainage of containment areas as discussed in Section 10.1.2.4 below.

Excavation of soils from edges of areas behind verges and kerbs will be required to allow for future capping of asbestos impacted soils to tie into existing site features. Areas to the north of the beach (leading to the access road / car parking) are void of surface cover and will need to be capped as discussed in Section 10.1.2.2 below. To the west of this area (adjoining the mini train station), investigations have not shown any significant asbestos contamination of near-surface soils, and there is generally grass cover in most areas. It is considered this area can be managed without capping, however consideration should be given to providing defined pathways to assist in maintaining grass cover.

Concept design of excavations and capping is provided within Section 10.1.2. Detailed design will need to give consideration to proposed future landuse, future installation of new services, removal and replacement of current site amenities and services, site trees and protection of heritage structures such as historical services and kerbs and gutters. Final landscaping design should be completed in consultation with Council as part of final design for remediation works.

Sediments adjoining the beach area have been found to contain asbestos materials, and could present a hazard particularly if water levels drop during dry weather and the sediments become accessible and dry out. Excavation of contaminated sediments is not considered feasible, and these should be capped in-situ as discussed in Section 10.1.2.3 below.

10.1.1.5 Access road and parking areas

Investigations have not been undertaken within the access road and parking areas, however it is assumed that there is asbestos contaminated fill beneath the current road base material. Historic rail lines are present within the roadway, and numerous underground historical (see Figure 4.3 in the ROA in Appendix B) which constrain excavation of the roadway. Capping with road base and asphalt or other permanent pavement is considered an adequate means of containment for contaminated fill which may be present.

As an interim management measure, existing roadbase and pavements (where present) should be maintained to prevent the exposure of potentially contaminated fill.

Detailed design will need to give consideration to future installation of new services and protection of heritage structures such as historical services and kerbs and gutters. Final design should be completed in consultation with Council, taking into account drainage requirements for the permanent roadway and underground utilities or utility corridors that may be required to service proposed future developments on the site.

10.1.2 Capping and containment

10.1.2.1 Capping of soils around trees

Capping of soils around trees shall be undertaken such that the integrity and viability of the tree shall not be compromised. Specific assessment and guidance from an arborist will be required to inform capping methodology for trees which are to be retained. The basis of capping around trees will potentially vary based on tree-specific and site-specific factors and shall be determined during final design. Capping considerations include the following:

– Capping around trees would include a marker layer to be selected as a part of arboricultural assessment, to provide visible separation and prevent upward migration of asbestos impact, while retaining permeability and grass cover root penetration where required. Specification of appropriate marker layer, and proximity to tree to ensure continued viability shall be undertaken in consultation with an arborist.
– Clean fill capping will be required to provide sufficient cover (minimum 0.2 m) to prevent exposure to asbestos impacted soils by site users. Capping thickness may be tapered off towards the tree if required, subject to consultation with the arborist and the Site Auditor. Final design shall specify the allowable depth of cover within the drip line of the tree, and any requirements for tapering.
– Drainage will be required to avoid ponding of water around the tree (i.e. from runoff from adjacent areas of cap).

10.1.2.2 Capping soils in-situ

Capping in-situ of contaminated soils will require installation of a marker layer and capping with clean soil. Capping will be required over any remaining soils known or suspected to contain asbestos which are unable to be excavated due to identified constraints, except where the risks are low enough that the contamination may be managed without capping. Capping may also be required for unexpected finds.

Capping thickness will need to be designed on the basis of Council's requirements for future land use, including provision for underground services such as irrigation or power. As indicated in Figure 10.1, this may be by way of greater capping thickness or by designated service corridors lined with marker layer and backfilled with clean material.

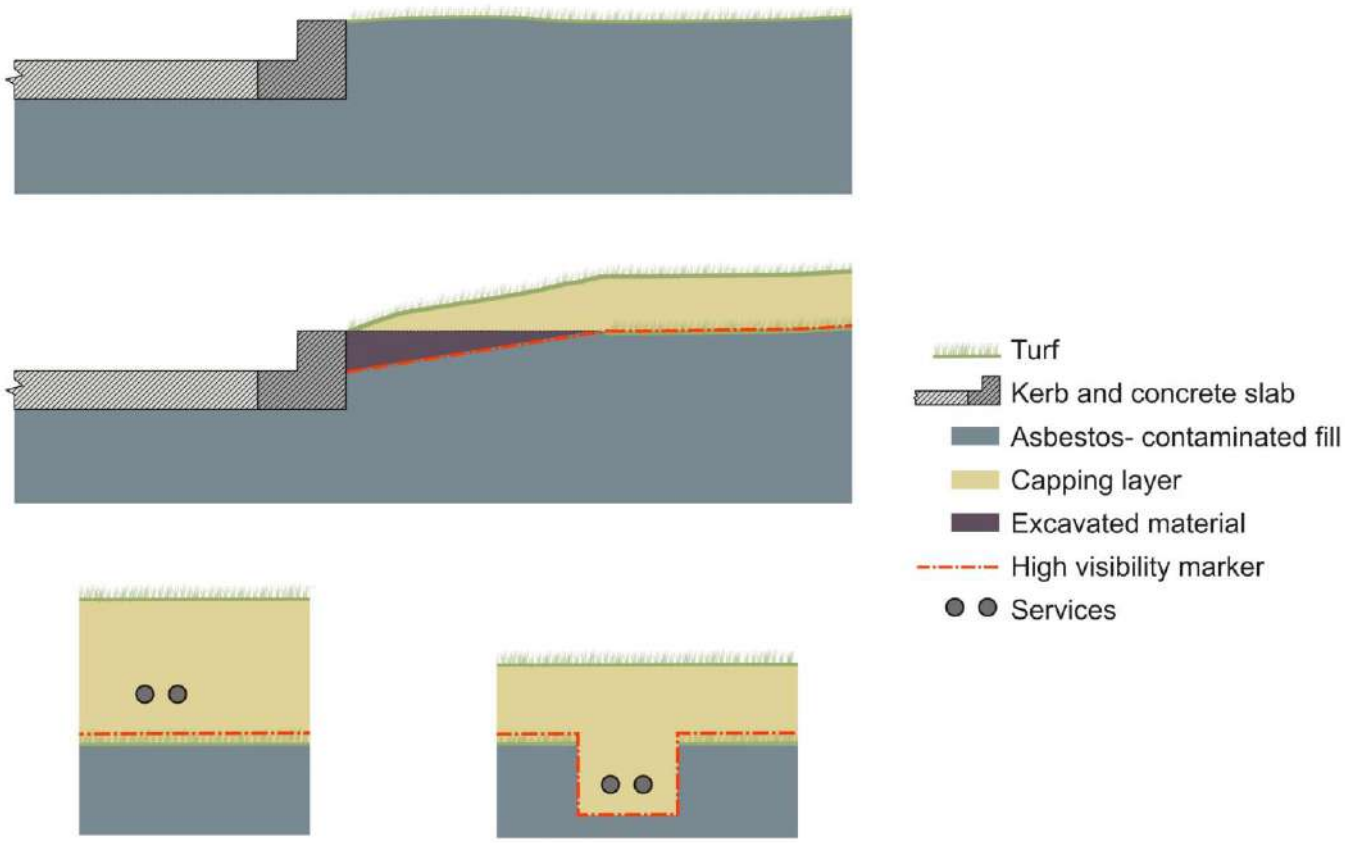


Figure 10.1 Conceptual design for in-situ capping

Capping thickness should be designed for the specific areas and intended land use with reference to ANZECC (1999) *Guidelines for the Assessment of On-site Containment of Contaminated Soil* and WA DoH (2021) *Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia*, giving consideration to the requirements noted above.

ANZECC (1999) provides the following information with regard to physical separation of contaminated soil:

- For plant growth media, a topsoil thickness of 0.1 to 0.15 m is commonly specified. Thicker layers would function satisfactorily but cost more. Uncompacted soil is required below the topsoil to provide root support and additional water storage. A minimum thickness of 0.2 m is considered adequate for grass cover, and 0.7 m for appropriate trees and shrubs.
- A thicker layer of cover (i.e. total 0.6 m cover) may be required to protect a geosynthetic barrier layer from damage from vehicular traffic and other post-construction surface loads. [GHD considers in this case, an impermeable geosynthetic layer is not required as there is no need to prevent infiltration, and a geotextile marker layer can be specified which would not be subject to such damage, even with thinner cover layers].
- For immobile contaminants where only physical separation is required, it may be sufficient to provide a thickness of soil that is unlikely to be penetrated by likely future users of the site. A minimum soil cover thickness of about 0.5 m is commonly adopted, but thicker layers may be required where there is a high risk of penetration or little opportunity for effective institutional management controls, such as in residential situations where gardening activities are expected.
- The soil separation layer may be underlain by a layer of "marker mesh" to serve as a visual signal that a potentially hazardous material exists below the mesh layer.
- Thinner soil cover or no soil cover is often considered acceptable where cover is provided by a permanent concrete floor slay or permanent concrete or asphalt surfaced pavement.

In design of appropriate containment systems, ANZECC (1999) notes that the minimal functional requirements depend on site specific conditions (including physical conditions, ownership and management arrangements, intended site use, adjoining land uses etc) from which it is possible to define the likely consequence of loss of containment, and how such loss of containment may be likely to occur (eg. erosion of soil cover, people digging through the capping layer).

WA DoH (2021) adopts a similar basis of design considerations, and notes the depth of clean cover should be sufficient to prevent access to and disturbance of any buried asbestos-containing material. The depth of cover should consider:

– Current and future site use
– The integrity of the final top surface cover (eg. hardstand, gravel, turf)
– Potential for damage/erosion of the cover through human activity, surface water movement or other causes
– Ability to inspect/maintain cover over the long term
– Safe access to below-ground infrastructure, including irrigation systems and underground services.

Where possible, depth of cover should be sufficient to address any access to or future installation of utility and underground services. Alternatively, underground services may be isolated from other buried contaminated material with a marker layer and backfilled with clean fill. The planning, size and design of buried services and/or service trenches should accommodate future maintenance or installation of additional services (e.g. allow sufficient clean area for additional services and/or room for re-excavation of trenches adjacent to buried services).

Contamination associated with high concentrations of fibrous asbestos may require a greater depth of clean fill or more frequent inspection of cover, depending on site circumstances.

WA DoH (2021) notes that dense vegetative barriers, such as turf, can be very useful in protecting the clean fill cover from erosion and some forms of human disturbance. In certain cases, the site may involve ongoing corporate or communal management, which will control what happens with the vegetative barrier, including its maintenance.

For the purposes of this RAP, it is considered a minimum capping thickness of 0.2 m topsoil is required to support grassed cover and prevent exposure of the underlying marker layer. This minimum thickness is based on consideration of the following:

– Heritage considerations recommend that the physical configuration and visual aspects of the site be changed as little as possible. A thicker capping layer would result in more significant changes to site topography, altering the physical configuration and visual aspects unless some contaminated material was removed to compensate (which would increase the risks associated with soil disturbance during the remediation works).
– The areas to be capped are relatively flat and should not be subject to excessive erosion, particularly if a good cover of turf is maintained.
– The Walka Water Works site has effective institutional management controls, whereby uncontrolled activities are unlikely to occur, and the capping layer can be regularly inspected and maintained. The marker layer provides a further measure of physical separation from underlying contaminated soil.

A thicker capping layer should be adopted where practical, giving consideration to the design considerations and site-specific factors noted above. In particular, for areas where future public events are planned that are likely to involve soil disturbance (eg. driving tent pegs for marquees, star pickets for temporary fencing etc) which may bring contaminated soil to the surface, thicker cover layers should be specified to avoid penetration of the cap.

The marker layer may be a high-visibility non-woven geotextile, or an erosion protection material such as Landlok 450 TRM (turf reinforcement mat) or equivalent if root penetration past the base of topsoil is required to support overlying turf.

In non-grassed areas, a permanent pavement (eg. asphalt, concrete or pavers on a stabilised base) is considered adequate capping, as is a suitable thickness (minimum 200 mm) of compacted roadbase or granular material overlaying a geotextile marker layer where a non-paved trafficked area is required. Detailed design should consider potential erosion and maintenance requirements associated with any non-permanent paving.

10.1.2.3 Capping sediments in situ

It is considered that contaminated sediments can feasibly be capped in-situ, using methodology common for marine protection measures such as revetments. Installation of a marker layer and appropriate cover material is required over sediments known or suspected to contain asbestos.

Capping will require a separation geotextile covered by adequate thickness of clean material of sufficient particle size to prevent erosion by wave action or surface water runoff. Detailed design of capping should be undertaken in consultation with Council to determine capping requirements that meet future land use requirements as well as providing a permanent and erosion resistant capping layer. In concept, it is considered the capping will comprise a rock armour of minimum 100 mm thickness over the geotextile, overlain by a granular material to suit Council's proposed use of the area. It is assumed that no underground services or utilities will need to be installed in the capping over the sediments. The conceptual sediment capping methodology is shown in Figure 10.2 below.

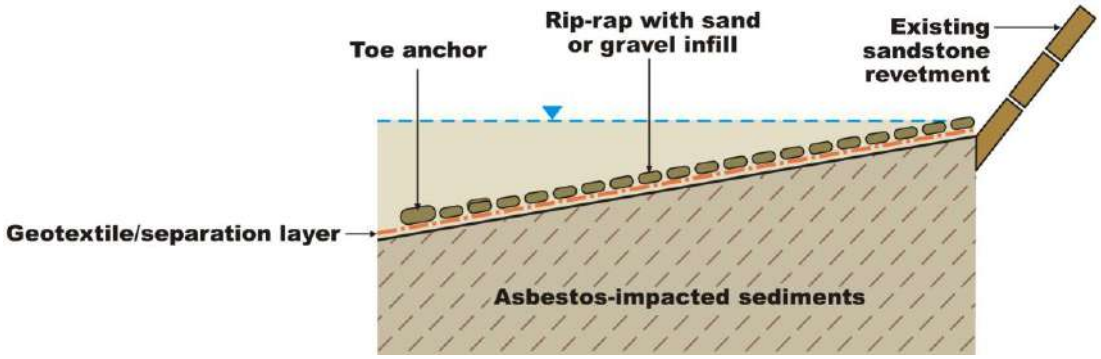


Figure 10.2 Conceptual sediment capping

Consideration in detailed design shall be given to factors including the following:

– Protecting heritage structures such as below ground services and the sandstone revetment
– Profile of designed slope or matched to existing slope
– Lower limit of capping requirements (based on elevation or footprint)
– Edge details at termination of capped area
– Upper limit interface with existing sandstone revetment
– Rock armour sized for stability under wind waves or finer material for aesthetics, habitat or recreation (with consideration of design slope)
– Toe anchor strategy – such as additional rock, use of beam or embedment
– Geotextile grade

Consideration also needs to be given to rising and falling water levels within the reservoir and data gaps pertaining to the extent of contamination within reservoir sediments. A conservative assumption regarding the extent of contamination should be combined with an understanding of lowest potential water levels to determine the extent of capping that is required. Based on investigations to date and potential for sediments to be exposed during prolonged dry weather, it is considered that capping of sediments up to 1 m beneath current water levels and extending approximately 20 m from the eastern end of the reservoir will be required, as indicated in Figures 4.1 and 4.2 of the ROA included in Appendix B.

The final extent of capping of sediments in-situ and the capping structure should be determined in the detailed design.

10.1.2.4 Containing within voids on site

The existing voids provided by former water treatment structures are considered to provide secure long-term containment for asbestos contaminated soils. The following specific requirements will need to be considered in final design:

– Water will need to be drained from the structures, and provision for permanent drainage is required. This may be by way of existing heritage pipework forming part of the structures, if it can be operated and maintained for that purpose. If not, provision for pump-out or amendments to existing structures will be required.

– A drainage layer will be required at the base of the structures to facilitate long-term drainage.
– Contaminated soil should be placed and compacted within the voids to meet geotechnical requirements for future use.
– A high-visibility geotextile marker layer and low-permeability cap of minimum 0.5 m thickness should be provided over the contaminated soil, to minimise long term maintenance requirements. (This thickness is based on the assumption that no underground services will be installed within the capped areas of the voids).
– Provisions for interpretation of the heritage structures will need to be confirmed with the heritage consultant. This may include capping to finish flush with or near to existing ground surface levels to support future site use, heritage amenity and site safety considerations while allowing visual interpretation of the structures.

A conceptual figure outlining factors to be considered is provided in Figure 10.3 below.

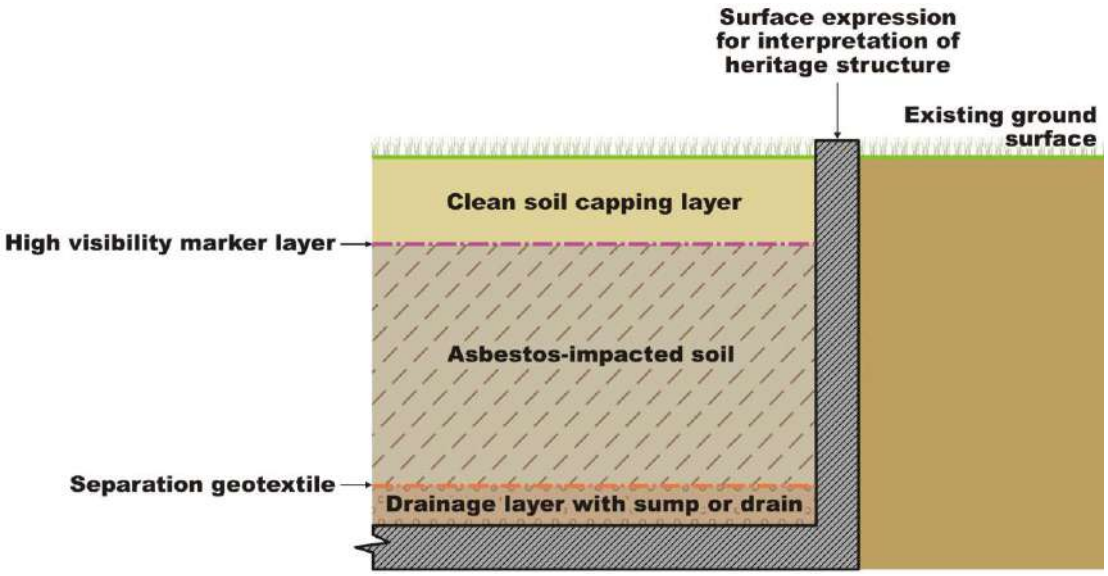


Figure 10.3 Conceptual containment and capping within existing structure voids

10.1.3 Management areas

Areas outside those requiring active remediation as described above will require ongoing management under a LTEMP. Management requirements would include requirements such as ongoing training/awareness, identification of areas of known or suspect contamination, development of inspection and monitoring plans, development of maintenance and rectification procedures.

Any proposed change in proposed future landuse of nominated management areas would trigger additional assessment and consideration of the management approach outlined above.

10.2 Remediation staging

Council's preferred remediation staging approach is shown on Figure D1 and Figure D2 in Appendix D (developed from Draft Council staging plans dated 28 June 2022).

The remediation staging outlines six stages, to be delivered in sequence including the following:

– Stage 1- installation of interim control measures to reopen the site (note this stage is considered interim management as discussed in Section 10.3).
– Stage 2- Remediation of pump house lawn.
– Stage 3- Remediation of car park and associated areas.
– Stage 4- Remediation of Power station lawn.
– Stage 5 - Remediation of Beach/Mini Train Station area.
– Stage 6- Broader areas of historic industrial site. (As discussed in this RAP, the former water treatment area, shown as Stage 6 on Figure D2, will be used for containment of material excavated from Stage 2 through to Stage 5, while the remaining areas of the broader site can be managed by way of the LTEMP).

It is understood the site will be required to be suitable for opening to the public at periods of time between stages of remediation.

10.3 Ongoing interim management

10.3.1 Interim management prior to remediation works commencing

Management of the site is required between the date of this RAP and commencement of remediation activities, to minimise the potential for additional contamination to occur from activities such as illegal dumping, or for changes to site characteristics to occur from on-site remediation activities in other areas of the site and to prevent inadvertent harmful exposure to site contaminants.

The site should be kept secure from public access. Interim site management should be conducted in accordance with the site AMP (GHD 2022h, dated 17 June 2022 or as updated in consultation with Council).

Should illegal dumping or other incidents occur, an assessment should be made as to whether contamination can be adequately managed on site until the commencement of remediation, or whether immediate remediation is required to prevent the spread of contamination. The relevant procedures outlined in this RAP should be followed if any remediation is required.

10.3.2 Stage 1 interim management works

As noted in Section 3.2, the site has been closed to public access. Council's intent is to open selected areas of the site to the public under interim management measures, in line with "Stage 1" as indicated on the figure provided within Appendix D, prior to the commencement of remediation works described in Section 10.1. Interim management requirements for this stage of access will comprise the following:

– Installation of appropriate fencing and signage to restrict access to hazardous areas (asbestos exclusion zones).
– Detailed inspection and asbestos clearance of areas open to public access. Where insufficient data is available targeted soil sampling may be required to determine management requirements.
– Interim capping for accessible areas if required as a result of the findings of inspections and/or sampling.
– Consideration of representative background air monitoring during periods of public access, particularly if the risk profile changes (e.g. prolonged periods of dry weather and/or site activities resulting in dusty conditions.
– Inspection of interim management measures for implementation and effectiveness.

10.3.3 Interim management between remediation stages

As noted above, the site is proposed to be reopened to the public at times between proposed remediation stages. Interim management between remediation stages, and subsequent public access to the site at that time would generally be contingent on, and consist of the following:

– Installation of appropriate fencing and signage to restrict access to hazardous areas (asbestos exclusion zones).
– Conduct representative background air monitoring during periods of public access.
– Suitable control airborne fibre monitoring results conducted during the applicable stage of remediation
– Suitable visual clearance inspection and clearance air monitoring results obtained from clearances of remediation areas and applicable transit routes at completion of the applicable stage of remediation.

In addition, ongoing management of the site between remediation stages should be conducted in accordance with the site AMP (GHD 2022h, dated 17 June 2022 or as updated in consultation with Council).

11. Remediation works plan

This section provides a description of the remediation works steps and procedures required to protect health, safety and the environment during any required remediation works. It is expected that these will be supplemented by detailed design and technical specifications, and that the Contractor will prepare an appropriate detailed work plan based on the requirements of this RAP and the technical specifications.

This RAP presents a concept design of capping and containment at the site, however final design shall be developed prior to remediation in consultation with Council, heritage consultant and environmental consultant design team. It is recommended that the Site Auditor be consulted during the preparation of final design documents (i.e. prior to final review), to facilitate appropriate interpretation of the contamination remediation or management requirements. These documents shall be reviewed by the Site Auditor prior to the commencement of remediation to confirm that they are consistent with the principles of this RAP.

11.1 Preliminaries

Prior to commencing remedial works, all relevant licences and approvals must be obtained by the site owner and/or Contractor from the relevant authorities.

Prior to the establishment at the site, the Contractor is required to prepare a Detailed Work Plan incorporating the following documentation:

– Work Health and Safety Plan (WHSP) including emergency response procedures
– Construction Environmental Management Plan (CEMP)
– Asbestos Management Plan (AMP)

It is a requirement for the various plans to be reviewed and accepted by the nominated responsible parties prior to any remediation works commencing. A separate WHSP will be prepared for environmental consulting works.

It is the responsibility of the Contractor to prepare and/or obtain all appropriate documentation prior to the commencement of the works including plans, programmes, licences and certificates and have undertaken any notifications necessary for the commencement of the work. All such documents must be completed and approved by the relevant consent authority (where required). These documents are anticipated to include, but are not limited to, the following:

– Consent from the relevant approving authority to undertake the remediation works (if not already covered by the project approvals)
– Insurance Certificates
– SafeWork NSW notifications
– Preparation of appropriate asbestos management and asbestos removal control plans (ARCP)

Following provision and approval of these documents, the Contractor will mobilise all necessary plant, equipment and amenities as required to complete the project in accordance with these requirements.

11.1.1 Heritage interpretation assessments

Heritage features are required to be interpreted and maintained. To support this process, a geophysical survey of heritage features may be conducted prior to commencement of remediation works, to document location, depth and extent of known heritage features.

11.2 On-site capping and containment cell concept design

Conceptual on-site capping and containment cell design has been established by GHD in consultation with Council, to achieve the remediation principles described in this RAP. Requirements for capping and/or containment specific to each site area are provided in Section 10.1 above and Section 4.4 of the ROA in Appendix B.

Detailed design will be required prior to remediation which will need to take into account consideration of site specific conditions and requirements for final landform and configuration.

The appointed Site Auditor will need to review and approved the detailed design.

11.3 Site mobilisation

Management of the site mobilisation process is to be included in the Contractor's Detailed Work Plan, including the following:

– Site access and security - The Contractor will be responsible for ensuring the security of all work areas and all plant and equipment maintained on-site during remediation works. This includes signage, control of site access (authorised personnel and vehicles only) and safety inductions and documentation.
– Plant re-fuelling/maintenance/cleaning - The Contractor will be responsible for designating locations/areas for equipment refuelling, maintenance, and cleaning activities undertaken during the site works and to ensure all vehicles leaving the site are free of any contaminated material. No refuelling or maintenance activities shall be undertaken without specific approval from the Principal Contractor Project Manager.
– Traffic control - The Contractor will be responsible for ensuring adequate traffic control measures are in place to ensure site safety and take into consideration the entry and egress of vehicles from the main site entrance or other approved access points.
– On-site traffic – The Contractor will be responsible to implement appropriate measures to prevent spread of contamination from the remediation areas, and shall ensure that on-site routes used to transport contaminated materials from one area to another are kept clean and are suitable for public access at such times as the site is opened to the public.
– Environmental controls - The Contractor will be responsible for installing and maintaining environmental controls consistent with their CEMP.

11.4 Vegetation clearance

Vegetation clearance will be subject to any requirements of the project approvals and design, Vegetation clearance may be required during remediation such as at areas of the perimeter embankments of the former power station area. In relation to site contamination, particular care shall be taken when clearing any thickly vegetated areas to avoid disturbance and spreading of contaminated materials, particularly ACM. An appropriately trained "spotter" shall supervise all vegetation clearance to ensure these requirements are met. The unexpected finds protocol shall be implemented if any contamination is observed during vegetation clearance.

All vegetation clearance must be approved by Council prior to undertaking any clearance. Where required, arborist advice shall be obtained to ensure vegetation to be retained is suitability protected and maintained during implementation of the remediation works.

11.5 Asbestos management

11.5.1 Documentation

The Contractor is required to prepare an AMP and asbestos removal control plan (ARCP) as part of their site management documentation. The Contractor's AMP and ARCP shall be consistent with the RAP's requirements for remediation or management of asbestos encountered at the site (as required), and meet the requirements of the WHS Regulation (2017) and relevant Codes of Practice.

11.5.2 Hand picking procedure

In relation to asbestos, the NEPM (Schedule B1 section 4.3) notes that asbestos materials which are present on the land surface and are included in wastes such as demolition materials, must be removed prior to disturbance during proposed site work activities. This is unlikely to be the case in most areas of the site, however if asbestos materials are identified on surface areas that are not intended to be excavated or covered with additional material, the materials shall be removed as described below.

Noting the preferred remediation strategy involves an excavation and/or cap and contain approach, hand picking of any observed fragments (as and where required) must be completed by a licenced asbestos removal contractor (if it is friable or involves more than 10 m^2 of bonded ACM) or competent person (for less than 10 m^2 of bonded ACM) in consultation with the Environmental Consultant.

Where ACM is identified/collected during hand picking, the location, condition and weights of asbestos should be recorded.

Hand picking should consist of at least two passes of the picking area made with 90 degree direction change between each and using a grid pattern. If ACM is in the form of non-friable fragments which are partially buried, surface raking of the top 100 mm of soil should be undertaken to disturb the subsurface soils and remove any partially buried fragments.

– ACM should not be further damaged or distributed by the process.
– Percent ACM contamination may be calculated using 1 cm as soil depth for hand picking.
– A final visual inspection should not detect surface ACM.
– The affected areas should be validated to confirm the removal of the ACM by visual and mechanical screening.

Any asbestos materials found and recovered will be handled in accordance with *How to Safely Remove Asbestos – Code of Practice*, SafeWork NSW 2019, classified in accordance with the NSW EPA Waste Classification Guidelines, Part 1: Classifying Waste (NSW EPA 2014), and disposed of offsite to a facility licenced to receive asbestos waste, or contained within on-site containment cells.

11.6 Excavation, cap and containment procedure

11.6.1 Earthworks

One of the major components of the proposed remediation of the site is the bulk excavation, cap and containment of soils that contain asbestos. Bulk earthworks will generally include the following steps as outlined in Table 11.1.

Table 11.1 Earthworks tasks and responsibilities

Activity	Responsibility
Locate the areas designated for bulk earthworks and assess the area as to the risk of disturbance of identified contamination	Contractor and Environmental Consultant
Removal of vegetation as appropriate (e.g. shrubs) for mulching or as otherwise required by specifications. Where possible, existing grass cover shall be maintained to minimise the exposure of asbestos contaminated soils.	Contractor
Visual assessment of exposed surface for potential ACM and foreign materials	Contractor and Environmental consultant
Excavation/movement of site soils (surface and subsurface materials and stockpiles) where required by final design, with visual screening for potentially contaminated material (ACM, aesthetic impacts)	Contractor and environmental consultant
Segregation and stockpiling or direct re-use of different waste streams (as required) based on visual assessment	Contractor

Activity	Responsibility
Characterisation of stockpiled material for management on site (containment or capping), for capping material, or for waste classification/disposal off site (if required) in accordance with NSW EPA 2014	Contractor / Environmental Consultant
Use of suitable material in designated areas as appropriate for capping in accordance with final design and specifications	Contractor
Transport contaminated material by licensed waste transporter, to an appropriately licensed site for disposal or to an approved recycling facility where appropriate – where offsite disposal is required	Contractor
Final design surfaces including pavements, topsoiling and revegetation as required	Contractor

All excavation and materials movement shall be conducted in accordance with the detailed design and specifications and with the Contractor's Detailed Work Plan and CEMP. All excavations undertaken within suspected contaminated areas or stockpiles shall be conducted under supervision of the Environmental Consultant to ensure all contamination is addressed and the objectives of this RAP are fulfilled, while minimising the amount of uncontaminated soil that is disturbed.

Excavation procedures shall be documented in the Detailed Work Plan as prepared by the Contractor and should include (but not be limited to):

– Definition of the boundaries of the areas to be disturbed (excavated) and expected depths (including liaison with the environmental consultant where required).
– Methods for excavation and stockpiling including selective excavations should different materials be encountered.
– Methods for detailed excavations around heritage structures, underground services and vegetation (e.g. mature trees) designated to remain.
– Designated areas and depths for placing (i.e. for immediate re-use) or stockpiling excavated materials.
– Plans for surface run-off protection measures around the immediate area in order to prevent surface waters running into or out of the disturbed areas (also to be included in CEMP).
– Backfill and compaction requirements.

Upon completion of the excavation works the Contractor shall ensure that plant and equipment is cleaned, decontaminated and subject to clearance inspection. Waste generated during the decontamination works is to be disposed of in accordance with NSW EPA 2014.

11.6.2 Capping/Containment Design

Appropriate capping (as described below) is considered sufficient to minimise potential exposure and (where relevant) the potential for leachate formation and impact to the site environment. "Containment" as used herein refers to placing contaminated materials in a particular area of the site either at depth or capped by hard stand or similar surfacing. Capping and containment will only be used in appropriate areas and with methods complying with NSW EPA 2017 and ANZECC 1999 *Guidelines for the Assessment of On-site Containment of Contaminated Soil*. This includes the following considerations:

– Geotechnical requirements appropriate for the future land use of the areas used for containment shall be met so as to maximise the long-term stability of the capping system and any proposed structures above it (from an engineering perspective) and, where applicable, minimises the potential for leachate formation.
– Containment will not be undertaken in any areas where structures would subsequently be built on the containment area that may result in a risk of harm to public health or the environment. Where structures are proposed over capped material, the cap shall be specifically designed to prevent a risk of harm to public health or the environment.
– All areas of capped or contained contaminated material shall be surveyed for location and depth to enable documentation and long term management.

Notification and enforcement mechanisms will be used to ensure that the containment areas are protected from any unintentional or uncontrolled disturbance that could breach the integrity of the physical barrier, such as placing

a covenant on the property title and a notation on the Section 10.7 certificate. The containment areas will be detailed and subject to procedures documented in the LTEMP.

The method of capping and containment works will be undertaken as follows:

– Where possible and in accordance with the detailed design, contaminated material will be capped in situ to avoid increased health risk (including to remediation workers) from disturbance of contaminated materials during the remediation works.
– Designated containment or capping areas/voids are to be excavated to the required depth as per detailed design plans and material re-use schedule to be developed as part of final design. (Where applicable, noting that existing voids provide the volumes for containment without further excavation).
– Placement of segregated materials to be contained/capped within the designated areas, minimising disturbance to surrounding areas as far as reasonably practicable, in accordance with geotechnical requirements and the principles outlined in Section 10.1.
– Placement of uncontaminated capping material to physically separate sensitive receptors from the contained materials. A high visibility marker layer shall be placed over the contaminated material prior to capping. Concrete slabs or surface paving (asphalt or concrete) over a gravel base may provide an appropriate barrier.

To minimise the potential for surface water infiltration, the final design and location of the containment areas will need to be either located away from surface water sources, or the capping should be engineered to divert any up gradient surface water sources away from the containment area. Further, the finished levels of the capping layer are to be designed to encourage drainage of surface water away from the containment area. Erosion of the cap surface layer will also require control (through revegetation or sealing of the finished surface).

Final design and specification of the containment and/or capping will be provided to the Site Auditor for review once the requirement for containment is confirmed and the volumes of materials and nominated areas for containment are known. The design and specification shall comply with the minimum requirements of this RAP.

Both placement of the fill materials within the containment area and the construction of the final capping layer must be supervised by a competent person to ensure construction in accordance with any design specifications and geotechnical suitability for the final design.

In areas subject to management of contamination, any future services shall be installed above the contained materials designated by the marker layer, or if installation is required at greater depth, services shall be installed in trenches lined with marker layer and in clean backfill material to facilitate any future repairs and maintenance. Excavation and preparation of trenches shall be subject to material handing requirements for contaminated soil.

Verification of capping construction (where utilised) will include inspection and testing of material characteristics and placement as required by the design and specifications, and validation of the final cap thickness in accordance with specifications by way of a survey prior to cap installation and following completion. Following placement of the cap, a detailed inspection of the cap profile, drainage systems and overall site will be undertaken.

A Construction Quality Assurance (CQA) / validation plan should be prepared as part of final design and specifications, to detail the requirements for verification of capping construction and to provide a basis for verifying and documenting the appropriate implementation of this RAP and final design documentation.

11.6.3 Material tracking

Material tracking and control shall be documented in the Detailed Work Plan to be prepared by the Contractor covering all stages of the works including excavation, stockpiling, backfilling, off-site disposal and imported materials, to include as a minimum:

– Minimisation of mixing different materials or materials from different sources unless specifically required and approved by the Environmental Consultant
– Material movement control (decision / approval process)
– A register of material movements shall be recorded documenting:
    - material source area / stockpile description or source site
    - material characteristics (type and description)
    - quantity (i.e. volume and/or weight as applicable)
    - destination (including on-site locations for intermediate movement)

- date of any movements
- authorisation details
- reference to testing results.

The material movements register shall be kept up to date at all times, and a completed copy with any relevant supporting information (including weighbridge dockets where applicable) shall be reconciled and provided to the Environmental Consultant to be included in the validation report (see Section 12.5).

11.6.4 Transport of material

Transportation of material shall be undertaken in accordance with the Detailed Work Plan and CEMP.

– All material movements shall be documented in accordance with Section 11.6.3 above.
– Wastes shall only be removed off-site after the material has been classified and written approval has been received for the disposal of the contaminated soil at the nominated treatment or disposal site, or evidence of appropriate recycling (in accordance with regulatory requirements and relevant codes of practice) has been provided.
– All asbestos debris and contaminated PPE should be doubled bagged prior to transportation to an appropriately licensed landfill that can accept asbestos waste. Management of asbestos waste is to be undertaken in accordance with the POEO (Waste) Regulation 2014.
– Waste tracking shall be undertaken in accordance with EPA requirements (specifically the POEO (Waste) Regulation 2014) and include evidence of instructions, load registers/records (source, classification, volume, date and time, vehicle details etc), weigh bridge dockets.
– Any vehicles used to transport contaminated materials from the site shall meet NSW EPA licensing requirements for the waste transported.
– All trucks carrying contaminated materials off-site shall have the load covered, the exterior of the vehicle, including wheels, thoroughly cleaned down by the Contractor after it has received its load and prior to the vehicle leaving the site. Only vehicles which have clean exterior bodywork and which will not pollute the off-site transportation corridors shall be permitted to leave the site.

11.6.5 Site reinstatement

Following the completion of any excavation, capping and containment works, the Contractor shall reinstate the site. Reinstatement should be undertaken by re-contouring the surface to remove any trip hazards, and/or backfilling with suitable site materials and/or imported fill of suitable composition to address the final design specifications. Fill of suitable composition shall meet geotechnical and other material property requirements for the area of use, not present hazards to future development from pH, electrical conductivity (EC) or contamination, and should also be compatible with the existing soil characteristics for site drainage purposes.

Compaction requirements will be dependent on final design, dimensions of excavations, and the type of soil used in each location. The compaction method proposed for the area must be approved by the Principal Contractor Project Manager prior to commencing works.

Where not covered by structures (e.g. pavement), the area shall be revegetated or otherwise reinstated to a stable condition as directed by the Principal Contractor Project Manager.

11.6.6 Imported fill materials

Any fill imported from outside the project site must be Virgin Excavated Natural Material (VENM) or material subject to a Resource Recovery Order that is permitted to be used as a fill material under the conditions of the associated Resource Recovery Exemption (such as, but not limited to excavated natural material (ENM)), in accordance with the provisions of the Protection of the Environment Operations Act 1997 and the Protection of the Environment (Waste) Regulation 2014.

Any imported construction or landscaping materials must comply with the relevant Australian Standards for that material.

All sources of imported material must be approved by Council prior to importation.

Where there is any question of the suitability of the material from an environmental or health-risk perspective, the Contractor shall advise Principal Contractor of the material characteristics prior to importation to the site, for assessment by the Environmental Consultant.

All material imported to the site shall be appropriately validated in accordance with the procedures described in Section 12.3.

11.7 Review of the RAP

This RAP will require review and updating following any significant changes in characteristics of the site, including those resulting from unexpected finds.

11.8 Long term site management

A Long Term Environmental Management Plan (LTEMP) will be required to record the placement of any contaminated material on site (including existing contaminated material remaining in situ), and provide procedures to be used in the event that it may be disturbed.

The LTEMP would include measures to prevent exposure under normal site use, and specific procedures would need to be developed for any works which would result in potential exposure.

As per NSW EPA 2017 the LTEMP will succinctly describe the nature and location of contamination remaining on-site and state what the objectives of the plan are, how contaminants will be managed, who will be responsible for the plan's implementation and over what time frame actions specified in the plan will take place.

The LTEMP will be prepared in consultation with key stakeholders and with reference to EPA (2020), EPA (2022b) and EPA (2017) and will include the following information:

– Purpose of the LTEMP
– Description of the nature of the residual contamination
– Responsibilities for implementation of the LTEMP
– Actions required by the LTEMP for routine use and maintenance of the site, with reference to additional planning required in the event of more significant site disturbance or redevelopment works
– How the LTEMP can reasonably be made to be legally enforceable
– How there will be public notification of the LTEMP and contamination management requirements at the site
– Process for review and update of the LTEMP if required.

As contamination requiring management at the site is primarily asbestos, it is expected that the LTEMP will include an asbestos management plan and register, and will be legally enforceable under the asbestos-related requirements of the Work Health Safety Regulation 2014.

The LTEMP will be subject to review and endorsement by the Site Auditor as part of the Site Audit process.

12. Validation

The process as outlined in the following sections applies to all areas of the site proposed for remediation and/or validation and will be based on visual observations, assessment of control and clearance air monitoring, assessment of site survey data and results of any validation sampling undertaken (if required). Validation sampling may be required in the event of unexpected finds or for potentially contaminated materials remaining at the site surface, or if materials are imported to the site.

12.1 Data quality objectives

The purpose of establishing data quality objectives is to ensure the remediation validation is undertaken in a way that enables the collection and reporting of reliable data on which to base the validation. The data quality objectives (DQOs) and the procedures designed to achieve these objectives are listed in Table 12.1, focussing specifically on asbestos contamination in line with the identified site contamination.

Table 12.1 Data Quality Objective Decision Process

Process	Response
Step 1 - State the problem	Historically the Site has been used for water treatment, electricity generation and filter sand washing, and associated potentially contaminating activities. The Site is currently zoned and used as recreational facilities. Friable asbestos contamination has been identified on the soil surface and within fill in the beach area, and within fill in the former power station footprint and the lawn to the east of the pump house. The lateral and vertical extent of asbestos contamination has not been fully delineated across the site, including in sediments extending into the reservoir from the beach area. There is the potential that asbestos contamination may pose a health risk to persons using the Site.
Step 2 – Identification of the decisions	The decisions are those required to ensure the successful management or remediation of contamination at the site and consequently the protection of the environment and human health. Key decisions include: – Have known areas of contamination been remediated and validated to achieve residual concentrations of contamination less than the adopted criteria? – Alternatively, have known areas of contamination been capped and contained in accordance with the requirements of the RAP, detailed design and specifications? – Have any unexpected finds encountered during site works been appropriately managed or remediated? – Is the site condition, from a contaminant perspective, suitable to allow redevelopment of the site for the proposed land use?
Step 3 – Inputs to the decisions	Data to be input to the decision making process includes: – Information from previous investigations – Assessment criteria as discussed in Section 7 – Consideration of proposed landuse – Monitoring the Contractor's work, site conditions and the Contractor's implementation of this RAP and supporting plans – Review of relevant documentation to be provided by the Contractor – Observations and analyses to be undertaken as part of the site remediation and validation works (described in Section 10.1)
Step 4 - Define the boundaries of the study	The lateral boundaries of the study area are indicated on figures outlined within Appendix A. Areas of remediation and staging are indicated on figures included in Appendix D. The vertical boundaries of the study area are the vertical extent of proposed remediation. Temporal boundaries include current data and consideration of data from previous investigations.

Process	Response
Step 5 – Site decision rule	Review of previous site investigations has been used to identify the main contaminants of concern and areas likely to require remediation or management prior to site redevelopment. Although specific validation sampling and analysis is not proposed (except for imported fill), it may be required should unexpected contamination be identified during site works. Concentrations of contaminants for validation (where required) will be compared with the criteria discussed in Section 7, giving consideration to the proposed landuse relevant to the particular area of the site, to assess the success of the remediation and/or screening processes and/or to assess waste disposal requirements. In order to decide whether the data obtained is precise, accurate, reliable and reproducible for the site at the time of the investigation, field and laboratory quality control and quality assurance (QA/QC) procedures will be utilised throughout and sampling completed. All sampling work will be carried out in accordance with Standard Field Operating Procedures, based on standard industry practices. QA/QC results will be compared to nominal acceptance limits (as outlined in in Section 12.2).
Step 6 – Specify limits on decision errors	The guidelines discussed in Section 7 will be used to assess the contamination status for the soils within the study area. Data Quality Indicators (DQIs) as described in Section 12.2 will be used to evaluate the acceptability of the data. Where quantitative data is used as a basis for decisions, where appropriate, data will be evaluated on a statistical basis as described in the NEPM (NEPC 2013) and WA DoH (2021), to a 95% confidence level.
Step 7 – Optimise the design for obtaining data	As detailed above, no specific validation sampling and analysis has been proposed for the capping and containment, except for capping material. Validation sampling will be undertaken as per Section 12.3. A CQA and validation program will be developed as part of final design and specifications, which will include appropriate inspection and test plans and documentation requirements including material tracking to verify that site works are undertaken in accordance with this RAP. The Contractor will be responsible for implementing the validation plan, which will be monitored and reviewed by the Environmental Consultant. Where necessary to verify appropriate implementation of the validation plan, the Environmental Consultant will undertake independent inspections and/or testing as required.

12.2 Data quality indicators

The DQIs for sampling techniques and laboratory analysis of collected samples define the acceptable level of error required for the investigation. The DQOs were assessed with reference to the DQIs as follows:

- **Data 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 in an appropriate pattern across the site. Consistent and repeatable sampling techniques and methods should be utilised throughout the sampling.
- **Completeness** – 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. If there is insufficient valid data, then additional data are required to be collected.
- **Comparability** – is a qualitative parameter expressing 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 and ensuring analysing laboratories use consistent analysis techniques and reporting methods.
- **Precision** – measures the reproducibility of measurements under a given set of conditions. The precision of the data is assessed by calculating the Relative Percent Difference (RPD) between duplicate sample pairs.

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

Where Co = Analyte concentration of the original sample
Cd = Analyte concentration of the duplicate sample

GHD adopts a nominal acceptance criteria of ± 30% RPD for field duplicates and splits for inorganics and a nominal acceptance criteria of ± 50% RPD for field duplicates and splits for organics, however it is noted that this will not always be achieved, particularly in heterogeneous soil or fill materials, or at low analyte concentrations.

As asbestos is a discrete contaminant, the practice of obtaining and comparing duplicate samples (as used for chemical contaminants) is not generally used for asbestos. Reproducibility of measurements may be difficult to achieve, particularly in heterogeneous soil or fill materials. This will be addressed by lines of evidence, and enough sample data to evaluate variability in results.

– **Accuracy** – measures the bias in a measurement system. Accuracy can be undermined by such factors as field contamination of samples, poor sample preparation techniques and poor selection of analysis techniques by the analysing laboratory. Accuracy is assessed by reference to the analytical results of laboratory control samples, laboratory spikes, laboratory blanks and analyses against reference standards. The nominal "acceptance limits" on laboratory control samples are defined as follows:

  - * Laboratory spikes – 70-130% for metals/inorganics 60-140% for organics
  - * Laboratory duplicates - <30% for metals/inorganics, <50% for organics
  - * Laboratory blanks - <practical quantitation limit

  Accuracy of field works is assessed by examining the level of contamination detected in equipment blanks. Equipment blanks should return concentrations of all organic analytes as being less than the practical quantitation limit of the testing laboratory.

  For analysis of asbestos, accuracy is based on the laboratory's accreditation and competency testing for analysis of asbestos in soils.

The testing laboratories conduct an internal assessment of their QC program; however, the results should be independently reviewed and assessed by the environmental consultant.

12.3 Validation methodology

If validation of materials is required at the site, the procedures described below will be used, in conjunction with the DQOs described in Section 12.1 and the criteria discussed in Section 7.

12.3.1 Decision process

12.3.1.1 Asbestos contamination and aesthetic issues

The aesthetic criteria (Section 7.3.4) and visual observations to confirm all potentially contaminated fill material has been removed will be used to guide the extent of excavations in areas of the site requiring remediation as deemed necessary by the Environmental Consultant and subject to further consultation with the Principal Contractor Project Manager and the Site Auditor during the remediation works.

In areas requiring capping, no validation of surfaces to be capped will be required.

In areas where complete removal of asbestos contaminated soil is undertaken, the Environmental Consultant will undertake a visual assessment of the remedial excavation providing an accurate log/description of its condition and a photographic record of the soils within the resulting excavation.

Validation of the remedial excavation will be carried out by a SafeWork NSW Licenced Asbestos Assessor (LAA) and in general accordance with WA DOH (2021) comprising the following:

– Visual validation procedure:
  - Visually checking the walls and base of the excavation to confirm absence of visible ACM
  - Raking or ripping soils (nominal 0.1 m minimum depth) if required to confirm all fill has been removed
– Where remaining soil cannot clearly be identified as uncontaminated natural materials, test pitting the base of the excavation to confirm natural soil and test pitting 2 m beyond the excavation wall to assess the condition of soil with respect to asbestos. Visual inspection for ACM on exposed surfaces and within test pits will be the primary method of validation, with verification as described in Section 12.3.2.2 below a second line of evidence.
– The location, description (including size and condition) and number of any fragments encountered, and during which pass/test pit they were encountered, will be documented. One complete pass without encountering any additional fragments is necessary for validation, or further assessment of any remaining ACM is required.

– Where asbestos is detected in any sample, the concentration of asbestos as fragments (ACM) and as asbestos fines or fibrous asbestos (FA or AF) will be compared with the validation assessment criteria as shown in Table 12.2 below.

Table 12.2 Asbestos validation criteria

Asbestos type	Validation Criteria	Area applicable
Bonded ACM	No visible fragments remaining in surface soils (nominally to 0.1 m depth) that will be exposed at completion of remediation, and <0.02% w/w of asbestos in a laboratory or field sample.	All areas where excavation and complete removal of ACM is undertaken as part of remediation, as well as the excavation border areas (up to 2 m width) directly surrounding the excavation.
Fibrous Asbestos (FA) and Asbestos Fines (AF)	Laboratory result of less than 0.001% for w/w of asbestos in a 500 mL sample.	

Note that a single exceedance will not necessarily be deemed a failure of the validation for any particular area, but the results will be considered on a weight-of-evidence basis in accordance with NEPC (2013) and WA DoH (2021).

Clearance inspection will be required to all asbestos works areas and associated transit routes. Clearance air monitoring would be required to be undertaken. Plant and equipment leaving works areas will be required to be subject to visual clearance inspection prior to leaving site, such as during de-mobilisation between remediation stages.

12.3.1.2 Health risk

Previous investigations have not identified any contaminants other than asbestos that present a potential health risk at the site. Should unexpected finds be encountered, assessment and if required, remediation and validation will be carried out using a sampling density as described in Section 12.3.2.2 below. Validation of capping material will also be carried out as discussed in Section 12.3.2.7 below.

The health-based assessment criteria for the identified contaminants on the site are discussed in Section 7. The area of contamination will be deemed suitable or successfully remediated (as required) if:

– The 95% UCLAVG concentration for contamination in soils remaining at the surface after remediation is less than the relevant criteria for area being remediated.
– No single sample concentration is greater than 2.5 times the relevant criteria.
– The standard deviation is less than half of the selected criteria. These criteria will be applied to each remediation area as a whole.

12.3.1.3 Ecological risk

In case of unexpected finds, assessment for potential ecological risk will be undertaken in conjunction with the assessment of health risk described above. Validation of capping material will also be carried out as discussed in Section 11.6.6 below.

The ecological criteria for the identified contaminants on the site are discussed in Section 7. These criteria will be applied to each remediation area as a whole, where ecological criteria are relevant (i.e. not covered by capping). Derivation of material-specific EILs may be undertaken based on analysis of pH and CEC of the subject material. Statistical assessment will be applied as for health-based criteria, in accordance with NEPC (2013).

12.3.2 Validation process

12.3.2.1 Sample identification

Validation and characterisation soil samples will be identified using a “V” prefix for validation, or a “C” prefix for characterisation. A detailed sample register will be kept, recording the sample number, date sampled, location, depth interval and field observations (including soil description). Duplicate samples will be recorded in the register, as will subsequent validation samples where these are needed to re-validate an area that has not met the assessment criteria and has had further remediation.

12.3.2.2 Validation of asbestos remediation

Where validation of asbestos remediation is required to fulfill the decision requirements described in Section 12.3.1.1 (i.e. for areas that will not be capped, and where visual inspection cannot adequately verify the remediation has been completed to uncontaminated natural soils), validation sampling will be undertaken as follows:

– Once the visual assessment confirms no residual ACM fragments are present on the excavated surface, validation soil sampling will be undertaken.
– Sampling will be carried out every 5 m along the excavation walls at representative depth intervals down the soil profile (minimum one per 1 m depth). Where excavation walls terminate in natural soils, the sampling frequency will be reduced to one validation sample every 10 m. This will be assessed at the completion of the remedial excavation.
– Collection of one 10L sample per every 50 m^2 of the base (i.e. 7 m x 7 m grid). This density is equivalent to twice the minimum sample density of Table 5 in WA DoH (2021), or slightly higher (as recommended for asbestos) than the minimum density in Table 2 of NSW EPA (2022a). Samples will be collected over a depth interval of approximately 0.1 m and an area of approximately 0.3 m x 0.3 m.
– Per sample location, the 10 litres of material will be spread out for inspection on a contrasting colour material, or sieved through a 7 mm sieve. Any fragments of suspected asbestos greater than 7 mm will be placed in a zip lock bag then submitted to the laboratory for weighing and confirmatory testing. Alternatively fragments may be assumed to contain asbestos, and be field weighed using an appropriate laboratory grade scale.
– One wetted 500 ml sample will be collected from the same location for laboratory analysis for asbestos quantification.

Sample results will be compared with the validation criteria and decision process described in Section 12.3.1.1.

12.3.2.3 Validation of excavations for chemical analysis

Based on previous investigations of the site as discussed in Sections 3.1 and 4 of this RAP, contaminants other than asbestos are not considered to be of concern at the site. Therefore validation sampling of excavations for chemical analysis will only be required where excavated surfaces may be subject to exposure following completion of the development, and where validation of unexpected finds is required.

Validation sampling from excavations will generally involve collecting one sample per 50 m^2 from the base of each excavation, with at least one base sample from any single excavation and one sample per 5 m of wall, with at least one sample for each excavation wall. Samples of surface soils (0.0-0.2 m) will be taken from each side of the excavation to validate the horizontal extent of remediation, with samples also taken from mid-depth (or any visually impacted soil strata) if the excavation depth exceeds 0.5 m. Aesthetic issues (re odours, debris) will be taken into account in the validation.

In the areas of aesthetically impacted soils, validation will be undertaken by visual assessment of the resultant excavations.

Soil samples collected for validation purposes will be analysed for the particular contaminants previously identified as exceeding (or potentially exceeding) assessment criteria in the area of the excavation, or for a wider range of potential contaminants associated with an unexpected find (to be determined by the Environmental Consultant in consultation with the Site Auditor).

12.3.2.4 Documentation of excavations

Photographs of the excavation will be taken as part of the validation works. The extent and depth of the completed excavation shall be measured by the environmental consultant, with reference to site boundaries or physical features, and shall be surveyed at the completion of remediation or prior to any backfilling.

12.3.2.5 Validation of Excavated Material/Stockpiles for on-site reuse

Based on previous investigations of the site as discussed in Sections 3.1 and 4 of this RAP, except in cases of unexpected finds of other potential contaminants (based on observations as indicated in Section 13), validation of material excavated from the site for on-site re-use (i.e. as capping material, or as fill in areas that are not capped and managed) may be limited to sampling and analysis for potential asbestos contamination. Validation in this case shall consist of the following:

– Visually inspect the entire surface of the stockpile and note the materials observed.

– Sampling should be evenly spread through the stockpile. Collect three samples for all stockpiles less than 75 m^3, with an extra sample for every additional 25 m^3.
– Suspect asbestos material or construction debris should be targeted, and all sample locations noted.
– At least one 10L sample from each location shall be screened with a sieve capable of capturing ≥ 7 mm x 7 mm fragments or spread out for inspection on a contrasting colour tarp (recommended for material potentially containing friable asbestos).
– One wetted 500 mL or 1 kg sample shall be collected from each location (taken from within the same impacted soil layer but separate from the 10L sample) and submitted for laboratory analysis of FA/AF.

Validation results must comply with the criteria discussed in Section 7.

Validation of stockpiles of material of unknown origin (i.e. previously imported to site) shall be sampled and analysed as described in Section 12.3.2.7 below.

12.3.2.6 Validation of Excavated Material/Stockpiles for waste classification

Waste classification samples will be collected from any soil requiring off-site disposal to landfill at a rate of one sample per 25 m^3 of material with a minimum of three samples per batch. (A batch being defined for the purposes of this RAP as a volume of material of similar physical and chemical characteristics, generally excavated from a particular area of the site). For larger volumes of soil (>100 m^3) sampling frequency may be reduced provided statistically representative classification can be achieved. Samples collected for waste classification purpose will be analysed for heavy metals (arsenic, cadmium, chromium, lead, mercury and nickel), TRH, PAH and asbestos.

The material will be deemed to be suitable for disposal if the 95% UCLAVG concentration for each contaminant of concern is less than the relevant waste classification criteria.

If required for classification purposes, representative soil samples will also be submitted for Toxicity Characteristic Leaching Procedure (TCLP) and the resultant leachate analysed for the relevant contaminants governing the waste classification.

In accordance with the NSW EPA 2014 Step 2, any liquids within the excavations during the remediation works that require offsite disposal would be classified as liquid waste, and as such “there is no need to undertake any further assessment”. GHD notes that the liquid waste should be disposed of to a facility licensed to accept / treat the liquid under the POEO Act 1997.

12.3.2.7 Validation of imported materials

If excavations are to be backfilled with imported VENM, as defined by NSW EPA (2014), the material is considered pre-classified. Materials may only be classified as VENM if they have been excavated from an area that is not contaminated with other waste materials or by manufactured chemicals. Where possible, the source and material as delivered shall be inspected by the Environmental Consultant to verify consistency with the VENM certificate. Where no supporting analytical results are available, the material should be classified as VENM by an appropriately qualified environmental professional, taking into consideration the following points:

– The history of the site of origin of the material should be understood and documented to identify whether any potentially contaminating activities have been undertaken at that location.
– An inspection of the source site should be undertaken by an appropriately qualified environmental professional, including a visual inspection of the VENM. Findings of the inspection should be fully documented.
– Validated as suitable for use as VENM with collection of samples at a minimum rate of 1 sample per 100 m^3, with at least three samples from any particular source to be analysed for TRH, BTEX, heavy metals, pesticides and asbestos.
– A visual inspection of the VENM should be undertaken as it is imported onto site to ensure that the material is consistent with documented observations. Where there is visual or olfactory evidence of contamination or anthropogenic materials noted during the inspection, the imported material load should be rejected. Inspection records are to be retained to support validation.

Excavated natural materials proposed to be used at the site which do not meet the definition of VENM as per the POEO Act must be assessed in accordance with the requirements of *The excavated natural material order 2014*, with review and inspection of source site and delivered materials as outlined above for VENM. Any other materials

must be inspected and tested in accordance with their relevant resource recovery requirements or Australian Standards as appropriate.

ENM and any other materials proposed to be imported under a RRO or Australian Standard (such as landscaping material) shall include specific inspection and testing for the presence of asbestos prior to importation.

Where fill material has already been imported to site for re-use, the materials will be validated for suitability for use as fill material at a rate of one sample per 25 m^3 of material with a minimum of three samples per stockpile. For uniform materials and quantities greater than 250 m^3 a reduced sampling frequency may be applied (minimum rate of one sample per 250 m^3) subject to a 95% UCL calculated for all relevant assessment criteria. The 95% UCL concentration shall be less than the corresponding assessment criteria described in Section 7. Analysis shall include TPH, BTEX, heavy metals, OCP/PCBs, PAHs. Sampling and analysis for asbestos shall be undertaken in accordance with Section 12.3.2.5 above.

In order to avoid importation of contamination to the site, fill judged suitable for use will have TPH, BTEX, heavy metals, OCP/PCBs and PAHs concentrations below the criteria in *The excavated natural material order 2014* (or Australian Standard relevant to the material) and shall contain no detectable asbestos. Physical characteristics of imported soil shall be consistent with the surrounding material, or specific to intended end use as approved by the Principal Contractor's Project Manager.

12.3.2.8 Validation of cap

A detailed CQA and validation procedure will be developed as part of detailed design. This shall include the following as a minimum.

Geotextile marker layer

As described in Section 10.1, areas designated for capping or containment are to be covered with a high visibility marker layer to delineate impacted material from capping material. The marker layer will be placed over the contaminated material and installed with a minimum 300 mm overlap between sheet interfaces and to at least 2 m beyond the edge of the area to be contained (unless physically confined in the case of former water treatment structures). In the case of sediments where capping is completed under water, the minimum overlap shall be 1 m.

The placement of the marker layer will be validated by observations and a survey of the extent and level of the geotextile. Photographic evidence of the marker layer will be provided in the Site Validation Report.

Capping layer

Soil capping will be placed over the marker layer to a thickness as required by the detailed design. Validation of the capping construction will include:

– Inspection and testing of material characteristics and placement as required by the detailed design and specifications.
– Validation of the final cap thickness, extent, cap profile and surface drainage will be completed by inspection of the area and detailed surveys at the marker layer and following completion of the cap. Photographic evidence of the capping layer and survey documentation will be provided in the Site Validation Report.

12.3.3 Analytical test methods and detection limits

In general, laboratory analysis will be conducted in accordance with the standard test methods outlined in Schedule B(3) of the NEPM (1999) for soils.

Where possible, the project laboratories will be NATA accredited for the analysis and will utilise their own internal procedures and their test methods (for which they are NATA, or equivalent, accredited) in accordance with their own quality assurance system that forms part of their accreditation.

12.4 Quality assurance / quality control

12.4.1 Quality assurance

All fieldwork will be conducted in general accordance with Standard Field Operating Procedures, which are aimed at collecting environmental samples using uniform and systematic methods. Key requirements of these procedures are as follows:

– Detailed field records with fieldwork being undertaken by suitably qualified and experienced staff.
– Decontamination procedures - including the use of new disposable gloves for the collection of each sample, decontamination of the sampling equipment between each sampling location and the use of dedicated sampling containers provided by the laboratory.
– Sample identification procedures - collected samples will immediately be transferred to sample containers of appropriate composition and preservation for the required laboratory analysis. All sample containers will be clearly labelled with a sample number, sample location, sample depth and sample date. The sample containers will then be transferred to a chilled cooler for sample preservation prior to and during shipment to the testing laboratory.
– Chain of custody information requirements - a chain-of-custody form, for each batch of samples, will be completed and forwarded to the testing laboratory.
– Sample duplicate frequency approximately 10% (5% each for intra and inter laboratory duplicates) – for chemical analysis only.

Field quality control procedures to be used during the project will include the collection and analysis of the following (for chemical analysis only):

– Intra Laboratory (Blind) duplicates/replicates: Comprise a single sample that is divided into two separate sampling containers. Both samples are sent anonymously to the project laboratory. Blind duplicates/replicates provide an indication of the analytical precision of the laboratory, but are inherently influenced by other factors such as sampling techniques and sample media heterogeneity. It is proposed to collect and analyse blind duplicate samples at a rate of at least 5%.
– Inter Laboratory duplicates/replicates: Individual samples are split in two in the field by the sampling crew and are placed in two separate containers. One sample is sent to the project laboratory and one sample is sent to an independent check laboratory. Field split duplicate samples provide an indication of the analytical accuracy of the project laboratory, but may be affected by other factors such as sampling methodology and the inherent heterogeneity of the sample medium. It is proposed to collect and analyse blind duplicate samples at a rate of at least 5%.
– Trip blanks: These are samples of organic free water normally prepared by the analytical laboratory which is providing the bottles to be used for sampling. They remain with the sample bottles while in transit to the site, during the sampling and during the return trip to the laboratory. At no time during these procedures are they opened. Upon return to the laboratory, they are analysed for all analytical parameters as if they were a field sample. Trip blanks are a check on sample contamination originating from sample transport, handling, shipping and site conditions.
– Equipment blanks: These are prepared in the field (at the sampling site) using empty bottles and the distilled water used during the final rinse of sampling equipment. After completion of the decontamination process fresh distilled water is poured over the sampling equipment and collected. The distilled water is exposed to the air for approximately the same time the sample would be exposed. The collected water is then transferred to an appropriate sample bottle and the proper preservative added, if required. Equipment blanks are a check on equipment decontamination procedures.
– Field blanks: These are similar to trip blanks except the water is transferred to sample containers on site. Field blanks are a check on sample contamination originating from sample transport, handling, shipping, site conditions or sample containers.

12.4.2 Laboratory program

The National Association of Testing Authorities of Australia (NATA) accredited project laboratory will use their internal procedures and NATA accredited methods in accordance with their quality assurance system. The

environmental consultant is to ensure that the laboratory analytical methods and limits of reporting are acceptable for analysis required.

Laboratory quality control procedures used during the project should include (where relevant):

– Laboratory duplicate samples: Duplicate sub samples collected by the laboratory from one sample submitted for analytical testing at a rate equivalent to one in twenty samples per analytical batch, or one sample per batch if less than twenty samples are analysed in a batch. A laboratory duplicate provides data on the analytical precision and reproducibility of the test result.
– Spiked Samples: An authentic field sample is spiked by adding an aliquot of known concentration of the target analyte(s) prior to sample extraction and analysis. A spike documents the effect of the sample matrix on the extraction and analytical techniques. Spiked samples will be analysed for each batch where samples are analysed for organic chemicals of concern.
– Certified Reference Standards: A reference standard of known (certified) concentration is analysed along with a batch of samples. The Certified Reference Standard (CRS) or Laboratory Control Spike provides an indication of the analytical accuracy and the precision of the test method and is used for inorganic analyses.
– Surrogate Standard/Spikes: These are organic compounds which are similar to the analyte of interest in terms of chemical composition, extractability, and chromatographic conditions (retention time), but which are not normally found in environmental samples. These surrogate compounds are spiked into blanks, standards and samples submitted for organic analyses by gas-chromatographic techniques prior to sample extraction. Surrogate Standard/Spikes provide a means of checking that no gross errors have occurred during any stage of the test method leading to significant analyte loss.
– Laboratory Blank: Usually an organic or aqueous solution that is as free as possible of analytes of interest to which is added all the reagents, in the same volume, as used in the preparation and subsequent analysis of the samples. The reagent blank is carried through the complete sample preparation procedure and contains the same reagent concentrations in the final solution as in the sample solution used for analysis. The reagent blank is used to correct for possible contamination resulting from the preparation or processing of the sample.

The individual testing laboratories will conduct an assessment of the laboratory QC program, internally; however, the results will also be independently reviewed and assessed by the Environmental Consultant.

Laboratory duplicate samples should return RPDs within the NEPM acceptance criteria of +-30%. Per cent recovery is used to assess spiked samples and surrogate standards. Per cent recovery; although dependent on the type of analyte tested, concentrations of analytes and sample matrix; should normally range from about 70-130%. Method (laboratory) blanks should return analyte concentrations as ‘not detected’.

12.4.3 Dispatch and transport of samples

All samples will be dispatched and transported with chain of custody documentation in accordance with laboratory procedures and requirements. The Environmental Consultant will conduct a review of these procedures and requirements to ensure that all statutory requirements are complied with.

The Environmental Consultant will seek to ensure that the specified holding times for analytes are not exceeded due to delays between sample dispatch and laboratory receipt.

12.5 Site validation reports

A site validation report (SVR) will be prepared in accordance with the relevant requirements of EPA (2020) detailing the remediation works undertaken, the validation carried out and the final condition of the site (or remediation area). Separate SVRs may be issued following each stage of remediation as discussed in Section 10.2, depending on the timing of remediation works and Council’s requirements for completing documentation prior to the next stage.

The SVR will assess the results of the validation observations and sampling against the assessment criteria stated in the RAP. Where validation has not been achieved, reasons must be stated and additional site work proposed to achieve the RAP objectives. The SVR will also include information confirming that all NSW EPA and other regulatory conditions and approvals have been met. In particular, the SVR will document evidence to confirm that any disposal of waste materials off-site has been completed in accordance with the RAP and relevant regulatory requirements, particularly addressing the requirements of Section 4.3.7 of the *Guidelines for the NSW Site Auditor Scheme* (EPA 2017) for any imported material or off-site disposal. The SVR will include:

– Summary of site details and previous results as required by EPA (2020)
– Description of implementation of the RAP, including any deviations
– Chronology of remediation works
– Validation results and discussion
– Quality assurance and quality control evaluation
– Field inspection records and photographic log of remediation works
– As-constructed drawings and survey data for containment areas
– Documented material movements (including on-site movement) as discussed in Section 11.6.3
– Supporting documentation for any imported materials (as per Sections 11.6.6 and 12.3.2.7 of this RAP) and waste disposal (including waste classification reports and disposal dockets)
– Conclusions and recommendations relating to the remediation objectives.

12.6 Audit requirements

As discussed in Section 1.4, the ultimate objective of this RAP and the reports (validation reports and LTEMP) that will be prepared following implementation of the RAP is to support Site Audit Statements determining the suitability of the historical industrial use area for recreational land use and the appropriateness of the LTEMP for managing known or potential remaining contamination. The key aspects of the site audit process in achieving this objective are outlined below:

– Auditor review and approval of this RAP.
– Consultation with Auditor during preparation of detailed design documentation.
– Auditor review and approval of detailed design documentation, prior to implementation of remediation, as discussed in Sections 10.1, 11.2 and 11.5.
– Consultation with the Auditor in the event of any unexpected finds or changes to the approved remediation approach and methodology.
– Auditor review and approval of Remediation and Validation Reports as described in Section 12.5, as respective stages of remediation are completed and documented (including waste management documentation).
– Auditor review and approval of the LTEMP, including provisions for enforcement and public notification as outlined in Section 11.8.
– Provision of Interim Audit Advice at appropriate stages and ultimately a Site Audit Report and Site Audit Statements as outlined in Section 1.4.

A successful audit outcome (i.e. certification of the suitability of the site and the appropriateness of the LTEMP) depends both on successful physical implementation of the RAP and adequacy of documentation demonstrating the various aspects of the works have been appropriately completed, including appropriately addressing any unexpected finds or changes to the remediation strategy that may occur. Hence it is important that the Auditor be kept appraised of the progress of works (including opportunity for site inspections at appropriate stages), and that the Auditor's approval at key milestones (as outlined above), or to address unexpected finds or changes to the proposed remediation works be obtained prior to proceeding with such works.

13. Remediation contingency and unexpected finds

The site has been investigated for contamination as detailed in previous investigations and will be subject to ongoing visual assessment during development earthworks. A degree of uncertainty is inherent in any site contamination investigation and there is a potential for undetected contaminated soils or wastes to be identified in other areas of the site.

Table 13.1 outlines some of the unexpected situations that may arise during the site works. The unexpected finds protocol and emergency response plans described in Sections 13.1 and 13.2 would apply in the event of any such issues arising.

Table 13.1 Contingency procedures

Issue	Response
A greater volume of soil contamination may be encountered than is estimated, or other types of contamination may be encountered.	The presence of previously unidentified types of contaminants may be detected during remedial works by observation of any unusual physical/sensory characteristics of the impacted soil. Indications of potential contamination may include: – Stained or discoloured fill, soils or seepage water. – Odorous fill, soils or seepage waters. – Construction/demolition wastes such as concrete, bricks, timber, tiles, asbestos sheeting, fragments and pipes. – General rubbish such as plastic, glass, packaging. – Materials such as ash or slag or coal chitter. If previously unidentified types of contaminants are detected, then further assessment and validation may be required and validation criteria may have to be revised to incorporate those contaminants. In the event that significant additional contaminants or volumes of contamination are identified, work would cease in the area of concern. An assessment of the impact of the additional contaminants would be undertaken by the Environmental Consultant. Any potential contaminated material in addition to the type previously identified will be treated in a method considered suitable for the type of contaminant. Additional testing would be undertaken to determine requirements in this respect. EPA requirements for treatment and disposal would be met in accordance with NSW EPA 2014.
Disposal within on-site voids is not suitable or insufficient volume available	Disposal within on-site voids may not be considered suitable due to unexpected heritage, structural or design issues. Void space may unexpectedly be insufficient to contain required volumes of excavated waste, or volumes of excavated waste may be greater than anticipated. Any waste unable to be capped and contained within on-site voids should be suitable to be capped and contained within other nominated areas subject to capping and containment. Excess material which cannot be capped on site may require off-site disposal.
Identification of unexpected heritage items	Unexpected heritage items could be encountered during remediation. Should this issue occur, works would be stopped and unexpected finds protocol implemented in consultation with Council's nominated heritage consultant. The ongoing feasibility of the preferred remediation strategy should be reviewed in light of the unexpected finds. Alternative cap and contain strategies are available at the site that do not involve excavation as a contingency.
Encountering potential combustible material	Should potentially combustible coal hazard be encountered during remediation the unexpected finds protocol would be implemented. Contingencies may include further assessment for combustibility and or blending coal material with soils if required.
Unacceptable Environmental Impacts as a result of remediation activities	The RAP has considered the potential environmental impact of side effects of the works such as noise, odour, dust and surface runoff. However, in the event that unacceptable levels of such side effects are detected at the site boundaries during remedial works, the Contractor shall cease work and the Environmental Consultant will assess the situation and direct corrective action, in accordance with the CEMP prepared for the remediation works and current EPA regulations and requirements, and in consultation with the Principal Contractor Project Manager.

13.1 Unexpected finds protocol

A contingency plan incorporating an “Unexpected Finds Protocol” (UFP) to be followed in the event of unexpected situations shall be prepared by the Contractor and form part of the Detailed Work Plan. The Contractor will be required to follow the contingency plan if unexpected situations are encountered.

A preliminary unexpected finds protocol (UFP) has been developed for the site and is included in Appendix E. The UFP will be integrated with the site specific emergency response plan (ERP) as detailed in Section 13.2 below, however, the ERP would take precedence over the UFP should any unexpected contamination or materials be identified that present an immediate hazard.

Where unexpected finds are encountered that are not clearly addressed by the procedures described in this RAP the Site Auditor must be notified and consulted to endorse any proposed changes to the agreed remediation approach described in this RAP.

Documentation of any unexpected finds must be completed for inclusion in the SVR, including date of discovery, description of find (including photographic record), environmental control measures (as applicable), consultation with Council, the Environmental Consultant and Site Auditor (as may be required), agreed course of action, and the remediation and validation works undertaken, commensurate with the level of documentation required for the equivalent works described in this RAP.

13.2 Emergency response plan – environmental protection and pollution control

The Contractor shall prepare a Site Specific Emergency Response Plan if unexpected situations are encountered. The following outlines some of the unexpected situations that may arise:

– Spills or leaks
– Adverse weather conditions
– Dust, noise, odour levels measured at site boundary may exceed acceptable levels
– Surface runoff may leave the site

The Contractor will have available measures, equipment and materials to counter these contingencies, and should ensure all staff are aware of and have had training in appropriate measures.

14. Protection of the environment and the community

Significant site levelling and earth movement at the site is required to enable development. A major part of the site management will involve the installation and maintenance of environmental protection and pollution control measures. The measures to be implemented are outlined within this section of the RAP. For the purposes of this RAP, these measures are specific to “remediation works”, including movement of potentially contaminated materials, but should also be applied to all development works undertaken at the site, and the Contractors’ safety and environmental management documentation should be developed on that basis.

These measures are designed to achieve the following objectives:

– Protection of the surrounding environment during all phases of remediation works
– Protection of the local community during all phases of the remediation works
– The containment of all contaminated and potentially contaminated materials (soils, run-off etc) to the site

As per Section 11.1, prior to commencing works, the Contractor must possess plans, programmes, licences, certificates and other documents necessary for the commencement of the work, addressing as a minimum the requirements of this RAP. These documents shall be subject to review by the Principal Contractor Project Manager and the Environmental Consultant.

The remedial program should be undertaken with due regard to legislative requirements and any relevant environment planning instruments that apply to the site.

14.1 Interim controls

Prior to the commencement of site remediation works, the following interim controls should be put in place:

– The Contractor is responsible for the construction of permanent fences around the subject area meeting appropriate specifications to prevent unauthorised entry
– Applicable asbestos related interim controls as described in Section 10.3 would be required to be implemented including site signage
– The Contractor is responsible for the construction of silt and sediment controls around the remediation site, meeting appropriate specifications to prevent erosion and runoff

14.2 Hours of operation

Unless otherwise permitted by the project approvals, all remediation work, including transport, shall be conducted within the following hours:

– Monday to Friday: 7 am – 6 pm
– Saturday: 8 am – 1 pm

The above meets the requirements of Maitland City Council. No work will be undertaken on Sundays or Public Holidays.

14.3 Contact details during remediation

During remediation works, representatives and on-site supervisors from the Contractor will be available to be contacted at all times. The Contractor’s CEMP should detail the incident reporting procedure for reporting environmental incidents during the project.

Additionally, the Site Health & Safety and Environmental Management plans as prepared by the Contractor will detail contact numbers for key project contacts once confirmed, emergency services and utility authorities.

14.4 Contaminated material management

It shall be the responsibility of the Contractor to ensure all potentially contaminated materials are contained on-site, within the confines of the designated work areas. This will be achieved by the control of potential pathways capable of moving contaminated material off-site including surface water runoff, erosion/sediment transport, vehicle/plant movements and dust generation. Specific controls for the site works shall be provided in the Detailed Work Plan and the CEMP prepared by the Contractor, as summarised in the following sections.

14.4.1 Soil and water management

All remediation works will be undertaken in accordance with a CEMP that will provide the specific details of the soil and water management measures. It is expected that a detailed CEMP will be required by consent conditions for the proposed development. The Contractor shall be responsible for implementation and maintenance of soil and water management measures throughout the remediation works. A summary of relevant measures is presented below:

– Surface runoff control – may include diversion drains, silt fences, sumps and pumping systems to prevent runoff entering or leaving excavation areas and to prevent runoff/suspended solids entering or leaving stockpile areas.
– Stockpiles – are not to be placed on footpaths or roads and shall be placed away from drainage lines, gutters or stormwater pits or inlets. Stockpiles likely to generate dust or odours shall be covered and stockpiles of contaminated soil shall be stored in a secure area. Preference will be given to storing segregated contaminated material in skip bins prior to disposal, where volumes are small enough for this to be feasible. This particularly applies to segregated foreign materials or ACM.
– Vehicle access - Movement of excavation equipment and trucks to and from the site will be strictly controlled, restricted to a minimum and will only take place during the designated working hours. Controls must be in place to prevent any material being tracked onto offsite roads including wheel washing and sediment barriers. Soil, earth, mud and other similar materials must be removed from the roadway preferably by dry methods (sweeping, shovelling).
– Excavation pump-out - If ponding occurs and it is not feasible for it to be re-used onsite (dust suppression, irrigated), or if time constraints restrict leaving water to evaporate or infiltrate, then offsite disposal will be required. Pump-out and transportation of ponded water within excavations for appropriate treatment/disposal may be required. Disposal (if required) should be undertaken by a liquid waste transporter. It is noted that discharge to stormwater would require consultation with the Principal Contractor, NSW EPA and local Council, if considered. No surface runoff and/or water from excavations/pits/trenches from the working area of the site is permitted to be discharged to the surrounding environment, except as may be required for dust suppression with the express approval of the Project Manager and Environmental Consultant.

  Subject to approval from Council (and the Principal Contractor) and compliance with relevant consent conditions and regulatory requirements, sediment dams may be constructed and/or existing voids and ponds on the site or adjoining areas of the overall development area may be utilised for detention of stormwater runoff. Details shall be prepared and approved as part of the detailed soil and water management plan, including design flows, sampling and discharge requirements.
– Landscaping - Due care shall be taken to protect any existing vegetation unless removal is required to undertake the remedial works. Any vegetation designated for protection shall be fenced to prevent disturbance during the works.

14.4.2 Noise

It shall be the responsibility of the Contractor to minimise noise generated from the remediation operations in accordance with NSW EPA and local council standards. Noise controls will be specified in the Detailed Work Plan and EMP.

The remediation works shall comply with the NSW Department if Environment and Climate Change (DECC) Interim Construction Noise Guideline, July 2009 (ICNG).

14.4.3 Vibration

The use of any plant and/or machinery shall not cause vibrations that can be felt or are capable of being measured at any off-site premises. A structural assessment shall be undertaken before use of any vibrating plant or machinery, to ensure that no damage occurs to any heritage structures on the site.

14.4.4 Waste management

The Contractor shall prepare a waste management plan identifying materials that can be re- used or recycled, and how these will be managed during the remediation works. The Contractor shall ensure that any waste disposed of from the site is appropriately classified and taken to a facility lawfully able to receive that waste.

The Contractor shall establish appropriate waste disposal containers as part of site mobilisation, which shall be maintained on site for the duration of the works. All waste materials (e.g. garbage) must be disposed of using safe waste disposal practises. No waste shall be disposed of on site. The waste disposal containers shall be emptied as necessary to avoid overflowing, and the contents disposed of to a waste disposal facility approved for the relevant waste type.

All potential pollutant materials shall be stored well clear of any poorly drained areas, flood- prone areas, and stormwater drainage areas. Such materials should be stored in a designated area. Containment bunds should be constructed with provision for collection and storage of any spilt material.

14.4.5 Air quality

14.4.5.1 Dust and particulate control

Dust emissions shall be confined within the site boundary. Dust control procedures may be employed to comply with this requirement including erection of perimeter dust screens, covering of stockpiles, dust suppression (water) and covering of truck loads. Dust control measures shall be specified in the Contractors' Detailed Work Plan and CEMP.

Consideration should be given to air quality monitoring during bulk earth works in accordance with the NSW Department of Environment and Conservation (DEC) *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (2005).

14.4.5.2 Asbestos

Where works are undertaken involving disturbance of asbestos containing materials and or soils known to contain asbestos, airborne fibre monitoring for asbestos must be conducted in accordance with the site AMP, the SafeWork NSW *Code of Practice: How to Safely Remove Asbestos* (2019) and the WHS regulations (NSW) by a licensed asbestos assessor. The monitoring should be conducted in accordance with NOHSC Guidance Note on the Membrane Filter Method for Estimating Method Airborne Asbestos Fibres 2nd Edition [NOHSC:3003 (2005)]. Asbestos air monitoring requirements and action levels will be specified in the AMP and HSE Plan.

Air monitoring requirements vary depending on the type of asbestos being removed, the location/position of the asbestos, if an enclosure is used and whether the asbestos removal work is within a building or outside.

Table 14.1 Air monitoring action levels

Action level	Action
< 0.01 fibres/ml	Continue with control measures
At 0.01 fibres/ml or <= 0.02 fibres/ml	Review control measures, investigate cause and implement controls to minimise exposure and prevent further release.
> 0.02 fibres/ml	Stop removal work Notify relevant regulator (phone followed by written statement) Investigate the cause Implement controls to eliminate or minimise exposure and prevent further release Do not recommence removal work until further air monitoring is conducted and fibre levels are < 0.01 fibres/ml

14.4.5.3 Odour control

It is noted that based on the nature of the contamination identified on the site odours are unlikely, however no odours should be detectable at any boundary of the property relying purely on a sense of smell. Dust control measures shall be specified in the Detailed Work Plan and CEMP. Controls may include covering stockpiles, use of fine mist sprays, odour mitigating agents and minimising exhaust emissions.

14.5 Traffic movements and management

Management of traffic movements will form part of the Detailed Work Plan as provided by the Contractor.

14.6 Community consultation

Any Community Consultation or consultation with other stakeholders will be conducted by the Principal Contractor Project Manager or nominated representative.

Any enquires made by members of the public to worker on site during remediation should be directed to the Principal Contractor representative.

15. Health and safety

15.1 Work health and safety

Work Health and Safety (WHS) is a necessity on all remediation and development projects to ensure the health and safety of all personnel working/visiting the site. Work shall be carried out in accordance with a site-specific Work Health and Safety Plan (WHS Plan). The remediation contractor shall prepare a site specific WHS Plan (or combined HSE Plan) for the remediation works, addressing as a minimum the requirements of this RAP, and shall appoint a Site Safety Officer for the duration of the works.

It is the responsibility of the Contractor to take all necessary practicable actions to safeguard the safety and health of all employees and subcontractors while they are on the site. The aim of the WHS Plan shall be to provide and maintain safety standards and practices, which offer the highest practical degree of personal protection, based on current knowledge.

All work undertaken shall be performed in accordance with the provisions of the Work Health and Safety Act 2011, the Work Health and Safety Regulations 2017 and any other relevant regulations or directions issued by regulatory authorities.

15.2 Community health and safety

To ensure the protection of the local community, the remediation contractor shall control the exposure pathways identified in this section.

Control mechanisms will include the following:

– Site security measures to control direct contact with the contamination
– Dust suppression measures to control inhalation exposure
– Cleaning and tarping trucks to control direct contact from migration of contaminated soils

These measures are described in Section 9 - Protection of the Environment and Community, and shall be documented in detail in the remediation contractor's CEMP.

16. Conclusions

Previous investigations of the site were carried out by GHD in 2021 and 2022, as documented in GHD's reports '*Walka Water Works, Contamination Assessment'* (GHD 2022a) (Rev. 1 dated 11 February 2022) and '*Walka Water Works, Supplementary Site Investigations'* (GHD 2022e) (Rev. 0 dated 25 August 2022). Council has engaged an independent site auditor (Lange Jorstad of Geosyntec) to review investigations and remediation with the ultimate aim of certifying whether the site is suitable for ongoing recreational use subject to implementation of an appropriate long term environmental management plan (LTEMP).

As described in the above-mentioned reports, investigations do not indicate any significant contamination is present at the site as a result of historical use except for asbestos, including bonded ACM and friable asbestos materials. On this basis the site contamination requiring active remediation or management is limited to that associated with asbestos concentrations in or on soil exceeding the adopted human health criteria located within areas nominated as:

– The former power station footprint including beneath soft-fall in the playground (separated by geotextile) and extending into the eastern embankment beyond the fence line
– The lawn to the east of the pump house
– The beach area, extending into the reservoir sediments and isolated occurrences around the mini train station.

It is considered the broader areas of the site areas (including identified asbestos in soil near the former workmen's cottages) are suitable for recreational use subject to ongoing management under the provisions of a LTEMP incorporating the site-specific asbestos management plan, including provision of an unexpected finds protocol to address any contamination that may be identified during future use of the site.

Water quality in the reservoir is not considered suitable for recreational use involving exposure to the water (eg. swimming or wading), primarily due to biological contaminants. Current restrictions to use (i.e. no swimming or fishing) should continue, however the water quality is not considered to affect the suitability of the site for other recreational (non water-based) land use.

The specific remediation goals for contamination to be remediated or managed at the site are as follows:

– Areas of identified contamination exceeding health investigation screening levels are capped or contained so that future site use (including routine maintenance activities) will not reasonably foreseeably result in exposure to contamination.
– Capping materials meet assessment criteria for recreational land use as described in Section 7.
– Any unexpected finds encountered during remediation are addressed in a manner consistent with this RAP.
– Remediation works are documented in sufficient detail to allow long term management of the site and maintain its suitability for recreational land use.

It is noted that this RAP has been developed on the basis of continued recreational site use consistent with the current use and configuration of the site. Any future development of site areas would require consideration of the nature of the proposed development, and appropriate investigations, assessment and (if required) remediation or management would need to be conducted to suit the specific development.

A remediation options assessment (ROA) was undertaken in consultation with Council and applicable site stakeholders, including a ROA workshop held with Council on 18 August 2022. As a result of the workshop, the preferred remediation approach determined in consultation with Council and relevant stakeholders consisted of the following:

– Staged approach to long term remediation of the site, taking into account funding availability, priorities for site use and details of future site configuration.
– On-site capping and containment of identified asbestos contaminated soils, including containment within existing water treatment structure voids and in-situ capping depending on available volumes for containment and feasibility of excavation (including heritage restrictions and physical constraints).

– Minor cut of soils impacted with asbestos where required to tie in to heritage features or to preserve existing mature trees, and emplacement of excavated soils beneath capped areas or within existing water treatment structure voids located on-site.
– Long term management of the on-site containment cells, capped areas and low-risk areas via a site-specific long term environmental management plan (LTEMP) and asbestos management plan.

Interim management of the site is required between the date of the RAP and commencement of remediation activities, as well as between stages of remediation if the site is re-opened to the public. The site is currently closed to public access. Interim site management should be conducted in accordance with the site AMP (GHD 2022h, dated 17 June 2022 or as updated in consultation with Council).

This RAP provides a summary of identified site contamination issues and description of the proposed remediation and soil management programs, procedures and standards which can be followed during the course of the remediation, to ensure the successful remediation of the site and consequently the protection of the environment and human health. It is expected that these will be supplemented by detailed design and technical specifications, and that the Contractor will prepare an appropriate detailed work plan based on the requirements of this RAP and the technical specifications.

This RAP presents a concept design of capping and containment at the site. Final design shall be developed prior to remediation in consultation with Council, heritage consultant and environmental consultant design team. It is recommended that the Site Auditor be consulted during the preparation of final design documents (i.e. prior to final review), to facilitate appropriate interpretation of the contamination remediation or management requirements. These documents shall be reviewed by the Site Auditor prior to the commencement of remediation to confirm that they are consistent with the principles of this RAP.

A LTEMP will be required to record the placement of any contaminated material on site (including existing contaminated material remaining in situ), and provide procedures to be used in the event that it may be disturbed. The LTEMP would include measures to prevent exposure to contaminated materials under normal site use, including management of low-risk potential contamination which is not capped as part of the remediation. Specific procedures would need to be developed for any intrusive works which would result in potential exposure to contaminated materials.

GHD considers that the site can be made suitable for the proposed use by implementation of this RAP, and subject to implementation of an appropriate LTEMP.

17. References

ADWG (2011), Australian Drinking Water Guidelines 2011, National Health and Medical Research Council, (Version 3.7 updated January 2022).

ANZG (2018), *Australian and New Zealand Guidelines Fresh and Marine Water Quality*, 2018

Casey & Lowe (2021) *Walka Water Works, Oakhampton Heights, Historical Archaeological Assessment.*

CRC Care (2011) *Health Screening Levels for petroleum hydrocarbons in soil and groundwater. Technical report series No. 10*. Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC Care). Friebel, E. and Nadebaum, P. 2011

CRC Care (2017) *Technical Report 39, Risk-Based Management and Remediation Guidance for Benzo(a)Pyrene*

GHD (2022a) *Walka Water Works, Contamination Assessment*, 11 February 2022.

GHD (2022b) *Walka Water Works, Activity-Based Exposure Assessment SAQP,* Draft A, 10 March 2022.

GHD (2022c) *Walka Water Works, Beach Area SAQP,* Draft A, 26 March 2022.

GHD (2022d) *Walka Water Works, SAQP for additional investigations,* Draft A, 23 May 2022.

GHD (2022e) *Walka Water Works, Supplementary Site Investigations 2022*, Rev. 0, 25 August 2022

GHD (2022f) *Walka Water Works, Remediation concept design and budget estimate*, 1 April 2022

GHD (2022g) *Walka Water Works, Remediation Options Assessment,* 8 August 2022

GHD (2022h) *Asbestos Management Plan, Walka Water Works,* 17 June 2022

HEPA (2020) *PFAS National Environmental Management Plan Version 2.0,* National Chemicals Working Group of the Heads of EPAs Australia and New Zealand

MCC (2021) *Project Brief, Walka Water Works Recreation & Wildlife Reserve Grounds Maintenance,* Maitland City Council, 2021

NEPC (2013). *National Environment Protection (Assessment of Site Contamination) Measure 1999*, as amended by the National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1), National Environment Protection Council, May 2013.

NOHSC (2005) *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres,* 2nd Edition, 2005.

NSW EPA (1995) *Sampling Design Guidelines*, NSW EPA, 1995. New South Wales Environment Protection Authority. September 1995.

NSW EPA (2015) *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*. NSW Environment Protection Authority 2015.

NSW EPA (2017) *Guidelines for the NSW Site Auditor Scheme (3rd Edition)*, NSW Environment Protection Authority. October 2017.

NSW EPA (2020) *Guidelines for consultants reporting on contaminated land*, NSW EPA, 2020. New South Wales Environment Protection Authority. August 2020.

NSW EPA (2022a). *Contaminated Land Guidelines: Sampling design part 1 – application* and *Sampling design part 2 – interpretation*. NSW Environment Protection Authority, August 2022.

NSW EPA, (2022b). *Practice note: Preparing environmental management plans for contaminated land.*

SafeWork NSW (2019). *Code of practice: How to manage and control asbestos in the workplace.*

SafeWork NSW (2019). *Code of practice: How to safely remove asbestos*.

WA DoH (2021), *Guidelines for the assessment, remediation and management of asbestos contaminated sites in Western Australia*, WA Department of Health.

18. Limitations

This Remediation Action Plan (RAP) for the Walka Water Works site in Oakhampton Heights NSW (the "Report"):

- Has been prepared by GHD Pty Ltd ("GHD") for Maitland City Council
- May be used and relied on by Maitland City Council
- May be provided to the Site Auditor for the purposes of conducting a site audit under the provisions of the Contaminated Land Management Act (CLM Act) 1997
- Must not be used by, or relied on by any parties other than those listed above without the prior written consent of GHD and subject always to the next paragraph
- May only be used for the purpose as stated in Section 1 of the Report (and must not be used for any other purpose)

GHD and its servants, employees and officers otherwise expressly disclaim responsibility to any person other than Maitland City Council arising from or in connection with this Report.

To the maximum extent permitted by law, all implied warranties and conditions in relation to the services provided by GHD and the Report are excluded unless they are expressly stated to apply in this Report.

The services undertaken by GHD in connection with preparing this Report:

- Were limited to those specifically detailed in Section 1 of this Report
- Were undertaken in accordance with current professional practice and by reference to relevant environmental regulatory authority and industry standards, guidelines and assessment criteria in existence as at the date of this Report

The opinions, conclusions and any recommendations in this Report are based on assumptions made by GHD when undertaking the services mentioned above and preparing the Report ("Assumptions"), as specified throughout this Report.

GHD expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with any of the Assumptions being incorrect.

Subject to the paragraphs in this section of the Report, the opinions, conclusions and any recommendations in this Report are based on conditions encountered and information reviewed at the time of preparation of this Report and are relevant until such times as the site conditions or relevant legislations changes, at which time, GHD expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with those opinions, conclusions and any recommendations.

This Report is based solely on the investigations and findings contained in the reports referenced herein and on the conditions encountered and information reviewed at the time of each referenced report. This Report should be read in conjunction with the referenced reports. It is also subject to all the limitations and recommendations in the referenced reports.

GHD has prepared this Report on the basis of information provided by Maitland City Council and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked ("Unverified Information") beyond the agreed scope of work.

GHD expressly disclaims responsibility in connection with the Unverified Information, including (but not limited to) errors in, or omissions from, the Report, which were caused or contributed to by errors in, or omissions from, the Unverified Information.

The opinions, conclusions and any recommendations in this Report are based on information obtained from, and testing undertaken at or in connection with, specific sampling points and may not fully represent the conditions that may be encountered across the site at other than these locations. Site conditions at other parts of the site may be different from the site conditions found at the specific sampling points.

GHD has considered and/or tested for only those chemicals specifically referred to in this Report and makes no statement or representation as to the existence (or otherwise) of any other chemicals.

Site conditions (including any the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD expressly disclaims responsibility:

– Arising from, or in connection with, any change to the site conditions
– To update this Report if the site conditions change

Subsurface conditions can vary across a particular site and cannot be exhaustively defined by the investigations carried out prior to this Report. As a result, it is unlikely that the results and estimations expressed or used to compile this Report will represent conditions at any location other than the specific points of sampling. A site that appears to be unaffected by contamination at the time of the Report may later, due to natural causes or human intervention, become contaminated.

Except as otherwise expressly stated in this Report, GHD makes no warranty, statement or representation of any kind concerning the suitability of the site for any purpose or the permissibility of any use, development or re-development of the site.

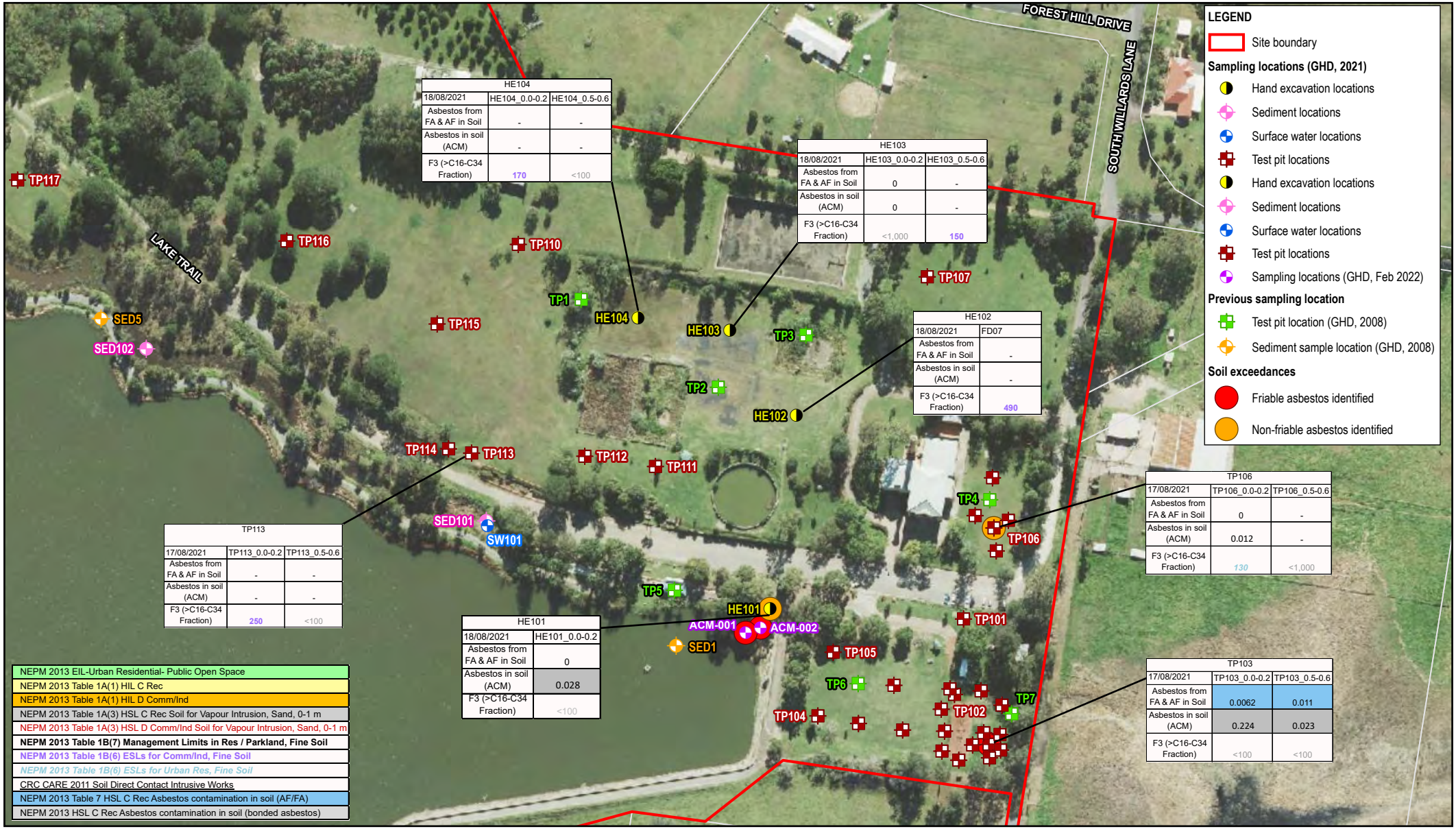
These Disclaimers should be read in conjunction with the entire Report and no excerpts are taken to be representative of the findings of this Report.

Appendices

Appendix A

Figures

Appendix A1 – Figures from GHD 2022a



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Grid: GDA 1994 MGA Zone 56

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GHD

Maitland City Council
Walka Water Works – Scobies Lane, Oakhampton Heights NSW
Contamination Assessment

Soil exceedances (August 2021)

Project No. **12553096**
Revision No. **1**
Date **10/02/2022**

FIGURE 5.1

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Metres

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Maitland City Council
Walka Water Works – Scobies Lane, Oakhampton Heights NSW
Contamination Assessment

Project No. **12553096**
Revision No. **1**
Date **10/02/2022**

Soil exceedances (October 2021)

FIGURE 5.2

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Appendix A2 – Figures from GHD 2022e

LEGEND

- Site boundary
- Cadastre
- Waterbody
- Watercouse
- Railway

Paper Size ISO A4

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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GHD

Maitland City Council
Walka Water Works – Scobies Lane, Oakhampton Heights NSW
Broader site sampling

Site locality

Project No. **12553096**
Revision No. **0**
Date **22/08/2022**

FIGURE 1

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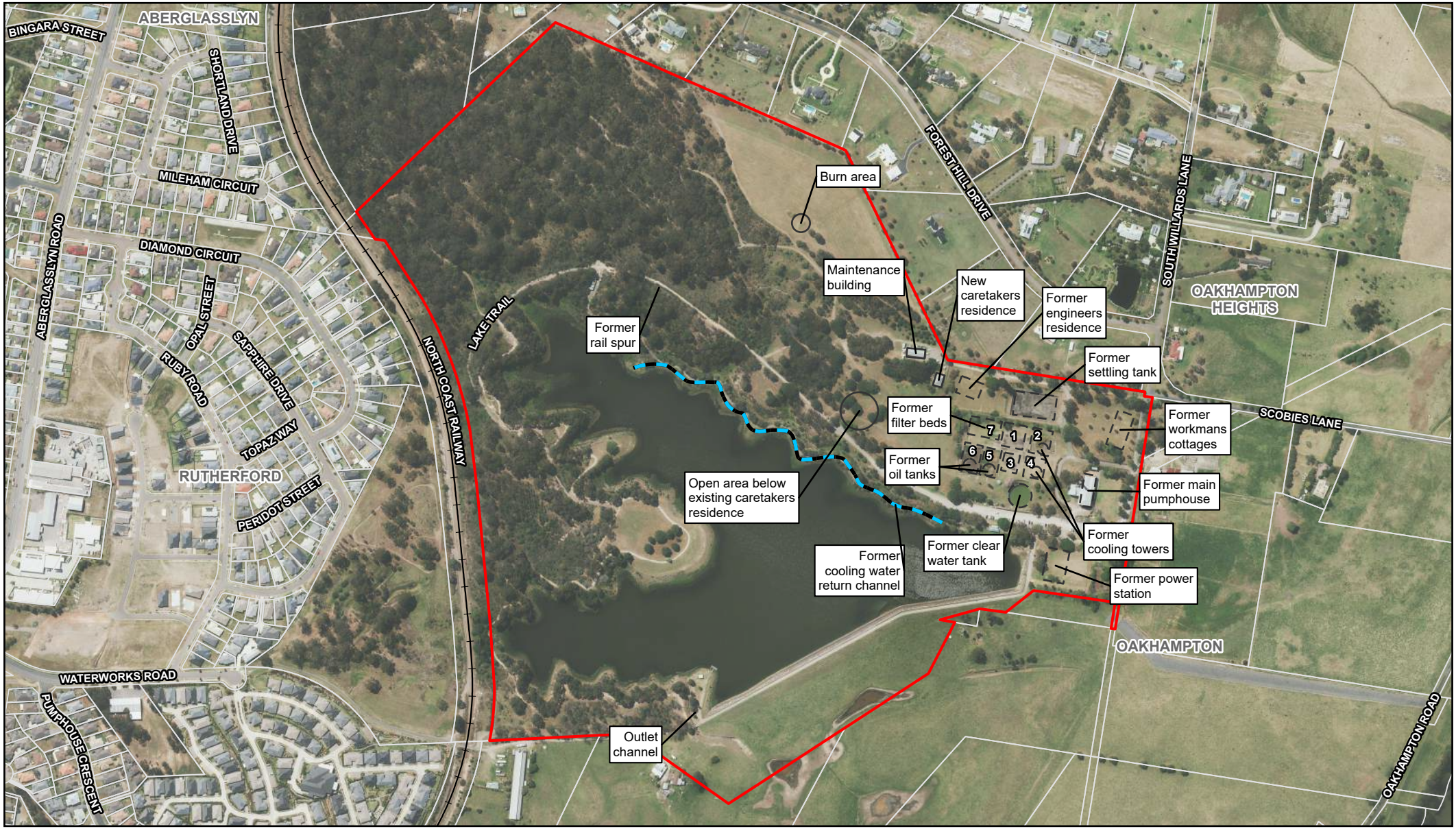

LEGEND

- Site boundary
- Cadastre
- Former site features
- Site features
- Former cooling water return channel
- Railway

Paper Size ISO A4

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Maitland City Council
Walka Water Works – Scobies Lane, Oakhampton Heights NSW
Broader site sampling

Site features

Project No. **12553096**
Revision No. **0**
Date **22/08/2022**

FIGURE 2

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LEGEND

- Plan outline
- Cadastre
- Railway

Paper Size ISO A4

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Maitland City Council
Walka Water Works – Scobies Lane, Oakhampton Heights NSW
Broader site sampling

Key Plan

Project No. **12553096**
Revision No. **0**
Date **22/08/2022**

FIGURE 3

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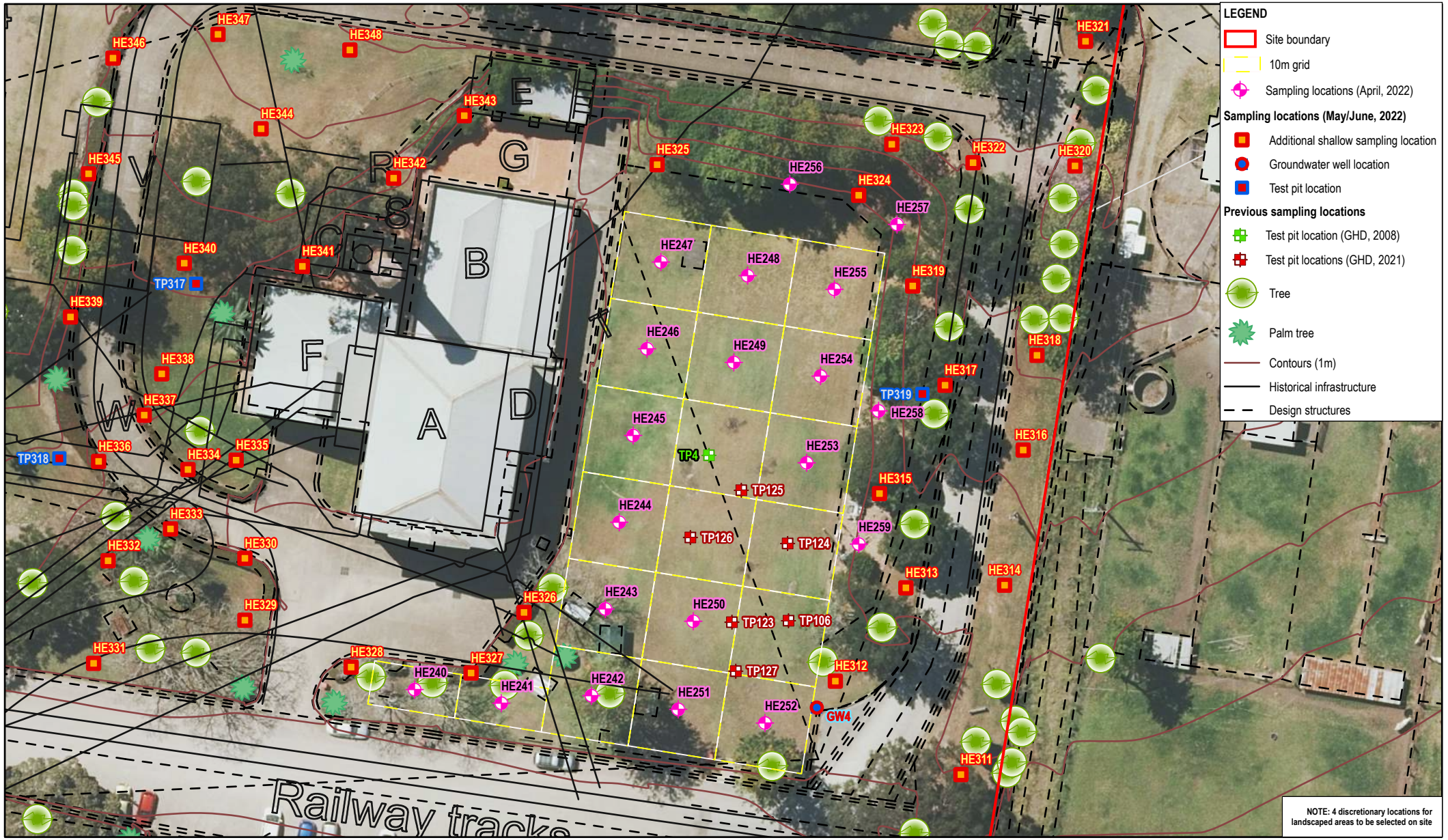
LEGEND
Site boundary
10m grid
Sampling locations (April, 2022)
Sampling locations (May/June, 2022)
Additional shallow sampling location
Groundwater well location
Test pit location
Previous sampling locations
Test pit location (GHD, 2008)
Test pit locations (GHD, 2021)
Tree
Palm tree
Contours (1m)
Historical infrastructure
Design structures
NOTE: 4 discretionary locations for landscaped areas to be selected on site
HE346
HE347
HE348
HE344
HE343
HE345
HE342
HE325
HE256
HE323
HE322
HE321
HE320
HE324
HE257
HE340
HE341
TP317
HE247
HE248
HE255
HE319
HE339
HE246
HE249
HE254
HE318
HE338
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HE312
HE240
HE242
HE241
HE251
HE252
GW4
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Railway tracks
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GHD
Maitland City Council
Walka Water Works – Scobies Lane,
Oakhampton Heights NSW
Broader site sampling
Pumphouse and surrounds
Project No. 12553096
Revision No. 0
Date 22/08/2022
FIGURE 4
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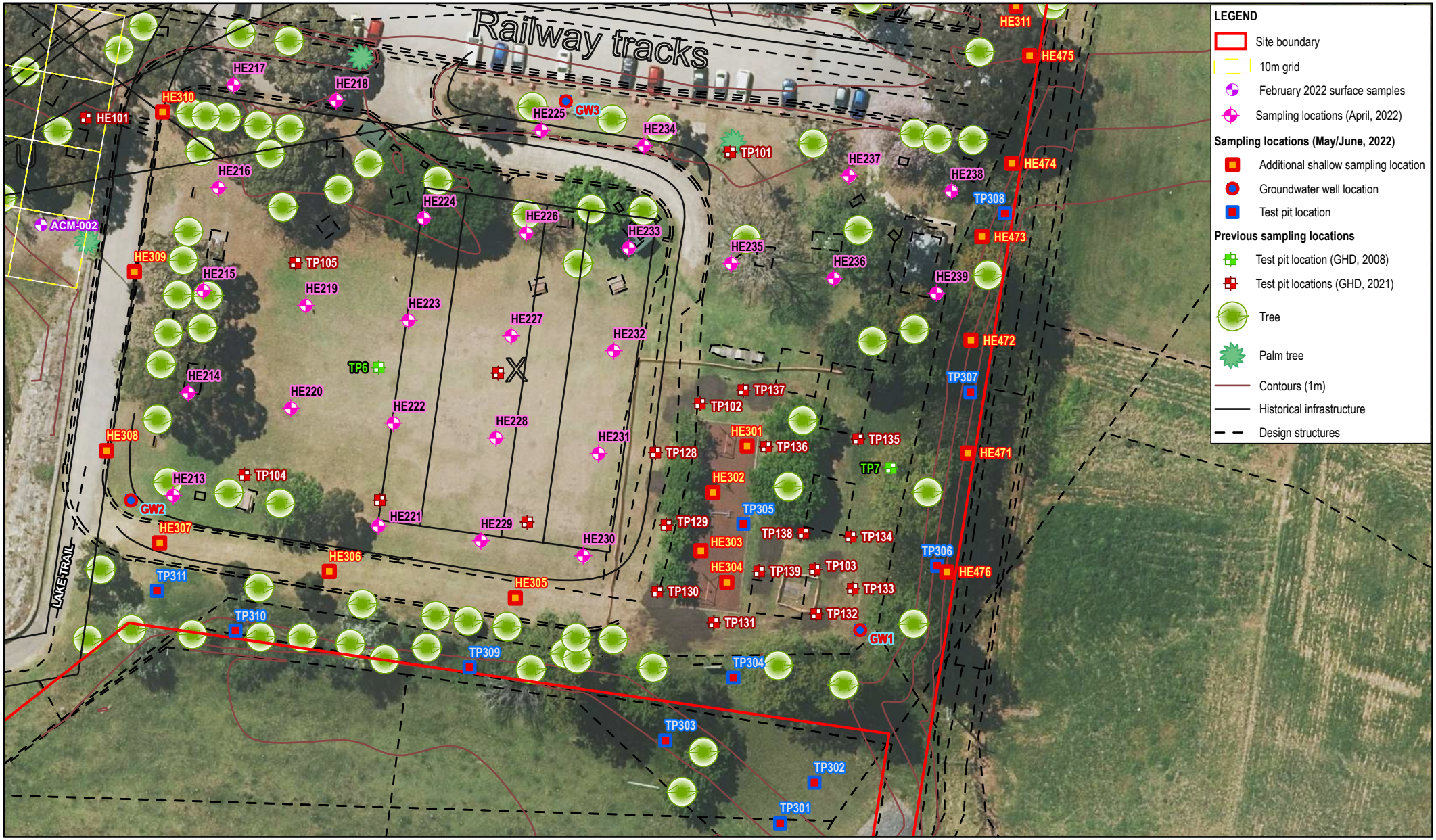

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Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

Maitland City Council
Walka Water Works – Scobies Lane, Oakhampton Heights NSW
Broader site sampling

Power station lawn

Project No. **12553096**
Revision No. **0**
Date **22/08/2022**

FIGURE 5

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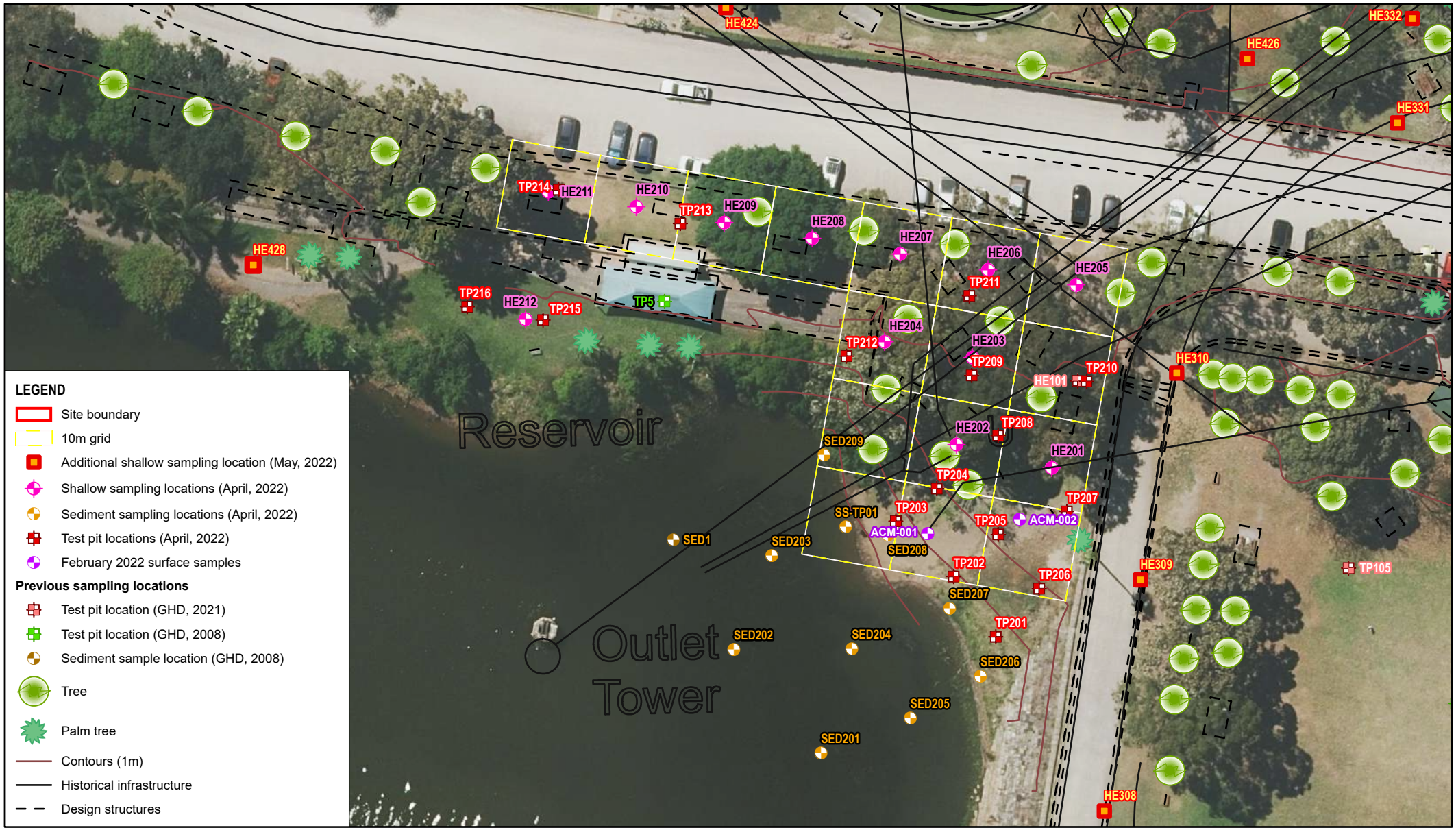

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Grid: GDA 1994 MGA Zone 56

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Maitland City Council
Walka Water Works – Scobies Lane, Oakhampton Heights NSW
Broader site sampling

Beach and Mini train station area

Project No. **12553096**
Revision No. **0**
Date **22/08/2022**

FIGURE 6

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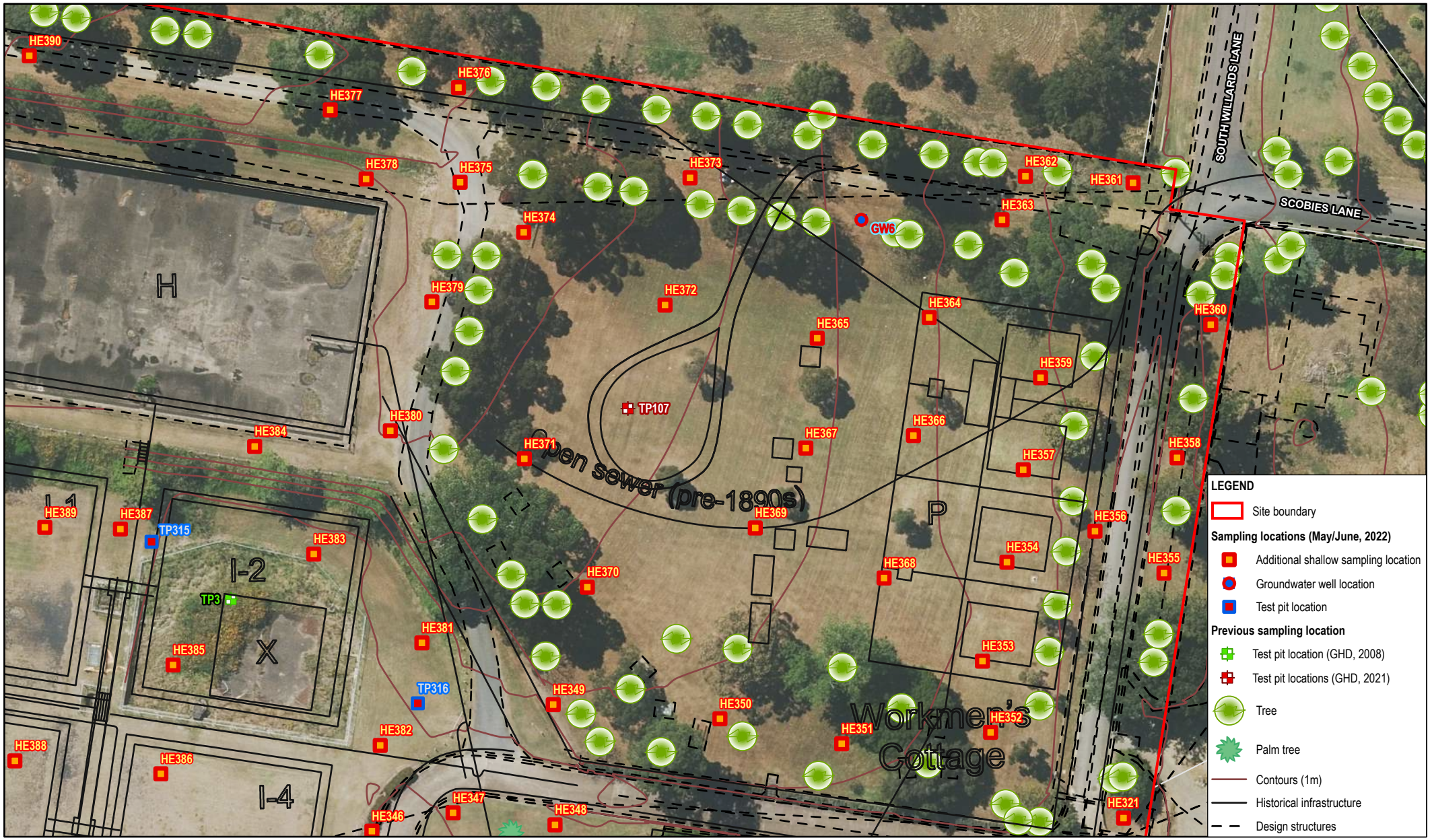

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GHD

Maitland City Council
Walka Water Works – Scobies Lane, Oakhampton Heights NSW
Broader site sampling

Former workmans cottages area

Project No. **12553096**
Revision No. **0**
Date **23/08/2022**

FIGURE 7

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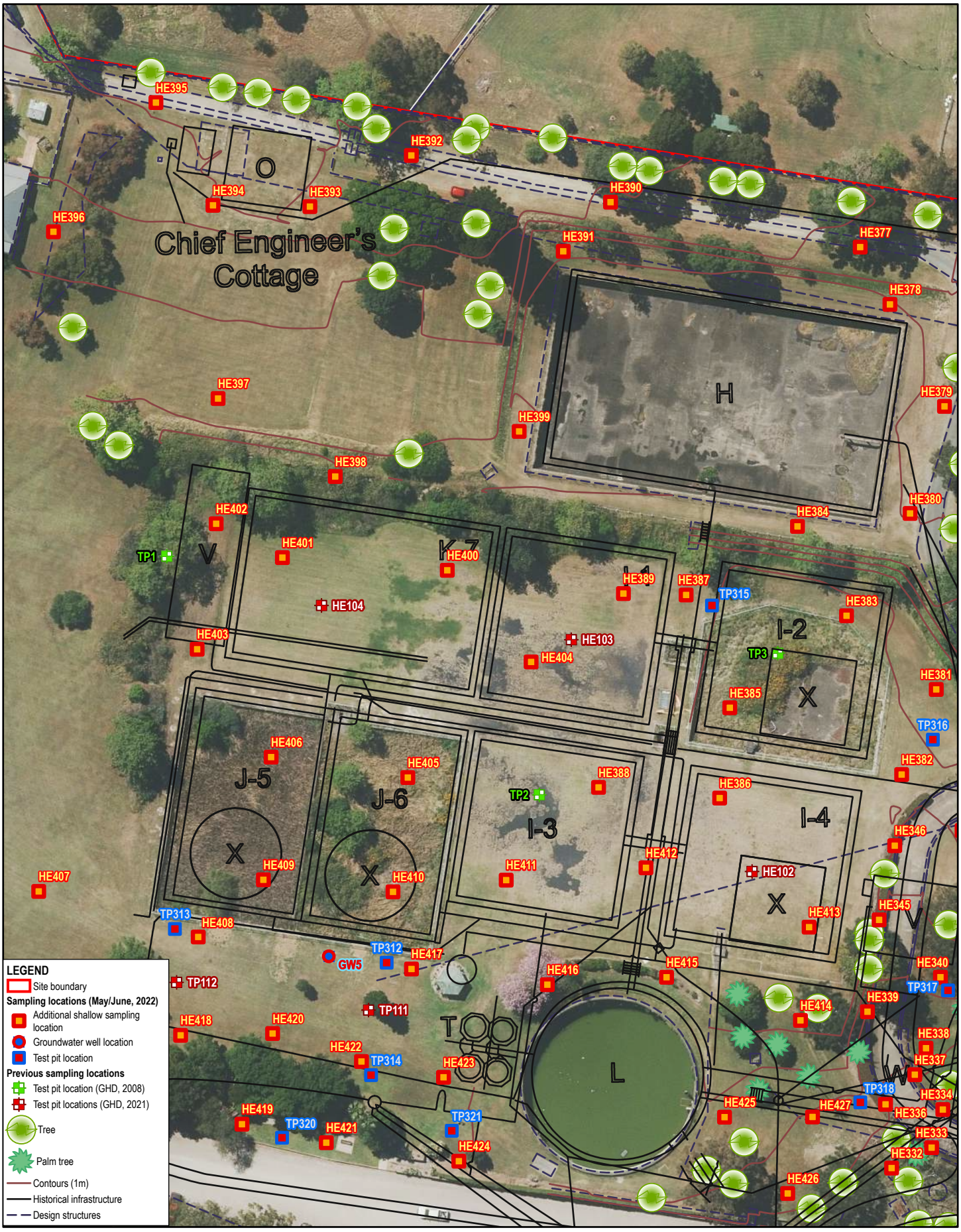

Paper Size ISO A4

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Metres

Map Projection: Transverse Mercator
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Maitland City Council
Walka Water Works – Scobies Lane, Oakhampton Heights NSW
Broader site sampling

Former water treatment area

Project No. **12553096**
Revision No. **0**
Date **23/08/2022**

FIGURE 8

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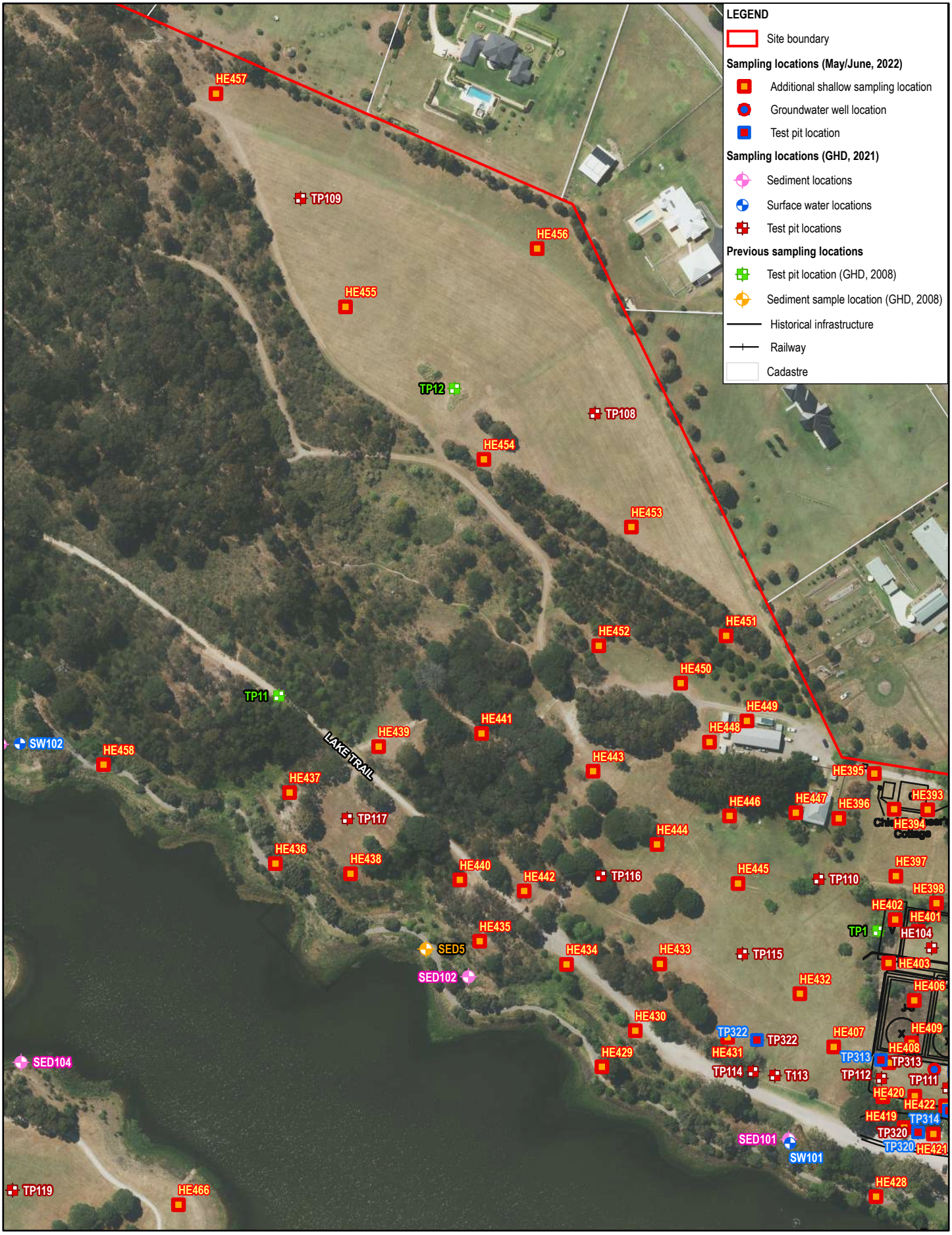

Paper Size ISO A4

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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GHD

Maitland City Council
Walka Water Works – Scobies Lane, Oakhampton Heights NSW
Broader site sampling

North-central area

Project No. **12553096**
Revision No. **0**
Date **22/08/2022**

FIGURE 9

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Paper Size ISO A4

0 20 40 60 80

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Maitland City Council
Walka Water Works – Scobies Lane, Oakhampton Heights NSW
Broader site sampling

North-western area

Project No. **12553096**
Revision No. **0**
Date **22/08/2022**

FIGURE 10

\\ghdnet\ghd\AU\Newcastle\Projects\22\12553096\GIS\Maps\Working\SAQP_ActivityBased_EA_A.aprx
Print date: 23 Aug 2022 - 10:19

Data source: LPI: DTDB / DCDB, 2017;Metromap Tile Service: . Created by: asharma4

Paper Size ISO A4

0 10 20 30 40 50

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Maitland City Council
Walka Water Works – Scobies Lane, Oakhampton Heights NSW
Broader site sampling

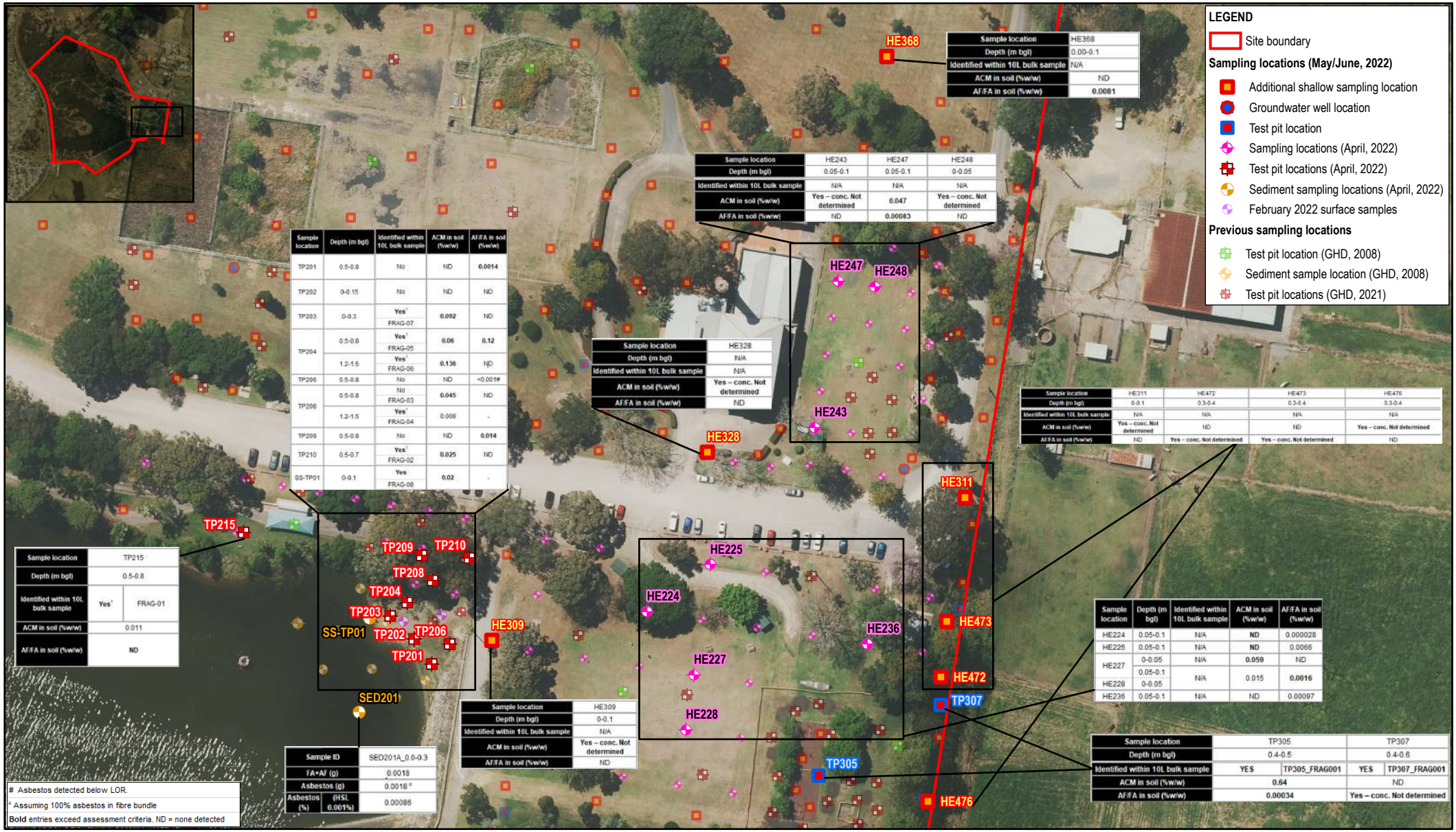
South-western area

Project No. **12553096**
Revision No. **0**
Date **22/08/2022**

FIGURE 11

\\ghdnet\ghd\AU\Newcastle\Projects\22\12553096\GIS\Maps\Working\SAQP_ActivityBased_EA_A.aprx
Print date: 23 Aug 2022 - 10:01

Data source: LPI: DTDB / DCDB, 2017; Casey & Lowe, 2022Metromap Tile Service: . Created by: asharma4



Sample location	HE368
Depth (m bgl)	0.00-0.1
Identified within 10L bulk sample	N/A
ACM in soil (%w/w)	ND
AF/FA in soil (%w/w)	0.0081

Sample location	HE243	HE247	HE248
Depth (m bgl)	0.05-0.1	0.05-0.1	0-0.05
Identified within 10L bulk sample	N/A	N/A	N/A
ACM in soil (%w/w)	Yes – conc. Not determined	0.047	Yes – conc. Not determined
AF/FA in soil (%w/w)	ND	0.00083	ND

Sample location	HE328
Depth (m bgl)	N/A
Identified within 10L bulk sample	N/A
ACM in soil (%w/w)	Yes – conc. Not determined
AF/FA in soil (%w/w)	ND

Sample location	HE311	HE472	HE473	HE476
Depth (m bgl)	0-0.1	0.3-0.4	0.3-0.4	0.3-0.4
Identified within 10L bulk sample	N/A	N/A	N/A	N/A
ACM in soil (%w/w)	Yes – conc. Not determined	ND	ND	Yes – conc. Not determined
AF/FA in soil (%w/w)	ND	Yes – conc. Not determined	Yes – conc. Not determined	ND

Sample location	Depth (m bgl)	Identified within 10L bulk sample	ACM in soil (%w/w)	AF/FA in soil (%w/w)
TP201	0.5-0.8	No	ND	0.0014
TP202	0-0.15	No	ND	ND
TP203	0-0.3	Yes[1] FRAG-07	0.092	ND
TP204	0.5-0.8	Yes[1] FRAG-05	0.06	0.12
	1.2-1.5	Yes[1] FRAG-06	0.136	ND
TP206	0.5-0.8	No	ND	<0.001#
TP208	0.5-0.8	No FRAG-03	0.045	ND
	1.2-1.5	Yes[1] FRAG-04	0.008	-
TP209	0.5-0.8	No	ND	0.014
TP210	0.5-0.7	Yes[1] FRAG-02	0.025	ND
SS-TP01	0-0.1	Yes FRAG-08	0.02	-

Sample location	TP215
Depth (m bgl)	0.5-0.8
Identified within 10L bulk sample	Yes[1] FRAG-01
ACM in soil (%w/w)	0.011
AF/FA in soil (%w/w)	ND

Sample location	HE309
Depth (m bgl)	0-0.1
Identified within 10L bulk sample	N/A
ACM in soil (%w/w)	Yes – conc. Not determined
AF/FA in soil (%w/w)	ND

Sample ID	SED201A_0.0-0.3
FA+AF (g)	0.0018
Asbestos (g)	0.0018 ^
Asbestos (%) (HSL 0.001%)	0.00086

Sample location	Depth (m bgl)	Identified within 10L bulk sample	ACM in soil (%w/w)	AF/FA in soil (%w/w)
HE224	0.05-0.1	N/A	ND	0.000028
HE225	0.05-0.1	N/A	ND	0.0066
HE227	0-0.05	N/A	0.059	ND
	0.05-0.1	N/A	0.015	0.0016
HE228	0-0.05			
HE236	0.05-0.1	N/A	ND	0.00097

Sample location	TP305		TP307	
Depth (m bgl)	0.4-0.5		0.4-0.6	
Identified within 10L bulk sample	YES	TP305_FRAG001	YES	TP307_FRAG001
ACM in soil (%w/w)	0.64		ND	
AF/FA in soil (%w/w)	0.00034		Yes – conc. Not determined	

Paper Size ISO A4

0 20 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

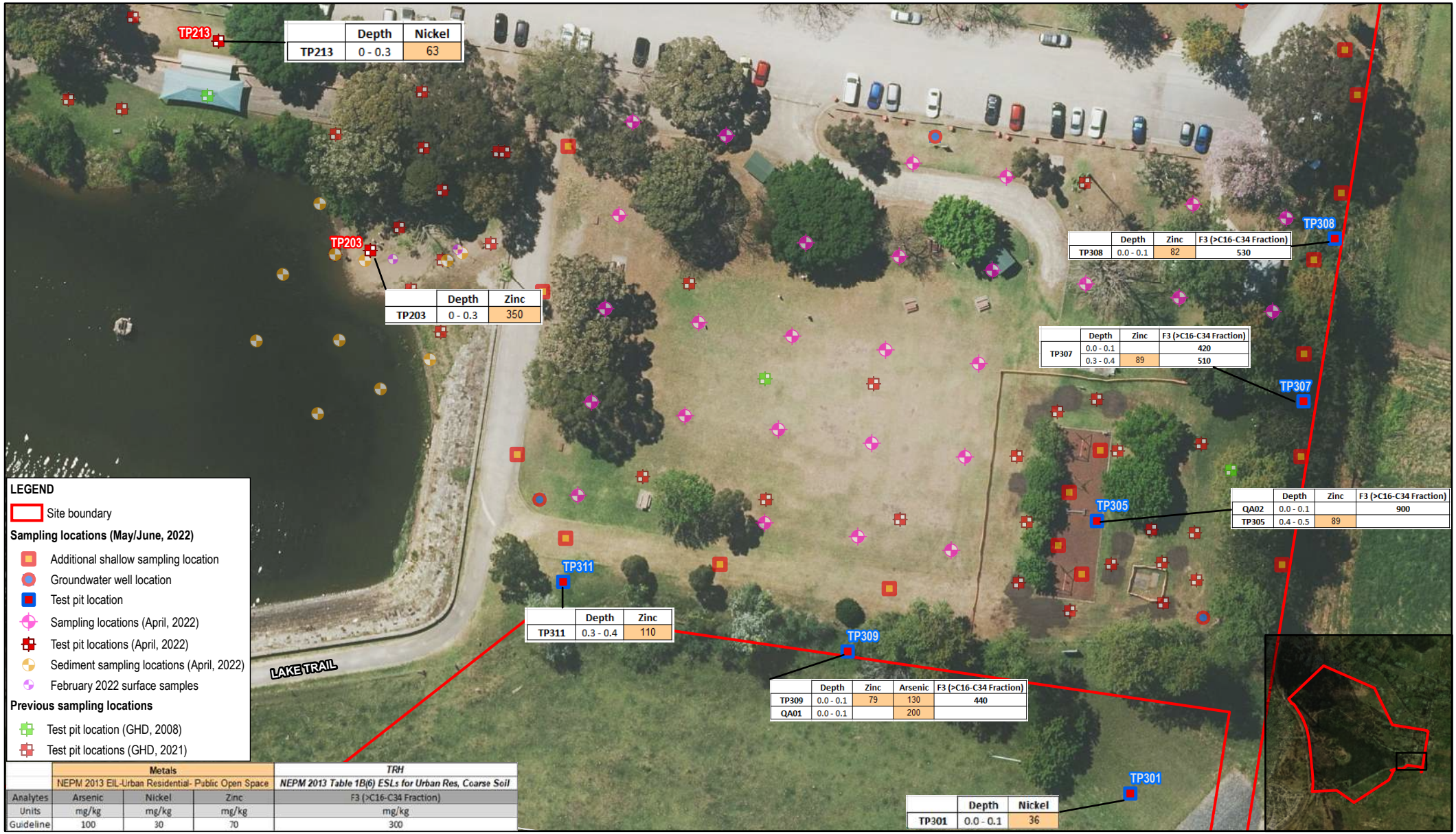
Maitland City Council
Walka Water Works – Scobies Lane, Oakhampton Heights NSW
Contamination Assessment

Asbestos in soil exceedances

Project No. **12553096**
Revision No. **0**
Date **23/08/2022**

FIGURE 12

\\ghdnet\ghd\AU\Newcastle\Projects\22\12553096\GIS\Maps\Working\12553096_ContamAssessment.aprx
Print date: 23 Aug 2022 - 10:44



	Depth	Nickel
TP213	0 - 0.3	63

	Depth	Zinc
TP203	0 - 0.3	350

	Depth	Zinc	F3 (>C16-C34 Fraction)
TP308	0.0 - 0.1	82	530

	Depth	Zinc	F3 (>C16-C34 Fraction)
TP307	0.0 - 0.1		420
	0.3 - 0.4	89	510

	Depth	Zinc	F3 (>C16-C34 Fraction)
QA02	0.0 - 0.1		900
TP305	0.4 - 0.5	89	

	Depth	Zinc
TP311	0.3 - 0.4	110

	Depth	Zinc	Arsenic	F3 (>C16-C34 Fraction)
TP309	0.0 - 0.1	79	130	440
QA01	0.0 - 0.1		200	

	Depth	Nickel
TP301	0.0 - 0.1	36

	Metals			TRH
	NEPM 2013 EIL-Urban Residential- Public Open Space			*NEPM 2013 Table 1B(6) ESLs for Urban Res, Coarse Soil*
Analytes	Arsenic	Nickel	Zinc	F3 (>C16-C34 Fraction)
Units	mg/kg	mg/kg	mg/kg	mg/kg
Guideline	100	30	70	300

Paper Size ISO A4

0 10 20

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Maitland City Council
Walka Water Works – Scobies Lane, Oakhampton Heights NSW
Contamination Assessment

Soil heavy metals exceedances

Project No. **12553096**
Revision No. **0**
Date **23/08/2022**

FIGURE 13

\\ghdnet\ghd\AU\Newcastle\Projects\22\12553096\GIS\Maps\Working\12553096_ContamAssessment.aprx
Print date: 23 Aug 2022 - 10:50

Data source: LPI: DTDB / DCDB, 2017; Metromap Tile Service: . Created by: asharma4

Site ID	Cadmium	Chromium (III+VI)	Copper	Nickel	Zinc
GW1			0.009		0.039
FD01			0.008		0.056
GW2				0.11	0.096
GW3		0.006	0.004	0.11	0.097
GW4		0.002		0.063	0.13
GW5	0.0011		0.002	0.14	0.42
GW6				0.025	0.059

Analytes	Cadmium	Chromium (III+VI)	Copper	Nickel	Zinc
Unit	mg/L	mg/L	mg/L	mg/L	mg/L
ANZG (2018) - FW - 95% (updated 26 July 2021)	0.0002	0.001	0.0014	0.011	0.008

Paper Size ISO A4

0 25 50

Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

Maitland City Council
Walka Water Works – Scobies Lane, Oakhampton Heights NSW
Contamination Assessment

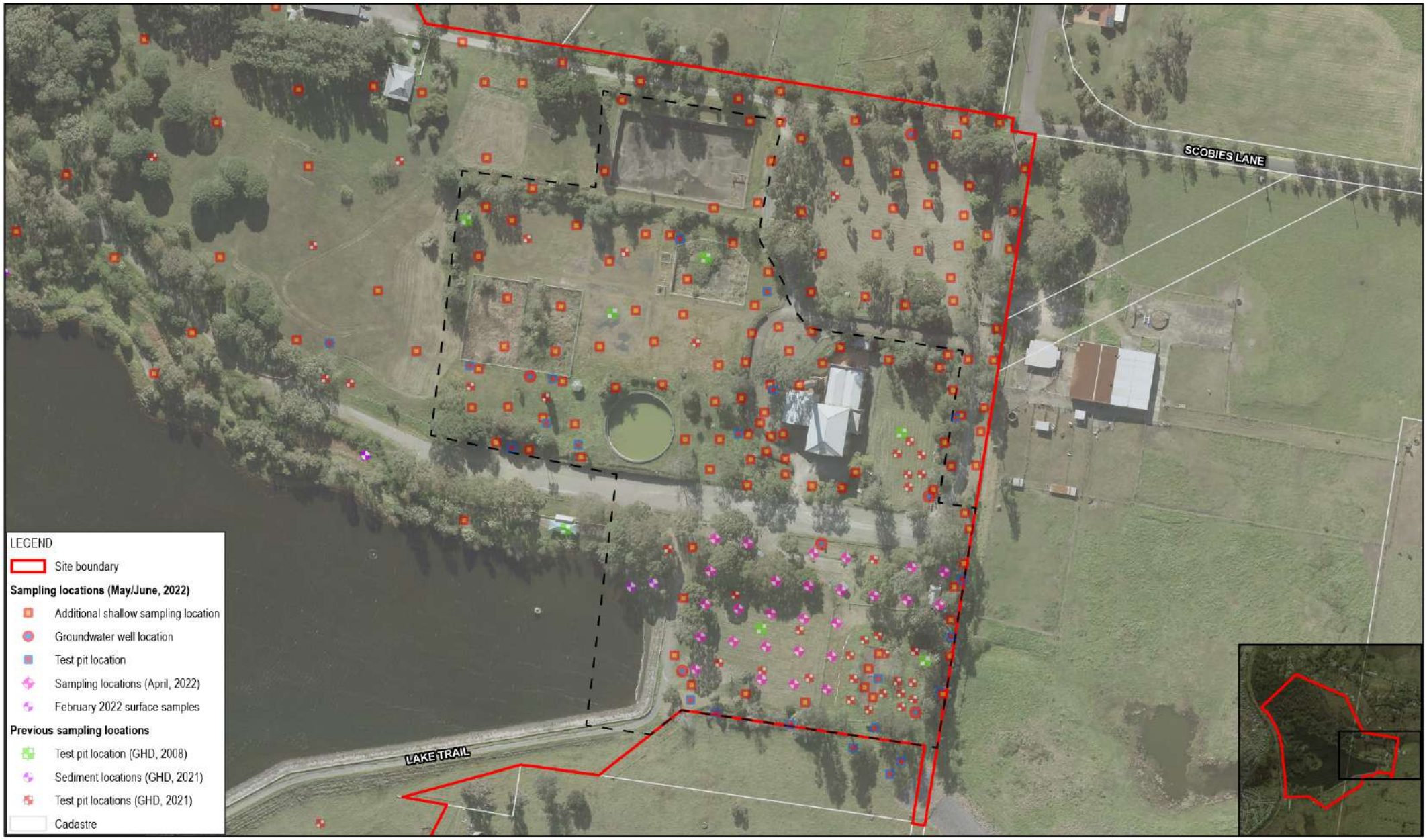
Groundwater heavy metals exceedances

Project No. **12553096**
Revision No. **0**
Date **23/08/2022**

FIGURE 14

\\ghdnet\ghd\AU\Newcastle\Projects\22\12553096\GIS\Maps\Working\12553096_ContamAssessment.aprx
Print date: 23 Aug 2022 - 12:09

Data source: LPI: DTDB / DCDB, 2017; Metromap Tile Service: . Created by: asharma4



Paper Size ISO A4

0 30 60

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Maitland City Council
Walka Water Works – Scobies Lane, Oakhampton Heights NSW
Contamination Assessment

Site audit boundary

Project No. **12553096**
Revision No. **0**
Date **18/10/2022**

FIGURE 15

\\ghdner\ghd\AU\Newcastle\Projects\22\12553096\GIS\Maps\Working\12553096_ContamAssessment.aprx
Print date: 18 Oct 2022 - 11:52

Data source: LPI: DTDB / DCDB, 2017; Metromap Tile Service; . Created by: ashanma4

Appendix B

Remediation Options Assessment

GHD Tower, Level 3, 24 Honeysuckle Drive
Newcastle, New South Wales 2300
Australia
www.ghd.com

Your ref:
Our ref: 12553096

08 August 2022

[redacted]
Maitland City Council
285-287 High Street
Maitland NSW 2320

Walka Water Works – Remediation Options Assessment

Dear Scott

1. Introduction

Maitland City Council (MCC) has engaged GHD Pty Ltd (GHD) to provide consulting services associated with the assessment and management of contamination at Walka Water Works, 55 Scobies Lane, Oakhampton NSW (the site). The site contains heritage listed infrastructure and is a popular recreational facility which attracts a variety of users, including walkers, tourists, school groups, special interest groups, Park Run [for the last 7 years, averaging 300 participants per week], and Council organised special events including wedding receptions at the historic pump house building and adjacent lawn area.

Recent investigations have identified contamination at the site which requires remediation and/or management to enable the site to be made suitable for continued recreational use by the public. The investigations and findings are described in the following reports:

– GHD (2022a) *Walka Water Works, Contamination Assessment*, 11 February 2022
– GHD (2022e) *Walka Water Works, Supplementary Site Investigations*, Rev A, 31 July 2022

This letter presents a review and assessment of potential remediation options to address the contamination which has been identified at the site as described in Section 3 below. It is noted that the site is currently closed to the public pending selection and implementation of an appropriate remediation strategy.

The investigations and subsequent remediation planning and implementation are subject to independent review by an accredited site auditor, Lange Jorstad of Geosyntec.

2. Objectives

The objectives of the proposed remediation works are to restore the site to a condition which is suitable, from a contamination perspective, for ongoing use as a public recreational facility incorporating the types of land use described in Section 1 above.

The objectives of this remediation options assessment (ROA) are to:

– Outline the contamination issues requiring remediation or management at the site
– Review and assess potentially feasible remediation options in the specific context of the identified contamination and site characteristics
– Outline site-specific factors influencing the selection of the most appropriate remediation strategies for the site

– Provide a basis for discussion with relevant stakeholders to agree on the preferred remediation approach (which may involve a combination of remediation options, depending on the area of the site), which can then be incorporated in a remedial action plan (RAP) for the agreed works.

3. Background

Investigations at the site have incorporated a review of historical site use and associated potential site contamination issues, intrusive investigations, sampling and analysis for potential contamination in soil, sediment, surface water and groundwater at the site.

Details of site history, physical setting and characteristics and the scope and findings of investigations are provided in the reports listed in Section 1 above. Selected photographs of the site are provided in Attachment 1, and site features and sampling locations are shown in the figures provided in Attachment 2, as referenced throughout this ROA. A summary of contamination issues is as follows:

– Investigations do not indicate any significant contamination is present at the site as a result of historical use except for asbestos, including bonded and friable asbestos containing materials. While some elevated concentrations of metals and TRH were identified in soil and sediment, these are limited to exceedances of ecological criteria and based on the concentrations and frequency of occurrence, are not considered to present any significant risk to the environment nor affect the suitability of the site for continued recreational use.
– Groundwater does not appear to have been impacted by the former industrial use of the site. Metals concentrations exceeding groundwater investigation levels are considered likely to be representative of natural groundwater concentrations.
– Previous surface water sampling (GHD 2022a) and MCC monitoring results do not indicate that any significant contamination of surface water in the reservoir has occurred from contamination on the site (eg. attributable to historical land use), however the water quality is not considered suitable for recreational use involving exposure to the water (eg. swimming or wading), primarily due to biological contaminants. Current restrictions to use (i.e. no swimming or fishing) should continue, however the water quality is not considered to affect the suitability of the site for other recreational (non-water based) land use.
– Areas of significant asbestos contamination have been broadly delineated and appear to be primarily confined to the following areas:
    - Former power station footprint, including beneath soft-fall in the playground (separated by geotextile) and extending into the eastern embankment beyond the fence line
    - Lawn to the east of the pump house
    - The beach area, extending into the reservoir sediments and isolated occurrences around the mini train station.
– Isolated occurrences of asbestos have been observed outside the above areas, however the risk of exposure to airborne asbestos fibres from potential soil contamination in these broader site areas is considered low for normal use and maintenance of the site.
– Consideration of a Conceptual Site Model (CSM) and associated source-pathway-receptor linkages indicates chemical contaminants do not present any significant risk to human health or the environment for the proposed land use, but the following possible or potentially complete linkages are present in relation to asbestos:
    - Potential for inhalation of asbestos fibres from disturbance of asbestos contaminated soil, sediments or surface ACM for recreational uses or maintenance workers.

Interim management has been recommended, including maintaining appropriate interim asbestos control measures at the site to control asbestos exposure risks until such time that long term remediation at the site is conducted. These include restricting access to areas of the site with significant identified asbestos contamination; maintaining good grass cover, periodic inspections of site conditions and implementing appropriate asbestos control measures during site maintenance activities.

4. Remediation options assessment

4.1 Remediation hierarchy

The key principles for remediation and management of contaminated sites presented in the *National Environment Protection (Assessment of Site Contamination) Measure 1999* (NEPC 2013) (the NEPM) indicate the preferred hierarchy of options for site clean-up and management should include (in descending order):

– On-site treatment of the contamination so that it is destroyed or the associated risk is reduced to an acceptable level.
– Off-site treatment of excavated soil, so that the contamination is destroyed or the associated risk is reduced to an acceptable level, after which soil is returned to the site.

If the above are not practicable:

– Consolidation and isolation of the soil on site by containment with a properly designed barrier.
– Removal of contaminated material 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.

Other options, which are consistent with the philosophy of contamination management described in the NEPM, could include the following:

– Adopting a less sensitive land use to minimise the need for remedial works, which may include partial remediation.
– Leaving contaminated material in-situ providing there is no immediate danger to the environment or community and the site has appropriate management controls in place.

The NEPM also states the following:

When deciding which option to choose, the sustainability (environmental, economic and social) of each option should be considered, in terms of achieving an appropriate balance between the benefits and effects of undertaking the option.

In cases where no readily available or economically feasible method is available for remediation, it may be possible to adopt appropriate regulatory controls or develop other forms of remediation.

It should be emphasised that the appropriateness of any particular option will vary depending on a range of local factors. Acceptance of any specific option or mix of options in any particular set of circumstances is therefore a matter for the responsible participating jurisdiction.

In relation to asbestos, the NEPM (Schedule B1 section 4.11) notes that remediation options which minimise soil disturbance and therefore public risk are preferred; and management of asbestos in situ is encouraged, which may include covering the contamination with uncontaminated fill or other protective or warning layers. However, Section 4.1 of Schedule B1 notes that this guidance is not applicable to asbestos materials which are wastes such as demolition materials present on the surface of the land. Section 4.3 of Schedule B1 also notes that if visible asbestos is present and it may be disturbed during work activities, it must be removed.

The Waste Avoidance and Resource Recovery (WARR) Act 2001 establishes the following hierarchy for the management of resources:

– Avoid unnecessary resource consumption
– Recover resources (including reusing, reprocessing, recycling and recovering energy)
– Disposal

4.2 Screening assessment

A screening assessment of the remediation options discussed above is presented in Table 4.1 below, to establish which options are feasible for the contamination present at the site and therefore warrant more detailed consideration. The screening assessment is based on GHD's extensive experience with remediation projects and reference to the National Remediation Framework *Guideline on performing remediation options assessment* (CRC CARE 2019a).

Based on Table 4.1, further assessment of remediation options is limited to Options 3, 4 and 5.

Table 4.1 Screening assessment of remediation options

Option No.	Option Description	Screening assessment
1	On-site treatment of the contamination so that it is destroyed or the associated risk is reduced to an acceptable level.	Not feasible – asbestos cannot be destroyed (with any practical, available technology) and asbestos fines and friable asbestos cannot feasibly be removed from soil.
2	Off-site treatment of excavated soil, so that the contamination is destroyed or the associated risk is reduced to an acceptable level, after which soil is returned to the site.	Not feasible – asbestos cannot be destroyed (with any practical, available technology) and asbestos fines and friable asbestos cannot feasibly be removed from soil.
3	Consolidation and isolation of the soil on site by containment with a properly designed barrier.	Feasible, and consistent with NEPM guidance for asbestos contaminated soils.
4	Removal of contaminated material to an approved site or facility, followed, where necessary, by replacement with appropriate material.	Feasible.
5	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.	Applicable to areas of the site where the level of risk from asbestos does not warrant active remediation.
6	Adopting a less sensitive land use to minimise the need for remedial works, which may include partial remediation.	Not consistent with the objectives for future use of the site.
7	Leaving contaminated material in-situ providing there is no immediate danger to the environment or community and the site has appropriate management controls in place.	Essentially the same as Option 5. Not further discussed.

4.3 Comparison of feasible options

Giving consideration to the nature of the site and the contamination, the remediation objectives and specific constraints, further comparison has been made between the feasible options, as presented in Table 4.2.

Parameters that have been considered in comparison of the feasible options include the following, based on CRC CARE 2019a and GHD's experience with other remediation projects:

– Level of risk – that needs to be achieved by the remediation and the level of risk reduction that is necessary in order to do so (i.e. will the option reduce the risk of asbestos contaminated soil to an acceptable level).
– Reliability / Long-term outcomes – a measure of the degree of certainty that the remediation will succeed in meeting the remediation goals and be maintainable and acceptable in both the short and the long term.
– Policy – remediation hierarchy preferred by NSW EPA (as discussed in Section 4.1).
– Legal requirements – it is essential to satisfy legal requirements, particularly those relating to environmental protection and planning, as well as other issues such as occupational health and safety. All options are legal (see further discussion in Section 4.5 below), but the difficulty in obtaining regulatory approvals will be largely dependent on the nature of the remediation system proposed.

– Ongoing liability - any system that does not involve the full remediation of all contamination may necessitate some form of ongoing maintenance and/or monitoring to ensure the longer-term integrity of the remediation system adopted.
– Benefits – beyond reducing or controlling the unacceptable risks on site.
– Cost – of the remediation program (considered on a relative / comparative basis only; not all individual cost components or common remediation elements).
– Sustainability – will the remediation strategy provide an acceptable level of risk and a balance in terms of environmental, financial and social considerations. Energy use during remediation is considered a key metric of sustainability, given current emphasis on minimising climate change.
– Practicability – ability to implement the remediation system and carry out necessary maintenance. Also considers the experience local contractors have in undertaking the type of remediation works proposed.
– Duration / site disruption – during of the remediation program. As treatment is not involved and given the overall scale of remediation, all options are considered likely to be relatively similar in duration, and remediation will invariably involve disturbance to the site.
– Stakeholders – are their views considered and will the remediation strategy achieve an acceptable outcome on essential matters. This ROA is intended to facilitate stakeholder consultation and is applicable to all options, and hence this has not been considered in the comparison
– Risks – all risks that need to be controlled during remediation. This includes safety risks relating to works on site, risks to nearby residents, risks during transportation (if required).

Table 4.2 Comparison of feasible remediation options

Option	Consolidation and containment (#3)	Off-site disposal and replacement (#4)	Management strategy (#5)
Risk reduction achieved	Containment is a reliable option to eliminate the exposure pathway and reduce risks to an acceptable level.	Off-site disposal is a reliable option to eliminate the exposure pathway and reduce risks to an acceptable level.	A management strategy is only considered suitable in areas where the level of risk is low enough that inadvertent exposure during future use is unlikely to present an unacceptable level of risk.
Reliability / Long term requirements	Appropriately designed containment is considered reliable in the long term and should not impose maintenance requirements significantly greater than normal site maintenance.	Contamination is removed from site and presents no long-term maintenance requirements.	Long term reliability relies on an adequate level of site maintenance and awareness.
Policy	Given destruction of contamination is not achievable, consolidation and isolation is the first preference based on the remediation hierarchy in Section 4.1, and is highest on the WARR hierarchy.	Given destruction of contamination is not achievable, off-site disposal is the second preference based on the remediation hierarchy in Section 4.1, and is lowest on the WARR hierarchy.	Management is the lowest preference based on the remediation hierarchy in Section 4.1, but is highest on the WARR hierarchy.
Legal requirements / regulatory approval	Satisfactory. Subject to development approval process and WHS requirements. Heritage constraints to site disturbance.	Satisfactory. Subject to waste regulations and WHS requirements. Heritage constraints to site disturbance.	Satisfactory. Still subject to waste WHS requirements. Heritage constraints avoided as there is no site disturbance.
Ongoing liability	Ongoing liability associated with the presence of managed contamination.	Contaminated materials removed from site, minimal ongoing liability.	Ongoing liability associated with the presence of managed contamination.
Benefits	Opportunity to infill heritage structures, improving site	Can coordinate redesign of site facilities to work in with remediation.	No disturbance of site or heritage constraints.

Option	Consolidation and containment (#3)	Off-site disposal and replacement (#4)	Management strategy (#5)
	usability and reducing safety hazards. Can coordinate redesign of site facilities to work in with remediation.		
Relative cost	Medium (overall cost estimate for remediation and reinstatement in the order of $6.5M including GST from GHD 2022f)	High – additional disposal costs and replacement fill could double overall remediation costs (based on an assumption of up to ~13,000m^3 of contaminated soil disposal and reinstatement).	Low – where applicable (i.e. where risks are acceptable), costs would be limited to long term management.
Sustainability	Relatively high sustainability, due to minimising disturbance and use of resources while meeting remediation objectives.	Low sustainability due to use of landfill space, requirement for replacement fill, and energy use in transport and disposal off-site.	High sustainability due to lack of use of resources to management contamination, while meeting remediation objectives.
Practicability	Class A asbestos removal contractor required. Civil works relatively simple, subject to asbestos control measures.	Class A asbestos removal contractor required. Civil works relatively simple, subject to asbestos control measures.	Will require appropriate training of long-term maintenance staff.
Duration / site disruption	Moderate to high disturbance during earthworks phase. Minimal disruption to surrounding land users, as material will not be leaving site.	Substantial disturbance during earthworks phase. Potential disruption to surrounding land users with increased traffic movements from site.	No disruption or disturbance to site.
Risks during remediation	Moderate to high risks during remediation (depending on degree of disturbance). Subject to asbestos control measures.	High risks during remediation due to substantial disturbance. Substantial risk from transportation and disposal of asbestos waste.	No increased risks from remediation.

4.4 Constraints and opportunities

The following sections discuss the constraints and opportunities specific to each particular area of the site, based on the feasible remediation options discussed in Section 4.3.

4.4.1 Pump house lawn

Investigations indicate contamination in the area of the pump house is limited to the lawn to the east of the pump house, including landscaped areas at the south-west end of the lawn (see Photographs 1 and 2 in Attachment 1, Figure 5.2 and Figure 12 in Attachment 2).

Constraints to remediation including heritage structures (including kerb on the western side of the lawn), picnic facilities (tables, barbeques), underground services (current and historic) and future land use requirements. It is understood that site configuration is likely to remain similar for future land use (i.e. ongoing passive recreational use, wedding receptions).

Capping will need to tie in to the surface level of adjoining heritage structures, and contaminated soil will need to be excavated from behind the kerb to allow sufficient capping thickness without raising site levels. The excavation will need to transition (eg. taper up) to capped levels across the rest of the lawn. Capped surface levels can be increased to tie in with landscaped areas to the north and east of the lawn, so as not to require excavations in those areas. Access road design to the south should accommodate capping of the pump house lawn.

Excavated material could either be placed on the area to be capped, or contained elsewhere on site (see discussion in Section 4.4.6). Containing excavated material elsewhere on the site would minimise exposure to asbestos contaminated soils being spread out on existing turf, but would require transport from this area of the site.

Capping thickness may need to allow for erection of temporary structures (eg. marquees) on the lawn, if required for proposed future land use, unless specific procedures for such structures are practical to avoid disturbing soils (eg. weights instead of pegs). Permanent facilities (tables, barbeques) can be reinstated at existing locations or re-located depending on preferred future configuration.

Consideration should be given to underground service requirements (including electricity, water, potential irrigation) including capping thickness, ducting or service corridors.

4.4.2 Former power station area

The former power station area is generally level lawn with a playground near the centre of the eastern portion of the area, and a number of heritage access tracks which have previously been capped with geofabric and gravel (see Photographs 3 and 4 in Attachment 1). An existing amenities block and septic pump-out tank is in the north-eastern corner of this area. GHD understands provision is being made for a future sewer rising main, and a new playground is proposed which would be raised above current site levels.

Investigations indicate contamination extends across the former power station area, including beneath the playground and within the embankment on the eastern side of the site (outside the existing boundary fence and extending up to HE311 adjoining the access road) (see Figure 5.2 and Figure 12 in Attachment 2).

As with the pump station lawn, there are heritage constraints within the former power station area, including existing access roads and heritage kerbs, underground services (current and historic) and established trees as well as picnic facilities (tables, barbeques).

Capping will need to tie in to the surface level of heritage structures, and contaminated soil will need to be excavated from behind the kerbs to allow sufficient capping thickness without raising site levels. Hand excavation will be required around established trees (subject to arborist advice) to avoid damage but allow capping. The excavations will need to transition (eg. taper up) to capped levels across the rest of the lawn. Access road design to the north should accommodate capping of the former power station area.

Excavated material could either be placed on the area to be capped, or contained elsewhere on site. Containing excavated material elsewhere on the site would minimise exposure to asbestos contaminated soils being spread out on existing turf, but would require transport from this area of the site.

Permanent facilities (tables, barbeques) can be reinstated at existing locations or re-located depending on preferred future configuration.

Consideration should be given to underground service requirements (including electricity, water, potential irrigation) including capping thickness, ducting or service corridors.

4.4.3 Access road and parking areas

The access road is paved (concrete or asphalt) to the north-east corner of the power station. Eastward from this point, the access road is well-formed gravel roadbase, and railway tracks from the former rail spur are evident, flush with the road surface. No investigations have been carried out within the access road, rather it has been assumed that fill beneath the road is likely to be asbestos contaminated, and should be capped with permanent paving. Any excavations within the road would need to be managed with asbestos controls.

Constraints to remediation include heritage items (rail lines, underground services) and servicing requirements for future land use.

Temporary paving (eg. 2-coat seal) may be considered pending design and installation of underground service requirements (including electricity, water, drainage) and provision of more permanent paving.

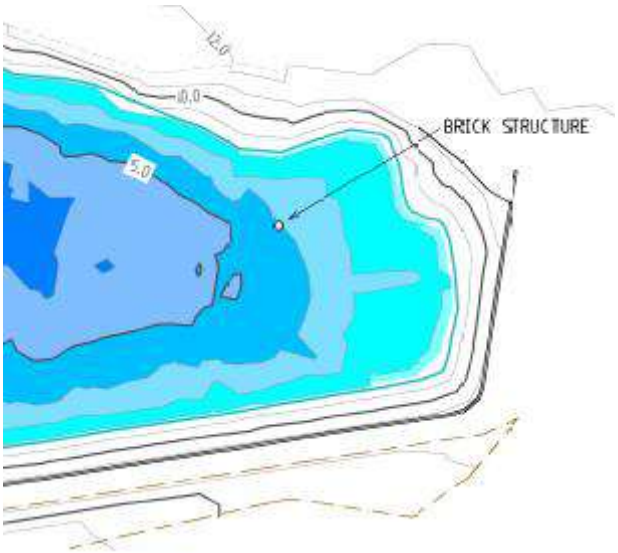
4.4.4 Beach area

Friable asbestos contamination has been identified on the surface of the beach area (which, unlike most other areas of the site, does not have a good cover of turf) as well as within fill material and sediments extending into the reservoir (see Photographs 5 and 6 in Attachment 1, and Figure 5.2 and Figure 12 in Attachment 2). There are extensive historical underground services in the beach area as shown on Figure 6 in Attachment 2. These pose significant heritage constraints to excavations in the beach area. Sandstone revetment of the dam wall also presents a significant heritage constraint, including constraints to any excavation of sediments that may disturb the revetment.

The presence of friable asbestos, lack of surface cover and access of this area by the public during recreational use of the site make this a high risk area which is a priority for remediation.

Difficulties in sampling of sediments means there is uncertainty regarding the extent of sediment that may be contaminated with asbestos, although detection of asbestos in sample SED201 (see Figure 12) indicates contamination extends at least 5 – 10 m from the present shoreline.

At the time of recent investigations, reservoir water levels were relatively high (note locations SS-TP01 and SED206 to SED208 were under water at the time). However, historical survey and aerial photography (see Figure 4.1 and Figure 4.2 below) indicate a significant area of sediments may become exposed at times of low water. While submerged, asbestos contamination in sediments presents no risk of airborne fibres, however this risk would increase if sediments become exposed and dry out. Therefore, unless sufficient investigations can be undertaken to provide certainty as to the extent of asbestos contamination in sediments, a precautionary approach should be taken to the extent of management or remediation.



Elevations Table

Number	Minimum Elevation	Maximum Elevation	Color
1	2.2	3.0	
2	3.0	4.0	
3	4.0	5.0	
4	5.0	6.0	
5	6.0	7.0	
6	7.0	8.0	
7	8.0	8.2	

Figure 4.1 Reservoir depths (from North Point Surveys 18/02/2020) – water level RL 8.2

Figure 4.2 Aerial photograph from MetroMap 10 January 2007 showing lower water level

Contaminated soil and sediments could be removed from the beach area and disposed off-site or contained elsewhere on the site, however the heritage constraints and difficulty in excavating sediments suggest that in-situ capping may be a more effective remediation strategy for this area.

As future excavations or installation of underground services in the beach area are unlikely, a relatively thin erosion-resistant capping layer is likely to be sufficient to prevent exposure to contamination. This may involve grading the on-shore beach area to facilitate placement of a geofabric separation layer, and placement of rock armouring over the geofabric. This could also be undertaken over the submerged sediments, to the extent that the sediments could become exposed during low water levels. Gravel or sand could be placed over the rock armouring to facilitate access to the reservoir in the beach area, if required as part of future land use plans; however it is noted that fishing, swimming or other contact with reservoir waters are prohibited for health and safety reasons, so it may be preferable not to encourage general access.

4.4.5 Mini train station area

While shallow soil investigations in the area of the mini train station did not encounter asbestos contamination, there is some deeper asbestos-contaminated fill to the south (sampling location TP215 as shown on Figure 12 in Attachment 2). In addition, degraded ACM fragments were encountered in the vicinity of location HE101 as shown on Figure 5.1 in Attachment 2, and bare soil is present in this area due to foot traffic (e.g. during Park Run – this is the start and finish area) and tree cover suppressing grass cover (see Photographs 8 and 9 in Attachment 1). Anecdotal information indicates ash from the former power station was used as fill beneath the mini train station.

Constraints to remediation in this area include underground services (current and historic) and established trees as well as picnic facilities (tables, barbeques).

The highest risk areas are considered to be those with the most use and disturbance, directly to the north of the beach area. In-situ capping of these soils with a marker layer and maintenance of turf cover is considered appropriate to prevent exposure to potentially asbestos-contaminated soils. Based on investigation results and provided good grass cover is maintained, it is considered that areas to the west (approximately from HE208 on, as shown on Figure 6 in Attachment 2) can be managed without active remediation, by means of a long term management plan, inspection and maintenance protocols and unexpected finds procedure.

Permanent facilities (tables, barbeques) can be reinstated at existing locations or re-located depending on preferred future configuration.

Consideration should be given to underground service requirements (including electricity, water, potential irrigation) including capping thickness, ducting or service corridors.

4.4.6 Former water treatment area

Asbestos contamination has previously been identified within the former water treatment area, as indicated on Figure 4.2 and Figure 5.1 in Attachment 2. The areas of identified contamination were within former sand filter beds, most of which are fenced off and not accessible to the public for safety reasons. Collapse of buried structures has also occurred in this area, where filter beds have been filled in. The setting tank and a typical filter bed are shown in Photographs 9 and 10 in Attachment 1.

While the filter beds and other water treatment facilities (including the settling tank and clear water tank as shown on Figure 13 from Casey & Lowe 2021, reproduced below as Figure 4.3) are heritage listed items, they also present a safety hazard and restrict public use of this area of the site. Subject to heritage requirements, these voids present an opportunity for on-site containment of asbestos-contaminated soil that must be excavated from other areas (eg. to tie in to heritage kerbs or from around mature trees to allow capping of the pump station lawn, power station area and mini train station area), which could also eliminate the safety hazards presented by these structures and allow more productive future use of this area. Appropriate preservation and interpretation of these archaeological resources should be undertaken. Potentially surface expression of the features (eg. the exposed top of the buried structure) could be retained.

Consultation with a heritage specialist and relevant stakeholders will be required to determine whether in-filling of these structures is an acceptable and appropriate approach.

Survey of remaining voids is recommended to assess the volume available for containment; however from historical drawings, it appears that over 8,000 m^3 of void space is present, which would be more than enough to contain the estimated volumes of material that must be excavated to allow capping of the other site areas as described above.

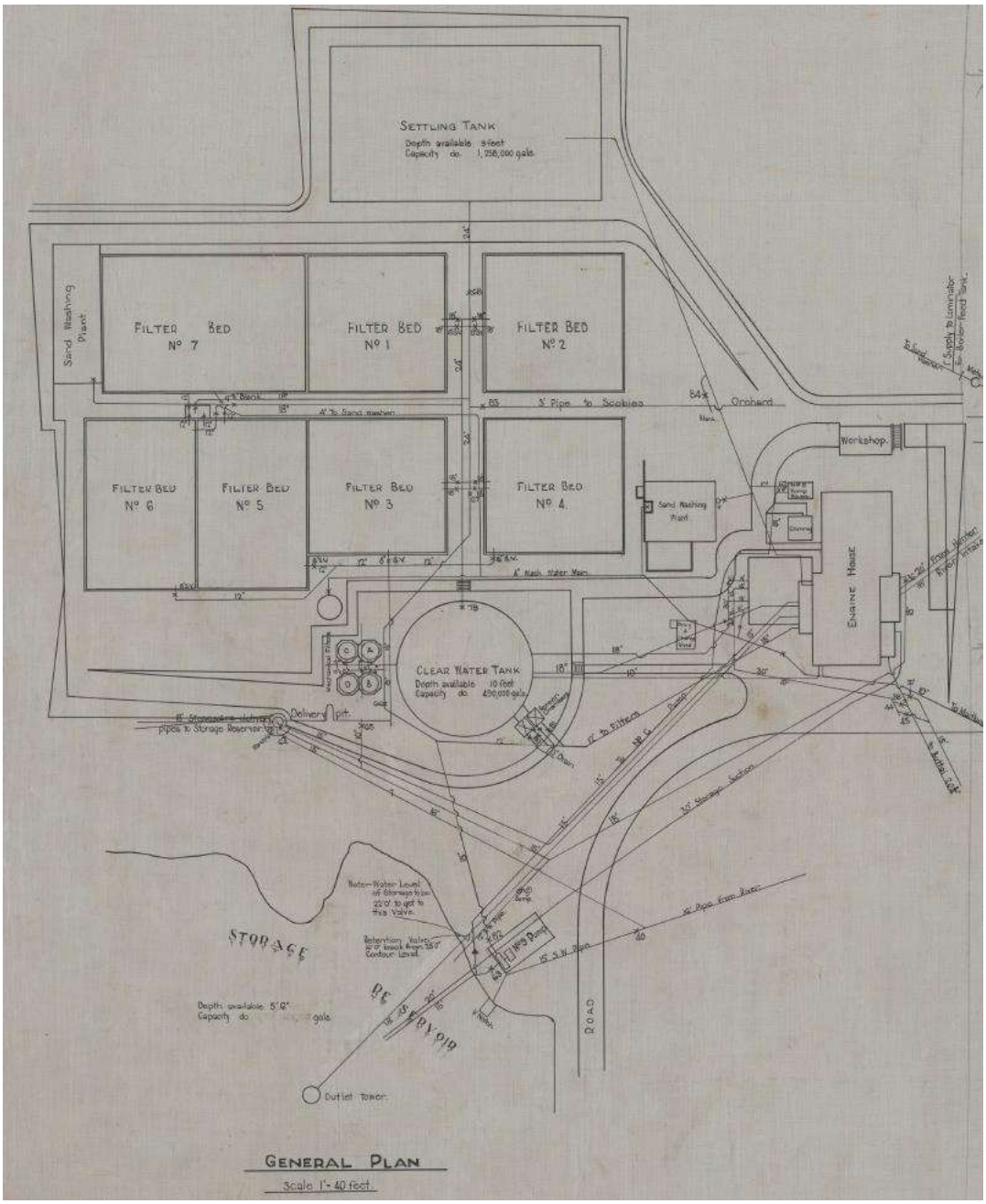


Figure 4.3 General plan of water treatment works in 1928, from Casey & Lowe (2021) Figure 13. NSWSA NRS-21965-1-199-6_d_1A

4.4.7 Former workmen's cottages and broader site areas

Excluding the areas described above, investigations have shown the site to have a low potential for the presence of contaminated fill or asbestos materials, particularly in the broader site areas away from historic structures. Previous investigations (GHD 2008 as cited in GHD 2022a) have found isolated fragments of ACM and remnant asbestos-containing infrastructure across the broader area of the site as shown in Figure 3 in Attachment 2, and recent investigations identified asbestos in shallow surface soil at location HE368 as shown in Figure 12 in Attachment 2. Bonded ACM fragments were also identified and subsequently removed from surface soils near the driveway to the Caretaker's residence, and fibre cement sheeting had previously been identified and subsequently removed from the footprint of the former Chief Engineer's residence (GHD 2022a).

Visual inspection of surfaces and extensive investigation of shallow soils has been undertaken in these areas, and only isolated occurrences of asbestos have been identified. In the most likely areas of contamination (i.e. around former heritage structures, as per most recently identified asbestos), heritage

restrictions apply to deeper investigations and to any active remediation. As these areas are not subject to intense use, it is considered asbestos contamination is unlikely to be disturbed and presents a low risk to health in these areas, and can be adequately managed by a long term management plan, inspection and maintenance protocols to maintain adequate grass cover and minimise potential risk to grounds maintenance staff, and an unexpected finds procedure to identify, record and remove or manage any potential asbestos contamination that may be encountered during future use and maintenance of the site.

4.5 Regulatory requirements

The following sections outline regulatory requirements particularly relevant to the nature of the proposed remediation works. This is not intended to be a comprehensive summary of the relevant planning pathway for the works, which is expected to have broader requirements as part of the approval process.

4.5.1 WHS Legislation

The remediation works will be subject to the requirements of the Work Health and Safety (WHS) Act 2011 and the WHS Regulation 2017, including but not limited to requirements relating to asbestos. Remediation of asbestos in soil is considered asbestos removal works, and must be carried out in accordance with the SafeWork NSW *Code of Practice How to Safely Remove Asbestos*, 2019.The contamination includes friable asbestos so works must be carried out by a Class A licenced asbestos removalist. Control and clearance air monitoring must be conducted by a licensed asbestos assessor during asbestos related works.

4.5.2 CLM Act

At this time the site is not subject to a Notice or Declaration under the Contaminated Land Management Act 1997 (CLM Act). However, the remediation works are subject to site audit, which is being carried out in accordance with relevant requirements of the CLM Act. As discussed in Section 4.5.3, the EPA's recent Position Statement on WA DoH (2021) indicates the CLM Act is the appropriate legislation (together with relevant planning and assessment legislation) for regulation of historical asbestos contamination.

4.5.3 POEO Act

The Protection of the Environment Operations (POEO) Act 1997 administers a wide range of environmental requirements including pollution offences as well as waste regulatory requirements. Particularly relevant to this site are the following.

The POEO (Waste) Regulation 2014 introduced an amendment to Schedule 3 of the POEO (General) Regulation 2009, to the definition of "land pollution", which "*for the purposes of paragraph (b) of the definition of **land pollution** or **pollution of land** in the Dictionary to the Act, the following matter is prescribed:….(c) more than 10 tonnes of asbestos waste…"*

This is present as subclause 1 under Section 148 of the POEO (General) Regulation 2021.

Subclause 2 states:

> *Matter referred to in subclause (1) is excluded from the definition of land pollution or pollution of land in the Dictionary to the Act if the matter is placed in or on, or otherwise introduced into or onto, land on which the matter was generated—*
>
> *(a) in accordance with an approved voluntary management proposal, management order or ongoing maintenance order under the Contaminated Land Management Act 1997 or a public positive covenant or restriction imposed under section 29 of that Act, or*
>
> *(b) as part of category 1 remediation work carried out under State Environmental Planning Policy No 55—Remediation of Land.*

As discussed in Section 4.5.4 below, the remediation is expected to be category 1 remediation, which would therefore be excluded from this prescribed pollution of land offence.

The EPA provided a position statement in April 2022 relating to the WA DoH *Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia* (WA DoH 2021) (Position statement — WA guidelines for the assessment, remediation and management of asbestos contaminated sites (nsw.gov.au)). It should be noted that this position statement is currently under review by the EPA, following substantial response from practitioners. While a number of the positions taken by the EPA in this statement are contentious, these generally do not relate to the proposed remediation of the Walka Water Works site; rather EPA's position is generally supportive of the nature of the proposed remediation, as indicated by the following extracts:

- Land that is significantly contaminated as a result of poor historical on-site management of asbestos materials is generally regulated by the EPA under the CLM Act and Contaminated Land Management Regulation 2013.
- The asbestos and the contaminated soil are most commonly disposed of to a landfill licenced to accept asbestos waste. If they have not been imported to the site, it may be possible to bury them on site in an approved containment cell.
- Guidance for design and construction of containment cells is found in the Contaminated Land Management Guidelines for the NSW Site Auditor Scheme **(PDF 998KB)** and the **Environmental Guidelines - Solid waste landfills (PDF 1.18MB)**. [Note, the EPA has since verbally acknowledged that the Environmental Guidelines – Solid waste landfills are not necessarily applicable to design of containment cells].
- In NSW, asbestos contaminated soil can be contained/buried elsewhere on the same site, but only if:
  - it has not been imported to the site
  - the site has appropriate development consent and/or complies with relevant planning legislation
  - it does not trigger s142A of the POEO Act in relation to pollution of land
  - it does not trigger s144AAB of the POEO Act
  - containment is the most appropriate remediation strategy and is supported by a remedial action plan and an ongoing Environmental Management Plan
  - it meets any other relevant requirements.
- The EPA also strongly recommends that a notation be placed on the relevant section 10.7 planning certificate and/or a notation on the land title.

Any off-site disposal of material would need to comply with the requirements of the POEO (Waste) Regulation 2014.

4.5.4 EP&A Act 1979

The Environmental Planning and Assessment Act 1979 (EP&A Act) provides the framework for environmental planning and development approvals and includes provisions to ensure that the potential environmental impacts of a development are assessed and considered in the decision-making process.

Parts 4 and 5 of the EP&A Act contain requirements for environmental assessment and approval.

Part 4 provides for control of development that requires development consent from a consent authority (typically a local council, but sometimes a regional planning panel or some other public body).

Within Part 5 of the Act, Division 5.1 provides for control and assessment of 'activities' that do not require development consent under Part 4. Division 5.2 provides for environmental assessment and approval of State Significant Infrastructure.

The need or otherwise for development consent is regulated by environmental planning instruments made under this Act – primarily State Environmental Planning Policies (SEPPs) and Local Environmental Plans (LEPs).

4.5.5 SEPP (Resilience and Hazards) 2021

The State Environmental Planning Policy (Resilience and Hazards) incorporates the former SEPP 55 – Remediation of Land. Chapter 4 of the Resilience and Hazards SEPP aims to promote the remediation of contaminated land to reduce the risk of harm to human health or any other aspect of the environment.

Section 4.8 of Chapter 4 in this SEPP outlines remediation works which are considered to be category 1 remediation and therefore requires development consent. Remedial works fall within category 1 where any of the following apply to those works:

(a) designated development, or

(b) carried out or to be carried out on land declared to be a critical habitat, or

(c) likely to have a significant effect on a critical habitat or a threatened species, population or ecological community, or

(d) development for which another State environmental planning policy or a regional environmental plan requires development consent, or

(e) carried out or to be carried out in an area or zone to which any classifications to the following effect apply under an environmental planning instrument:

(i) coastal protection,

(ii) conservation or heritage conservation,

(iii) habitat area, habitat protection area, habitat or wildlife corridor,

(iv) environment protection,

(v) escarpment, escarpment protection or escarpment preservation,

(vi) floodway,

(vii) littoral rainforest,

(viii) nature reserve,

(ix) scenic area or scenic protection,

(x) wetland, or

(f) carried out or to be carried out on any land in a manner that does not comply with a policy made under the contaminated land planning guidelines by the council for any local government area in which the land is situated (or if the land is within the unincorporated area, the Western Lands Commissioner).

Based on the available information, GHD understands that the planning pathway for the proposed works will be Section 4.8 – Category 1 remediation work: work needing consent, that is work:

> – (e) carried out or to be carried out in an area or zone to which any classifications to the following effect apply under an environmental planning instrument—
>
> (ii) conservation or heritage conservation.

Walka Water Works is listed on the State Heritage Register (Heritage item I222, Maitland LEP 2011):

> – …a person cannot carry out any development in relation to the land on which the building, work or relic is situated, the land that comprises the place, or land within the precinct, except in pursuance of an approval granted by the approval body under Subdivision 1 of Division 3.

4.5.6 NSW Heritage Act

As noted in Casey & Lowe (2021), the main legislation governing heritage, including relics, is the NSW Heritage Act 1977. The Walka Water Works is listed on the NSW State Heritage Register as an item of cultural significance. This means the item is of Stage heritage significance and warrants conservation into the future for the State, and is managed under s.57 of the NSW Heritage Act. According to s.57, any

potential disturbance to the heritage infrastructure is prohibited except pursuant to an approval granted under Subdivision 1 of Division 3.

According to Casey & Lowe (2021), impacts within the identified curtilage of the Walka Water Works SHR area which may lead to the disturbance and removal of relics require an approval from the Heritage Council of NSW under s.60 of the Heritage Act 1977. This requires the writing of an Archaeological Research Design for the application, specifying the methodology to undertake any excavation and field recording, and identifying suitably qualified archaeologists to undertake this work.

A number of policies are recommended in Casey & Lowe (2021) which are relevant to proposed remediation works that have the potential to disturb any of the heritage infrastructure.

4.6 Guidelines

Aside from guidance in the *Guidelines for the NSW Site Auditor Scheme* (EPA 2017) and the remediation hierarchy in the NEPM (NEPC 2013) as discussed in Section 4.1 above, there is little prescriptive guidance on remediation (particularly capping and containment) in documents prepared or endorsed by the NSW EPA. A brief summary of relevant guidance is provided below as context for this ROA. Further consideration would be given to relevant requirements in preparation of the RAP, following agreement on the preferred remediation strategy.

4.6.1 ANZECC (1999)

In the absence of more recent specific guidance, the ANZECC (1999) *Guidelines for the Assessment of On-site Containment of Contaminated Soil* is still considered a useful reference for such remediation. These guidelines provide a number of principles for assessing on-site containment of contaminated soil, as well as recommendations for capping and containment based on the environmental behaviour of the particular contaminants. As asbestos is an inert and non-leachable contaminant, the capping and containment requirements are simply required to prevent future exposure to the contaminated soils.

In such cases, ANZECC (1999) states that if all contaminants are effectively immobile and only physical separation is required, it may be sufficient to provide a thickness of soil that is unlikely to be penetrated by likely future users of the site. A minimum soil cover thickness of about 0.5 m is commonly adopted, but thicker layers may be required where there is high risk of penetration of little opportunity for effective institutional controls, such as in residential situations where gardening activities are expected. The soil separation layer may be underlain by a layer of “marker mesh” to serve as a visual signal that a potentially hazardous material exists below the mesh layer. Thinner soil cover or no soil cover is often considered acceptable where cover is provided by a permanent concrete floor slab, or a permanent concrete or asphalt surfaced pavement.

Section 7 of ANZECC (1999) contains guidance on selection of an appropriate containment system [including capping], and states that the preferred means of achieving the minimum functional requirements will depend on site specific conditions (including physical conditions, ownership and management arrangements, intended post-remediation site use, adjoining land use etc) since it is only in the context of these specific conditions that it is possible to define the likely consequence of loss of containment. ANZECC (1999) notes that sometimes it is appropriate to adopt a less secure engineering technique, but to incorporate alternative environmental control measures to limit either the likelihood or the consequence of a loss of containment from the lower security containment cell.

The principles in ANZECC (1999) should be considered in further detail in preparation of a RAP for the site.

4.6.2 WA DoH (2009)

The *Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia* (WA DoH 2009) are referenced in the NEPM (NEPC 2013) which is in turn endorsed by the NSW EPA.

In discussion of site remediation, WA DoH (2009) states that in situ management primarily involves the isolation of the contaminated area with barriers and covers so that it cannot be readily disturbed and therefore will not generate airborne fibres. The barrier or cover is usually a layer of clean soil. Nominally,

the depth of the clean fill should be at least 1 m for public open spaces and at least 0.5 m for all other uses, such as residential or commercial activities. The greater depth for the public space is because of the potential for deeper below-ground activity associated with such areas, such as irrigation systems and service trenches; the potential lower awareness of the presence of the contamination; and the increase practicability of having such deep covers. The 0.5 m cover may need to be increased to avoid contamination disturbance by subsequent installation of sub-surface utilities below 0.5 m, unless any contamination excavated is properly managed and not mixed in with material used for backfilling.

WA DoH (2009) further states for covers of less than 3 m, additional management measures as well as a memorandum on title (MOT) would also be expected. Measures might include a geo-textile barrier, an ongoing site management plan (OSMP), and a vegetative cover. If all of these additional measures are used, then it may be argued that the depth of clean fill may be reduced, including for practical reasons contaminated areas immediately next to lower level existing road infrastructure. The presence of a hardstand is also a strong reasons to have a reduced depth of clean fill in that specific area.

4.6.3 WA DoH (2021)

The *Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia* were updated by WA DoH in 2021. As this is more recent than the last NEPM update, the revised WA DoH guidelines are not referenced in a guideline endorsed by the NSW EPA, although the EPA has issued a Position Statement on the revised WA DoH (2021 guidelines as discussed in Section 4.5.3 above. The EPA's Position Statement did not comment on the updated discussion of capping thickness provided in WA DoH (2021).

In discussion of design elements, WA DoH (2021) states that the depth of the clean cover should be sufficient to prevent access to and disturbance of any buried asbestos-containing material. The depth of required fill should consider:

– current and future site use
– the integrity of the final top surface cover (e.g. hardstand, gravel, turf)
– potential for damage/erosion of the cover through human activity, surface water movement or other causes
– ability to inspect/maintain cover over the long term
– safe access to below-ground infrastructure, including irrigation systems and underground service.

Where possible, the depth of cover should be sufficient to address any access to or future installation of utility and underground services. Alternatively, underground services may be isolated from other buried contaminated material with a marker layer and backfilled with clean fill. The planning, size and design of buried services and/or service trenches should accommodate future maintenance or installation of additional services (e.g. allow sufficient clean area for additional services and/or room for re-excavation of trenches adjacent to buried services).

As noted in WA DoH (2021), contamination associated with high concentrations of fibrous asbestos may require a greater depth of clean fill or more frequent inspection of cover, depending on site circumstances.

4.6.4 CRC CARE (2019)

The *National Remediation Framework Technology Guide: Soil - Containment* (CRC CARE 2019) discusses site-specific considerations in determining the feasibility of containment as a potential remediation management, and considerations for design of a containment system.

CRC CARE (2019) does not provide any prescriptive guidance on capping thickness.

5. Conclusions and recommendations

Based on investigations carried out at the site, contamination at the Walka Water Works site that requires remediation to enable the site to be suitable for continued public recreational use is limited to asbestos contamination in soils. Based on the EPA's preferred remediation strategy and the considerations discussed in this ROA, feasible remediation options are limited to consolidation and containment (either in-situ or in designated containment areas), off-site disposal and replacement with imported clean fill, or (in areas where the level of risk is low enough that inadvertent exposure during future use is unlikely to present an unacceptable level of risk) a long-term management strategy by way of a LTEMP. Of these feasible options, off-site disposal is the lowest preference due primarily to reasons of cost, lack of sustainability (i.e. use of resources, energy and landfill space), and increased risks due to site disturbance and transport. Off-site disposal would remain as an appropriate option for small quantities of asbestos contamination that may be encountered during future use and management of the site.

The appropriateness of the remaining preferred options varies depending on the particular area of the site, as summarised in Table 5.1 below.

Table 5.1 Proposed remediation strategy for discussion with stakeholders

Site area	Capping in-situ	Consolidation and containment	Management controls only
Pump house lawn	Preferred for majority of area to minimise disturbance. Capping will need to allow for future use, and tie in to heritage structures. Design to allow for permanent facilities and underground service requirements.	Containment in former water treatment area preferred for soil which must be excavated to allow capping, to minimise area of exposed contaminated soil during remediation.	Not applicable for this area.
Former power station area	Preferred for majority of area to minimise disturbance. Capping will need to allow for future use, and tie in to heritage structures. Design to allow for permanent facilities and underground service requirements.	Containment in former water treatment area preferred for soil which must be excavated to allow capping, to minimise area of exposed contaminated soil during remediation.	Not applicable for this area.
Access road and parking areas	Preferred. Temporary paving may be considered pending design and installation of underground service requirements.	Containment in other areas may be required for soil which must be excavated to allow for services.	Not applicable for this area.
Beach area	Preferred, to minimise disturbance of contaminated soils and underground heritage services. Sediments would be difficult to remediate except by in-situ capping.	Potential for excavation of beach material to be excavated and contained in other areas, but not preferred.	Not applicable for this area.
Mini train station area	Preferred for area directly to north of beach area, to minimise disturbance of contaminated soils and underground heritage structures.	Containment in former water treatment area or other site areas for soil which must be excavated to allow capping.	Appropriate for areas to the west of the area to be capped, based on investigation findings and lower intensity use of area.
Former water treatment area	Areas of identified contamination limited to within former water treatment structures. Capping is preferred in these areas (see consolidation column).	Subject to acceptability from a heritage perspective, infilling of former water treatment structures would allow containment of excavated contaminated soil from other	Not applicable for this area.

Site area	Capping in-situ	Consolidation and containment	Management controls only
		areas, and remove a safety hazard, allowing more productive use of this area.	
Former workmen's cottages and broader site areas	Not considered necessary due to isolated occurrences of contamination and less intensive use of these areas.	Not considered necessary due to isolated occurrences of contamination. In-situ management will also avoid disturbance of heritage structures (eg. footprint of former workmen's cottages, Chief Engineer's residence).	Appropriate for these areas based on investigation findings, subject to a long term management plan, inspection and maintenance protocols to maintain adequate grass cover and minimise potential risk to grounds maintenance staff, and an unexpected finds procedure to identify, record and remove or manage any potential asbestos contamination that may be encountered during future use and maintenance of the site.

It is recommended that a workshop be held with relevant stakeholders to review this ROA and agree on the preferred remediation strategy. Further consultation will be required to agree on the details of the preferred strategy to enable an appropriate RAP to be prepared.

The site auditor's endorsement of the ROA and RAP should be obtained in the context of their appropriateness to the ultimate site audit objective of certifying that the site is suitable for ongoing use as a recreational facility following implementation of the RAP, and subject to implementation of an appropriate LTEMP.

6. References

ANZECC (1999) *Guidelines for the Assessment of On-site Containment of Contaminated Soil*

Casey & Lowe (2021) *Walka Water Works, Oakhampton Heights, Historical Archaeological Assessment*, May 2021

CRC CARE (2019) *National Remediation Framework Technology Guide: Soil - Containment*

GHD (2008) *Report on Walka Water Works – Asbestos and Contamination Assessment. Phase 1 Assessment Including Limited Sampling.*

GHD (2022a) *Walka Water Works, Contamination Assessment*, 11 February 2022

GHD (2022e) *Walka Water Works, Supplementary Site Investigations*, Rev A, 31 July 2022

GHD (2022f) *Walka Water Works, Remediation concept design and budget estimate,* 1 April 2022

NEPC (2013) *National Environment Protection (Assessment of Site Contamination) Measure 1999*, as amended by the National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1), National Environment Protection Council, May 2013

NSW EPA (2017) *Guidelines for the NSW Site Auditor Scheme* (3rd Edition), NSW Environment Protection Authority. October 2017

SafeWork NSW (2019). *Code of practice: How to safely remove asbestos*

WA DoH (2009) *Guidelines for the assessment, remediation and management of asbestos contaminated sites in Western Australia*, WA Department of Health

WA DoH (2021) *Guidelines for the assessment, remediation and management of asbestos contaminated sites in Western Australia*, WA Department of Health

7. Limitations

This Remediation Options Assessment ("report") has been prepared by GHD Pty Ltd ("GHD") for Maitland City Council and may only be used and relied on by Maitland City Council for the purpose agreed between GHD and Maitland City Council as set out in Section 2 of this report.

This report may be used by and provided to the Site Auditor acting as an agent of Maitland City Council in this respect and may also be used by and provided to the NSW EPA and the relevant planning authority for the purpose of meeting statutory obligations in accordance with the relevant sections of the CLM Act 1997 or the Environment Planning and Assessment (EP&A) Act 1979.

GHD otherwise disclaims responsibility to any person other than Maitland City Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

This report is based solely on the investigations and findings contained in the reports referenced in the report (Referenced Reports) and on the conditions encountered and information reviewed at the time of

each Referenced Report. This report should be read in conjunction with the Referenced Reports, and is subject to all the limitations and recommendations in the Referenced Reports.

GHD has prepared this report on the basis of information provided by Maitland City Council and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

These Disclaimers should be read in conjunction with the entire report. This report must be read in full and no excerpts are taken to be representative of the findings of this report.

Regards

[redacted]

Attachments: Attachment 1 Photographs
Attachment 2 - Figures

Attachments

Attachment 1

Photographs

Photograph 1 – Pump house and lawn to east

Photograph 2 – Heritage kerbs east of pump house

Photograph 3 – Track at north of former power station area looking east

Photograph 4 – Former power station area looking south-east

Photograph 5 – Beach area looking south

Photograph 6 – Beach area looking west

Photograph 7 – Bare soil areas to north of beach

Photograph 8 – Bare soil areas to north of beach, looking west towards mini train station

Photograph 9 – Settling tank, northern end of former water treatment area

Photograph 10 – A filter bed at southern end of former water treatment area

Attachment 2

Figures

Paper Size ISO A4

0 200 400 600

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Maitland City Council
Walka Water Works – Scobies Lane, Oakhampton Heights NSW
Contamination Assessment

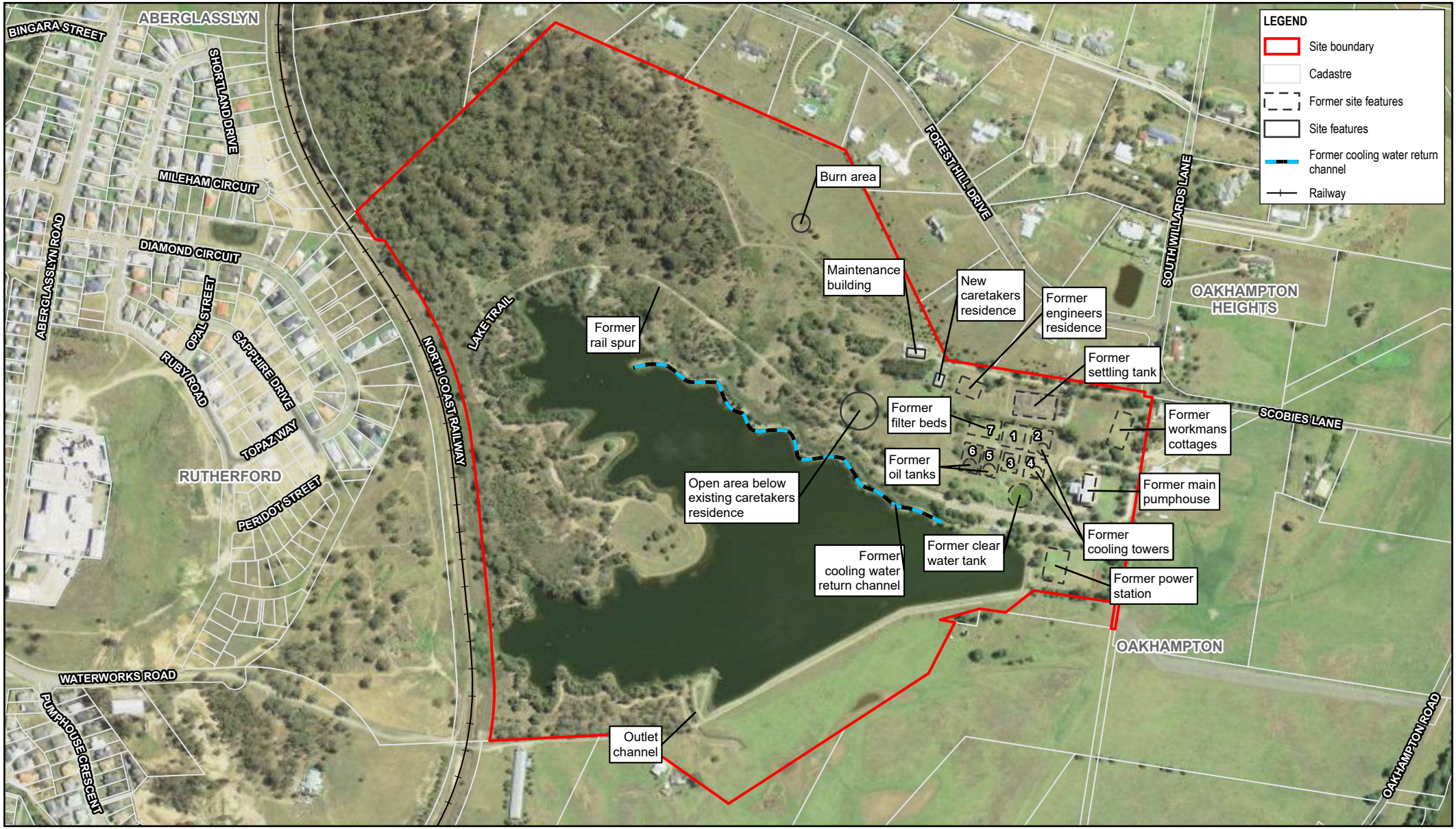
Project No. **12553096**
Revision No. **1**
Date **10/02/2022**

Site locality

FIGURE 1

G:\22\12553096\GIS\Maps\ContamAssess_1.aprx
Print date: 10 Feb 2022 - 13:10

Data source: LPI: DTDB / DCDB, 2017; public_NSW_Imagery: © Department of Customer Service 2020. Created by: tmorton



Paper Size ISO A4

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Metres

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

GHD

Maitland City Council
Walka Water Works – Scobies Lane, Oakhampton Heights NSW
Contamination Assessment

Project No. **12553096**
Revision No. **1**
Date **10/02/2022**

Site features

FIGURE 2

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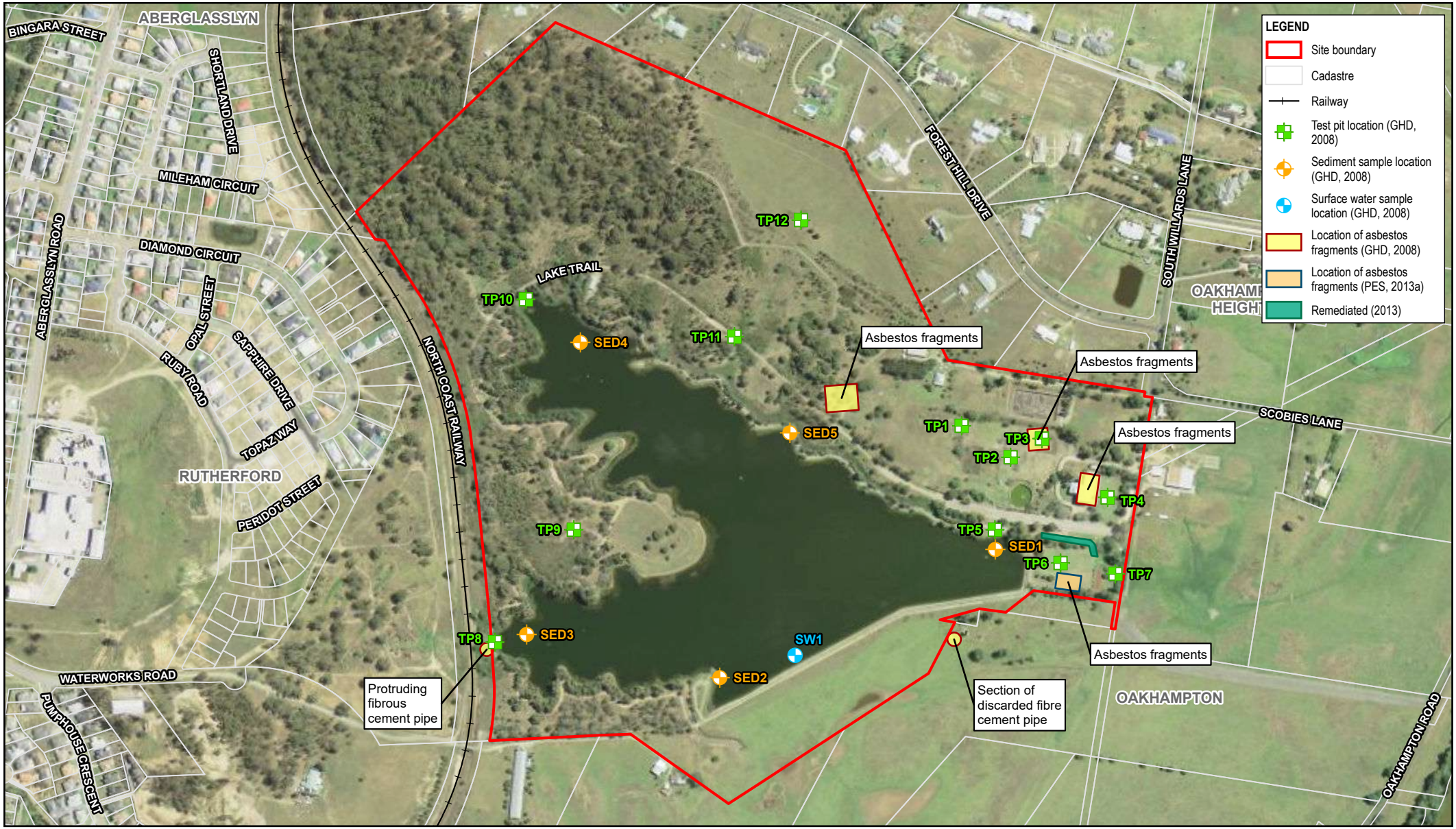

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Maitland City Council
Walka Water Works – Scobies Lane, Oakhampton Heights NSW
Contamination Assessment

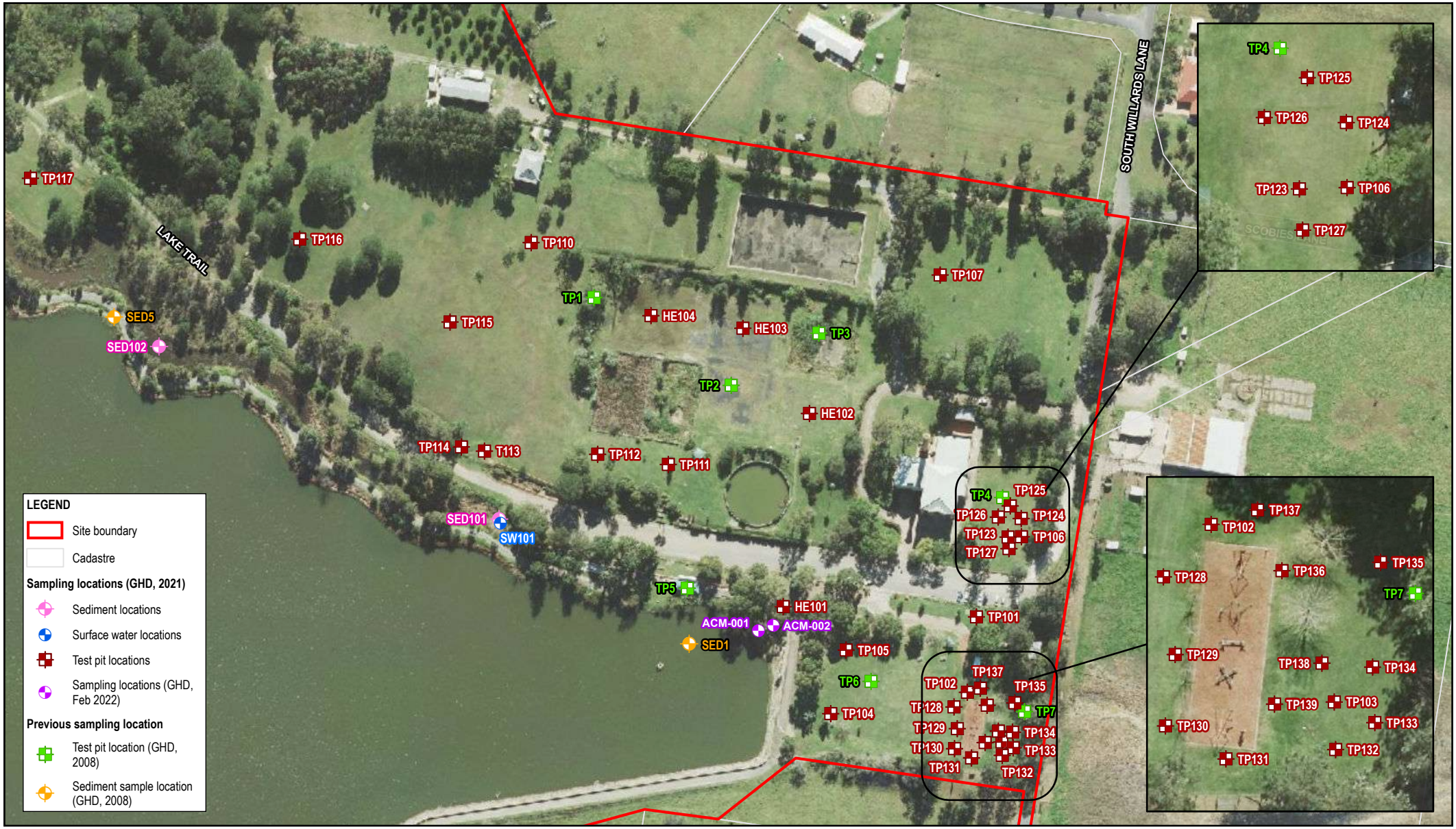
Previous site work and sampling locations

Project No. **12553096**
Revision No. **1**
Date **10/02/2022**

FIGURE 3

G:\22\12553096\GIS\Maps\ContamAssess_1.aprx
Print date: 10 Feb 2022 - 13:12

Data source: LPI: DTDB / DCDB, 2017; public_NSW_Imagery: © Department of Customer Service 2020. Created by: tmorton



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Maitland City Council
Walka Water Works – Scobies Lane, Oakhampton Heights NSW
Contamination Assessment

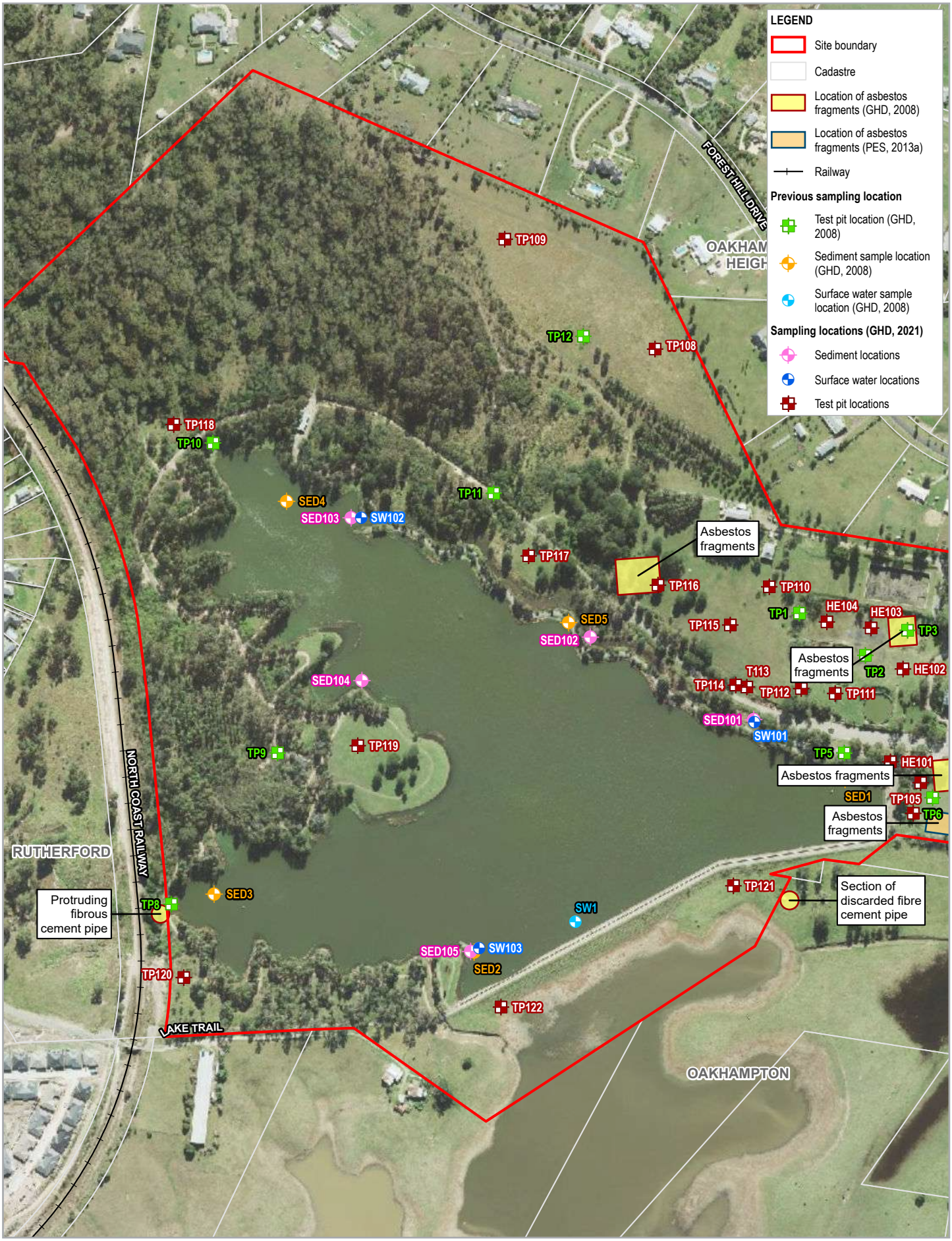
Sampling locations – Walka Water Works and Power Station site

Project No. **12553096**
Revision No. **1**
Date **10/02/2022**

FIGURE 4.1

G:\22\12553096\GIS\Maps\ContamAssess_1.aprx
Print date: 10 Feb 2022 - 13:11

Data source: LPI: DTDB / DCDB, 2017; public_NSW_Imagery: © Department of Customer Service 2020. Created by: tmorton



Paper Size ISO A4

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

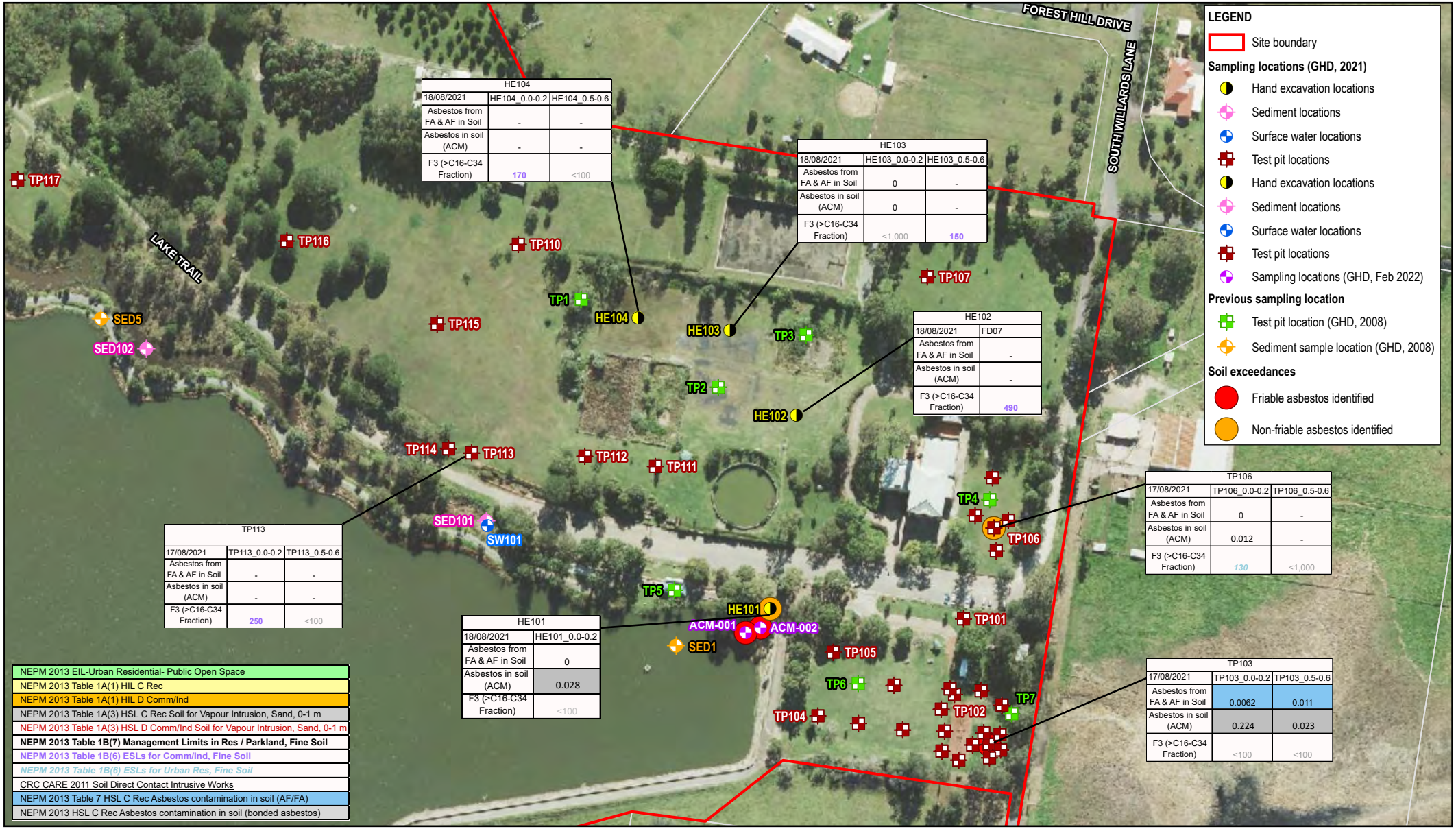
Maitland City Council
Walka Water Works – Scobies Lane, Oakhampton Heights NSW
Contamination Assessment

Sampling locations – Walka reservoir and community land

Project No. **12553096**
Revision No. **1**
Date **10/02/2022**

FIGURE 4.2

G:\22\12553096\GIS\Maps\ContamAssess_1.aprx
Print date: 10 Feb 2022 - 13:12



Paper Size ISO A4

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Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

GHD

Maitland City Council
Walka Water Works – Scobies Lane, Oakhampton Heights NSW
Contamination Assessment

Soil exceedances (August 2021)

Project No. **12553096**
Revision No. **1**
Date **10/02/2022**

FIGURE 5.1

G:\22\12553096\GIS\Maps\ContamAssess_1.aprx
Print date: 10 Feb 2022 - 13:11

Paper Size ISO A4

0 8.5 17 25.5 34

Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

Maitland City Council
Walka Water Works – Scobies Lane, Oakhampton Heights NSW
Contamination Assessment

Project No. **12553096**
Revision No. **1**
Date **10/02/2022**

Soil exceedances (October 2021)

FIGURE 5.2

G:\22\12553096\GIS\Maps\ContamAssess_1.aprx
Print date: 10 Feb 2022 - 13:11

Data source: LPI: DTDB / DCDB, 2017; public_NSW_Imagery: © Department of Customer Service 2020. Created by: tmorton

DRAFT

Paper Size ISO A4

0 6 12 18

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Maitland City Council
Walka Water Works – Scobies Lane, Oakhampton Heights NSW
Broader site sampling

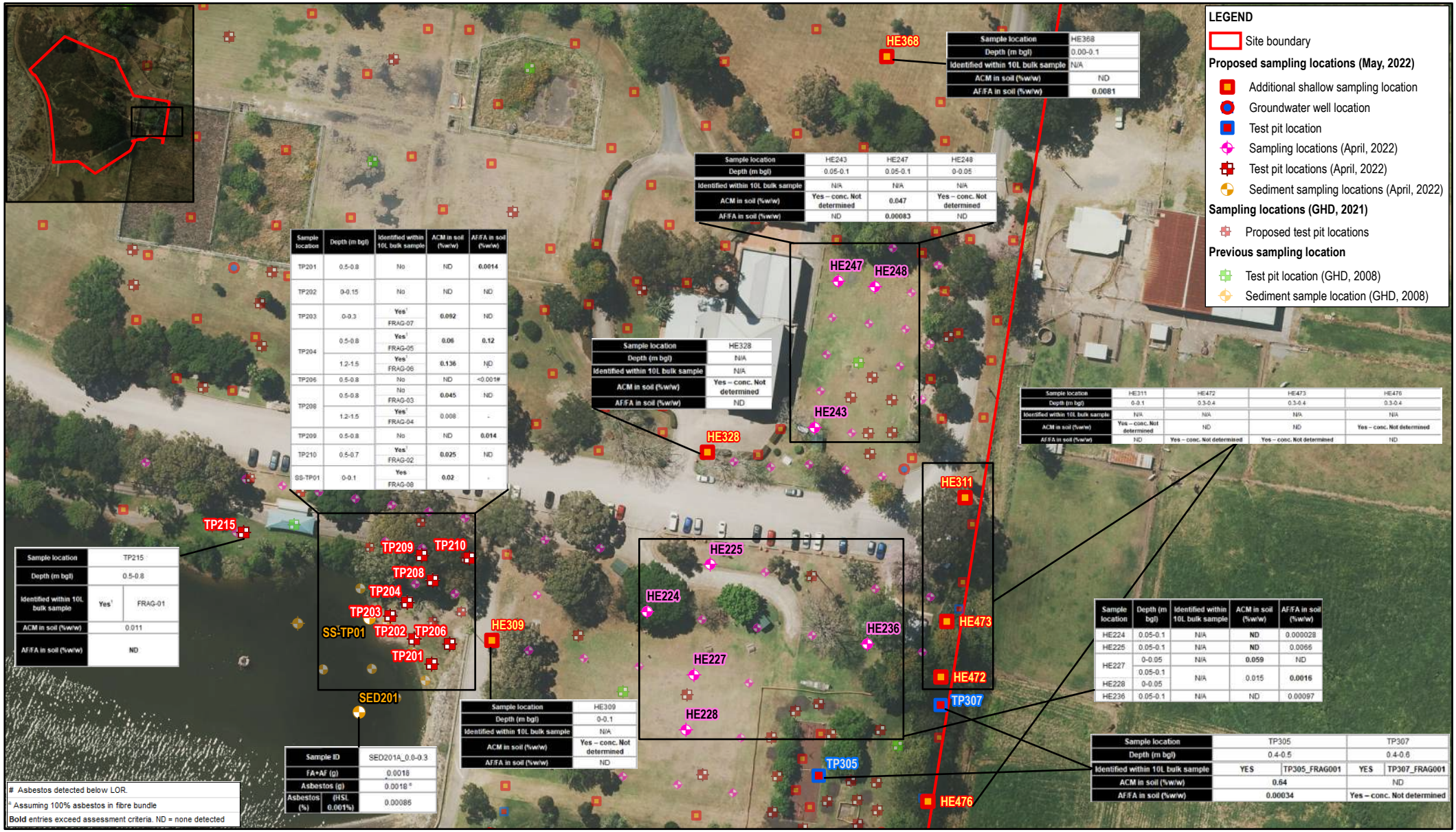
Mini train station area

Project No. **12553096**
Revision No. **A**
Date **08/06/2022**

FIGURE 6

\\ghdnet\ghd\AU\Newcastle\Projects\22\12553096\GIS\Maps\Working\SAQP_ActivityBased_EA_A.aprx
Print date: 08 Jun 2022 - 14:15

Data source: LPI: DTDB / DCDB, 2017; Casey & Lowe, 2022; Metromap Tile Service: . Created by: asharma4


LEGEND
Site boundary
Proposed sampling locations (May, 2022)
Additional shallow sampling location
Groundwater well location
Test pit location
Sampling locations (April, 2022)
Test pit locations (April, 2022)
Sediment sampling locations (April, 2022)
Sampling locations (GHD, 2021)
Proposed test pit locations
Previous sampling location
Test pit location (GHD, 2008)
Sediment sample location (GHD, 2008)
HE368
HE247
HE248
HE243
HE328
HE311
HE225
HE224
HE236
HE227
HE228
HE309
HE473
HE472
HE476
TP307
TP305
TP215
TP209
TP210
TP208
TP204
TP203
SS-TP01
TP202
TP206
TP201
SED201
Asbestos detected below LOR.
^ Assuming 100% asbestos in fibre bundle
Bold entries exceed assessment criteria. ND = none detected
DRAFT
Paper Size ISO A4
0 25 50
Metres
N
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56
Maitland City Council
Walka Water Works – Scobies Lane,
Oakhampton Heights NSW
Contamination Assessment
Asbestos in soil exceedances
Project No. 12553096
Revision No. A
Date 04/08/2022
FIGURE 12
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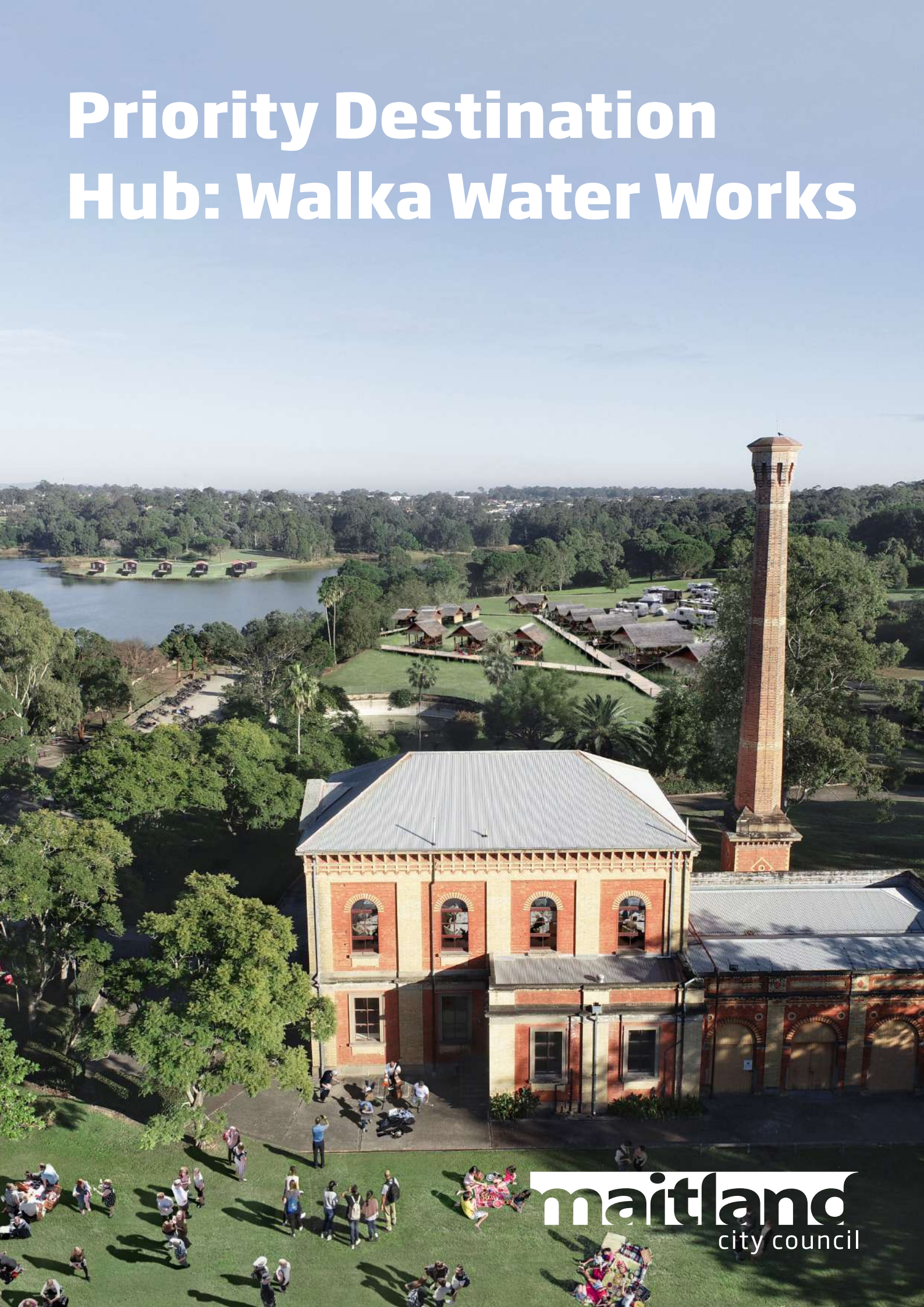
Print date: 04 Aug 2022 - 17:30
Data source: LPI: DTDB / DCDB, 2017; Metromap Tile Service:
World Hillshade: Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community. Created by: asharma4

Appendix C

Maitland City Council Prospectus – Priority Destination Hub: Walka Water Works

Priority Destination Hub: Walka Water Works



maitland
city council

OVERVIEW

Maitland's Destination Management Plan (DMP) brings together the ideas and vision of key stakeholders including the local community, industry and government. The plan identifies five priority destination hubs and seven key themes. Walka Water Works is a priority destination hub. A heritage listed complex set on 64.23 hectares of reserve, there is enormous potential for this hub to become 'the' destination in NSW for overnight eco and nature based tourism and special events.

THE VISION

Become an iconic visitor attraction for the city, with active day use as well as an overnight destination for nature based tourism, weddings, functions and events.

OPPORTUNITIES

1. Pumphouse Building

This would be the meeting place for guided walks and bird watching tours, kayak, bike and scooter hire, and for finding information about the site.

There could be the addition of a ground floor café and take away kiosk, so visitors can take advantage of picnic spots around the site. This could be combined with a museum which showcases the existing wildlife, ecology, and heritage with interpretation. The first floor is suitable for a restaurant, function space and bar overlooking the grounds.

The eastern annex could be upgraded to allow for a broader range of functions and events, as well as weddings. The western annex could be reimagined, with a new frontage to incorporate a craft brewery and/or distillery.

An outdoor dining space could be created in the rear courtyard. This connects the pumphouse with the workshop which could be used for a cellar door, small bar or artist in residence with gallery.

2. Eastern Lawn

This space would be suitable for events, activations, markets, and outdoor functions with connectivity to the pumphouse via the eastern annex.

It could also be used to test commercial activities through pilot initiatives, using temporary infrastructure and pop up activations like Street Eats (also at 3 and 4).

3. Outdoor function or event space

This could be used for medium to large scale events, either independently or as an extension of the eastern lawn (2).

4. Adventure play area (or extension of 3)

There is an opportunity to create a bespoke adventure play experience to complement the site here, or find an alternative location for this type of experience. The alternative for this location is for events, either independently or in conjunction with the eastern lawn to allow for larger scale events.

5. Shared pathway entry point

This will be the start or finish of the Morpeth to Walka Shared Pathway, which connects four priority destination hubs from the Maitland Destination Management Plan including Walka, Central Maitland, Maitland Gaol and Morpeth.

6. Miniature railway

Entry to the miniature railway experience, a mini train ride through the reserve. Opportunity to expand the days and hours of operation, as well as the route which could circumnavigate the lake.

7. Walka Beach

The beach provides access to the lagoon, but also a passive play space and potential launch area for small non-motorised watercraft such as kayaks.

8. Commercial accommodation

Site for commercial accommodation, which may include eco cabins, glamping, RVs, and caravans. The entry to this could potentially be separate to the rest of the site via the access road to the current caretaker's cottage.

9. Education Centre

Consider a multipurpose education centre here, that could a host range of school or special interest groups including bird watching.

10. Walking trails

Enhanced nature walks and trails with sculptures, wayfinding, and interpretive signage. Add interactive experiences such as guided walks, birdwatching tours, and small scale nature play and package these experiences. There is also potential for running and walking events.

11. Snake Gully Junction

Current turning point for the miniature railway experience, which could be extended to loop around the lake back to 6.

12. Commercial accommodation

Site identified for a possible single high end couples retreat cabin.

13. Commercial accommodation

Site identified for boutique eco cabins, which could be scattered through the reserve and on the water's edge.

14. Shared pathway entry point

Extension of the Morpeth to Walka Shared Pathway connecting Walka Water Works to Rutherford.

15. Pontoon

Provides access to the lagoon, which could be used for various activities, including catch and release sports fishing, and remote control boat launching.

ACTIVITIES AND OPPORTUNITIES ALREADY BEING REALISED

a. Education programs and resources

Walka is a valuable asset used by schools to support outcomes in science, history and geography.

b. Environmental programs

Activities focused on protecting the existing flora and fauna.

c. Birdwatching activities

Walka has special significance as a bird habitat and is home to over 140 species.

d. Miniature Railway

A mini train ride running on the first and third Sundays of the month.

e. Maitland Parkrun

A free fun and friendly weekly 5km community run.

f. Weddings and events

A popular wedding venue, set against the backdrop of the spectacular pumphouse.

g. Picnics and recreation

Picnic and barbeque facilities are available, and there's a small children's play area.

h. Connectivity

Plans are underway to connect Walka Water Works with Central Maitland and Morpeth. Work has already commenced in Morpeth, with several stages either underway or complete.

maitland

CONTACT:

Rachel MacLucas

Executive Manager Vibrant City

Maitland City Council

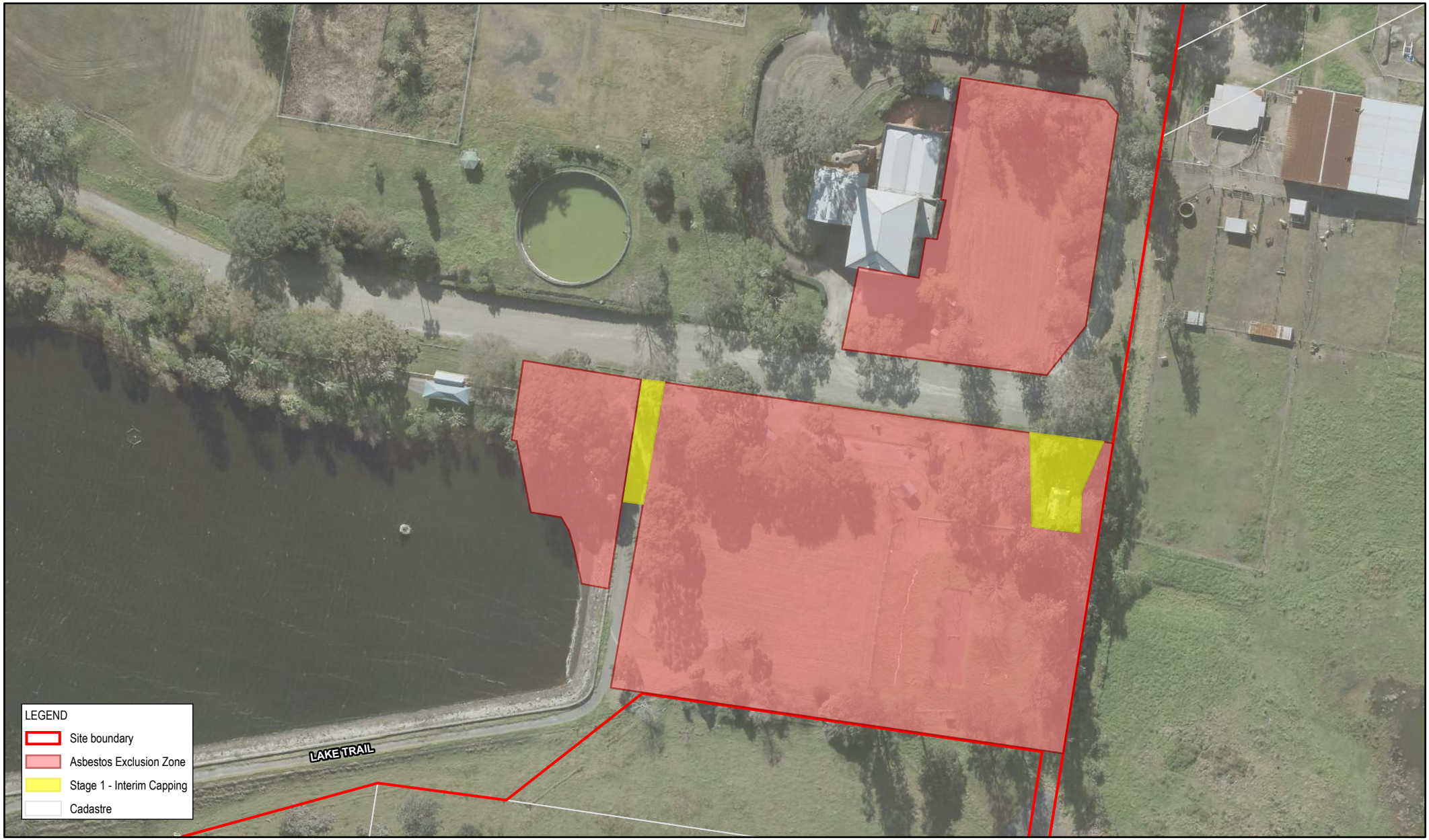
t 02 4931 2866

m +61 438 949 715

Rachel.MacLucas@maitland.nsw.gov.au

Appendix D

Proposed Remediation Staging



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Maitland City Council
Walka Water Works – Scobies Lane,
Oakhampton Heights NSW
Remedial Action Plan

Proposed Remediation Stage 1

Project No. **12553096**
Revision No. **0**
Date **07/10/2022**

FIGURE D1

\\ghdnet\ghd\AU\Newcastle\Projects\22\12553096\GIS\Maps\LTEMP.aprx
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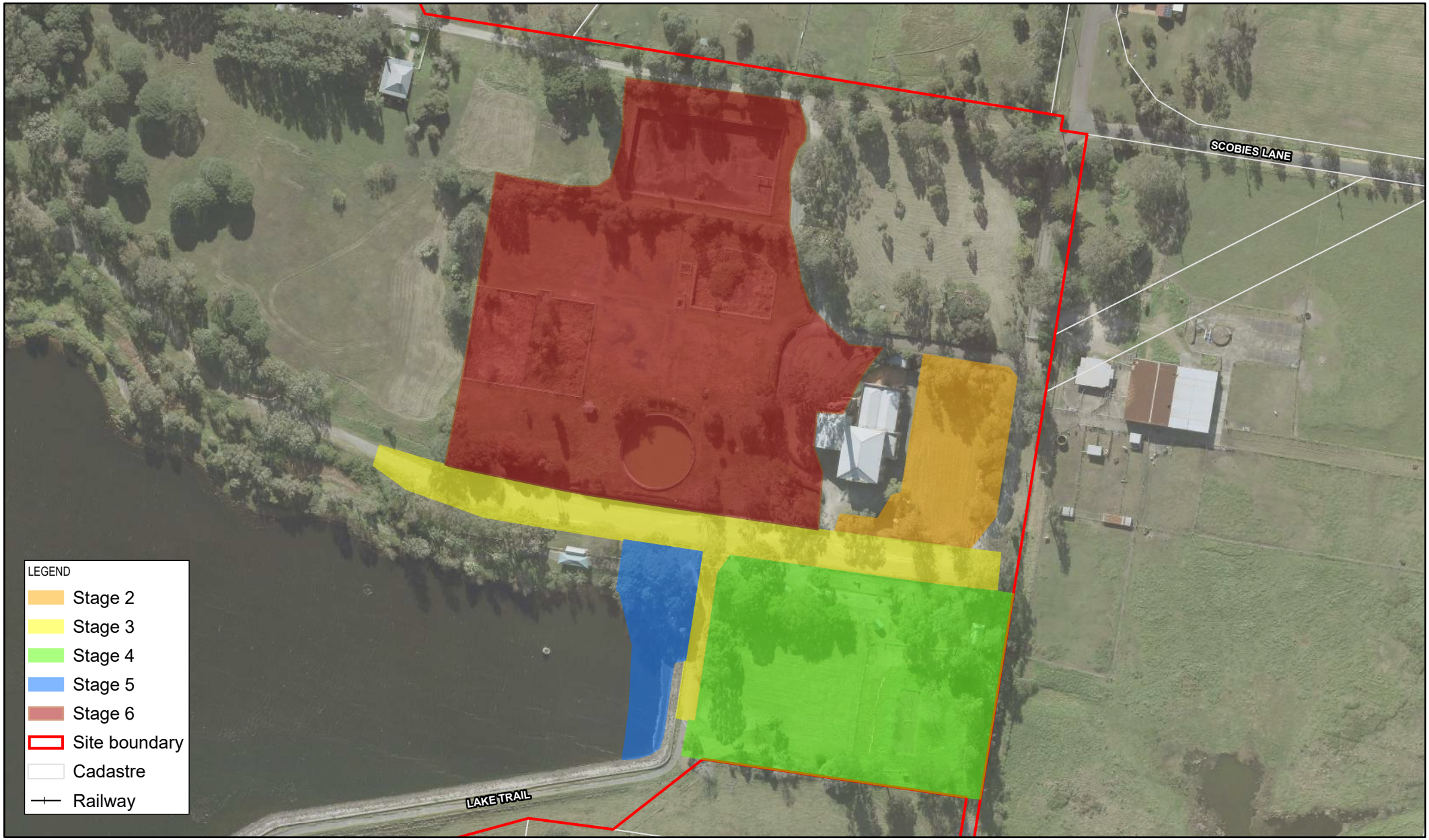
Data source: LPI: DTDB / DCDB, 2017; Metromap Tile Service: . Created by: dbbanatin



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Metres

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

GHD

Maitland City Council
Walka Water Works – Scobies Lane,
Oakhampton Heights NSW
Remedial Action Plan

Project No. **12553096**
Revision No. **0**
Date **07/10/2022**

Proposed Remediation Stage 2-6

FIGURE D2

\\ghdnet\ghd\AU\Newcastle\Projects\22\12553096\GIS\Maps\LTEMP.aprx
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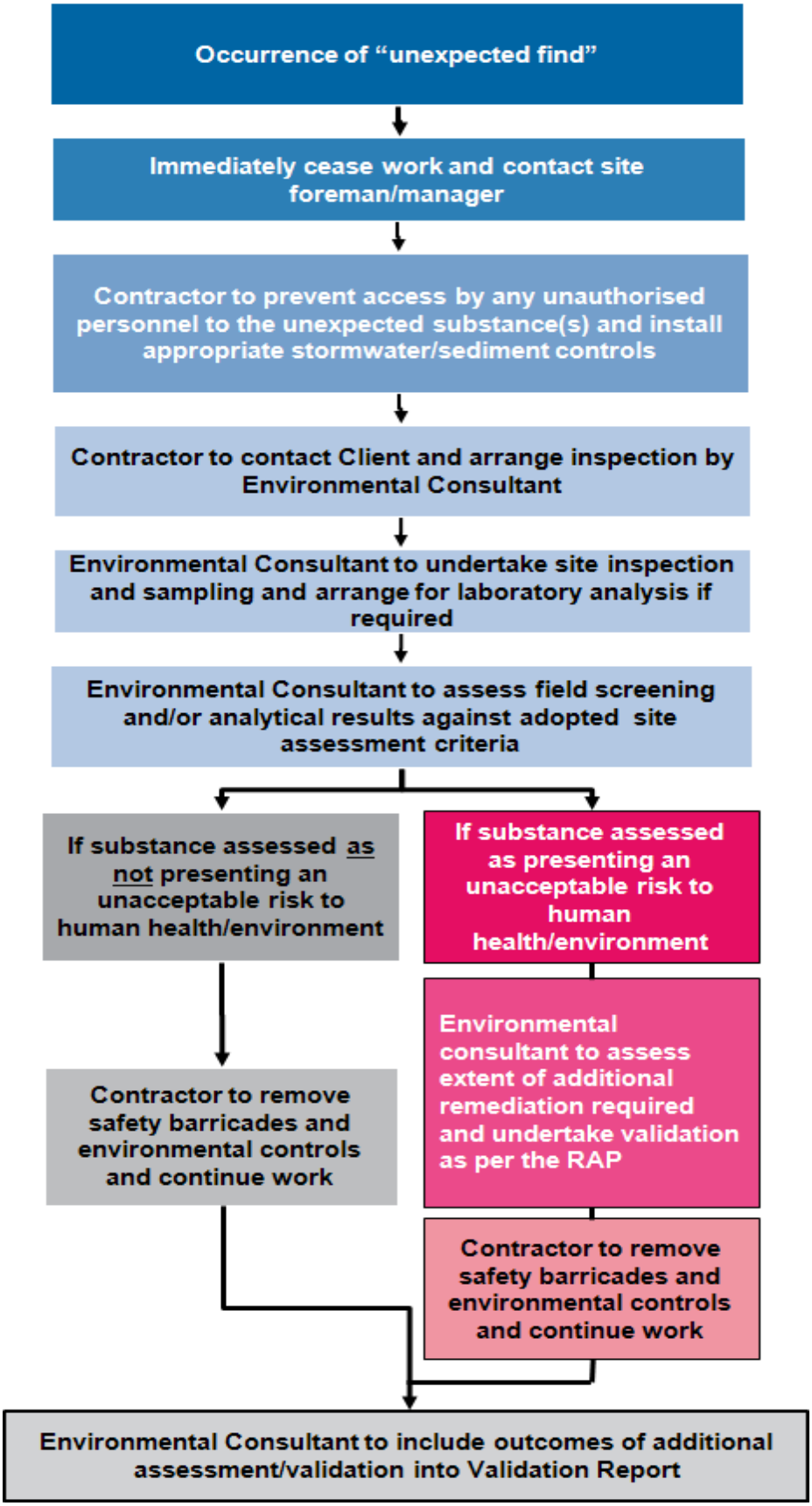
Data source: LPI: DTDB / DCDB, 2017; Metromap Tile Service: . Created by: dbbanatin

Appendix E

Unexpected finds protocol



Unexpected finds decision process

Appendix F

Monteith Powys Survey

LEGEND

TREES

TR	TREE
H	HEIGHT OF TREE
C	SPREAD OF CANOPY
D	DIAMETER OF TRUNK

SYMBOLOGY

- INV–/OBVERT LEVEL
- DRAINAGE PIT
- ELECTRICAL POWER POLE W/LIGHT
- ELECTRICAL PILLAR
- STAY POLE
- WATER METER
- WATER HYDRANT
- STOP VALVE
- WATER TAP
- SEWER PIT
- TELSTRA PIT
- FLOOR LEVEL
- ROAD SIGN
- BOLLARD

SURVEY INFORMATION

1. THE SURVEY IS ON MAP GRID OF AUSTRALIA (MGA) CO–ORDINATES (GDA 94) ZONE 56.

   –THE ORIGIN OF CO–ORDINATES IS PM 84693
   E 364276.701 N 6379962.107
   –SOURCE OF CO–ORDINATES: SCIMS
   –DATE 23/08/2022

2. ALL REDUCED LEVELS ARE ON AUSTRALIAN HEIGHT DATUM (A.H.D)

   –ORIGIN OF LEVELS PM 84693. RL 32.839
   –SOURCE OF REDUCED LEVELS: SCIMS
   –DATE OF REDUCED LEVELS 23/08/2022

3. CONTOUR INTERVAL IS 0.5m.
4. MGA AND ISG CO–ORDINATE SYSTEMS ARE BASED ON A MATHEMATICAL EARTH MODEL AND SUBJECT TO VARIABLE SCALE FACTORS. DISTANCES CALCULATED FROM CO–ORDINATES MAY VARY SIGNIFICANTLY FROM GROUND MEASUREMENTS. IF FURTHER CLARIFICATION IS REQUIRED CONTACT MONTEATH AND POWYS.
5. SOME WATER PIPES ON THIS SITE ARE POLY PIPE AND ARE NOT TRACEABLE

IMPORTANT NOTES

1. NOT ALL SERVICE INFORMATION MAY BE SHOWN DUE TO UNAVAILABILITY OF SERVICE PLANS OR CURRENT INFORMATION.
2. THE POSITION OF SERVICES LOCATED BY ACCREDITED SERVICES CONTRACTOR USING CONDUCTIVE TRACING TECHNIQUES ARE RECORDED ON THIS PLAN. MONTEATH & POWYS ARE UNABLE TO VERIFY THE ACCURACY OF THESE LOCATIONS AND ADVISE THE REQUIREMENT FOR POSITIVE IDENTIFICATION PRIOR TO EXCAVATION OR CONSTRUCTION IN THEIR VICINITY. ANY DEPTHS OF SERVICES FROM INDUCTIVE TRACING WHICH ARE INDICATED ON THIS PLAN ARE INDICATIVE ONLY AND SHOULD BE VERIFIED BY POTHOLING IF CRITICAL TO DESIGN.
3. INDEPENDENT ENQUIRIES FOR UP–TO–DATE SERVICE LOCATIONS THROUGH THE RELEVANT AUTHORITIES MUST BE UNDERTAKEN PRIOR TO COMMENCEMENT OF ANY WORKS/EXCAVATION. EXACT SERVICE POSITIONS SHOULD BE ESTABLISHED BY APPROPRIATE MEANS. WE RECOMMEND PROFESSIONAL SERVICE LOCATORS.
4. THE BOUNDARIES SHOWN ON THIS PLAN ARE BASED ON OUR FIELD SURVEY. TO FORMALISE THESE DIMENSIONS, WE WOULD RECOMMEND THE PREPARATION OF A REDEFINITION PLAN, SUITABLE FOR LODGEMENT AND REGISTRATION WITH NSW LAND REGISTRY SERVICES.
5. THIS PLAN SHOULD NOT BE USED FOR BUILDING WORKS CLOSE TO OR ON THE BOUNDARY, OR TO PROSCRIBED SET–BACKS WITHOUT FURTHER SURVEY INVESTIGATION.
6. 8. CRITICAL LEVELS (E.G. FLOOR LEVELS) AND CRITICAL LOCATIONS (E.G. STRUCTURES) THAT HAVE NOT BEEN SHOWN MUST BE VERIFIED BY FURTHER SURVEY PRIOR TO FINAL DESIGN.
7. NO EXCAVATIONS HAVE BEEN MADE TO DETERMINE THE EXTENT TO WHICH ANY SUBJECT WALLS, FOUNDATIONS OR FOOTINGS MAY ENCROACH UPON ADJOINING LAND.
8. NO EXCAVATIONS HAVE BEEN MADE TO DETERMINE THE EXTENT TO WHICH ANY ADJOINING WALLS, FOUNDATIONS OR FOOTINGS MAY ENCROACH UPON SUBJECT LAND.
9. ALL TREE DIMENSIONS, HEIGHT (H), CANOPY (C) AND TRUNK DIAMETER (D) HAVE BEEN ESTIMATED. IF ACCURATE DIMENSIONS ARE REQUIRED FOR DESIGN PURPOSES, FURTHER SURVEY SHOULD BE REQUESTED.
10. CONTOURS SHOWN DEPICT THE TOPOGRAPHY. CONTOURS DO NOT REPRESENT THE EXACT LEVEL AT ANY PARTICULAR POINT, EXCEPT AT SPOT LEVELS SHOWN.
11. THIS PLAN MUST REMAIN UNALTERED AS ISSUED BY MONTEATH & POWYS. ALTERING ANY PART OF THIS PLAN DESTROYS THE INTEGRITY OF THE PLAN. ANY REVISIONS REQUESTED MUST BE ISSUED BY MONTEATH & POWYS.
12. THESE NOTES ARE AN INTEGRAL PART OF THIS PLAN. REPRODUCTION OF THIS PLAN OR OF ANY PART OF THIS PLAN, WITHOUT THESE NOTES BEING INCLUDED IN FULL, WILL RENDER THE INFORMATION SHOWN ON SUCH REPRODUCTION INVALID AND NOT SUITABLE FOR USE.

DIAL BEFORE YOU DIG www.1100.com.au

0 50 100 150 200 250m
REDUCTION RATIO – 1:2500 (A1)
REDUCTION RATIO – 1:5000 (A3)

REVISIONS						
.	.	.	.	.	.	xx.xx.21
No	REVISION	SVY	DFT	CHK	DATE	

Monteath & Powys
PLANNING PROJECT MANAGEMENT SURVEYING 3D SPATIAL
monteathpowys.com.au
P (02) 4926 1388
NEWCASTLE SYDNEY GUNNEDAH MUSWELLBROOK

Surveyed	Drafted	Checked
PW	J.S	BJB

REGISTERED SURVEYOR

@A1 : 1:2500 @A3 : 1:5000	Original Size A1
DO NOT SCALE	

Client: MAITLAND CITY COUNCIL

Title: DETAIL SURVEY OVER PART OF LOT 445 DP 722263
WALKA WATERWORKS
SOUTH WILLARDS LANES OAKHAMPTON HEIGHTS

CAD File: 220336A | Ref No: 22/0336 | Date: 24/08/2022

Sheet No. 1/10

Revision •

REVISIONS

No	REVISION	SVY	DFT	CHK	DATE
.	.	.	.	.	xx.xx.21

Monteath & Powys

PLANNING PROJECT MANAGEMENT SURVEYING 3D SPATIAL

monteathpowys.com.au
P (02) 4926 1388

NEWCASTLE SYDNEY GUNNEDAH MUSWELLBROOK

Surveyed	Drafted	Checked
PW	J.S	BJB

REGISTERED SURVEYOR

@A1 : 1:750 @A3 : 1:1500	Original Size
DO NOT SCALE	A1

Client: MAITLAND CITY COUNCIL

Title: DETAIL SURVEY OVER PART OF LOT 445 DP 722263
WALKA WATERWORKS
SOUTH WILLARDS LANES OAKHAMPTON HEIGHTS

CAD File: 220336A | Ref No: 22/0336 | Date: 24/08/2022

Sheet No. 2 / 10

Revision •

M&P

MGA

CARETAKER'S HOUSE

SEWER PIT

SIGN

REFER SHEET 4

REFER SHEET 6

0 4 8 12 16 20m

REDUCTION RATIO – 1:200 (A1)
REDUCTION RATIO – 1:400 (A3)

REVISIONS

No	REVISION	SVY	DFT	CHK	DATE
.	.	.	.	.	xx.xx.21

M&P Monteath & Powys

PLANNING PROJECT MANAGEMENT SURVEYING 3D SPATIAL

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P (02) 4926 1388

NEWCASTLE SYDNEY GUNNEDAH MUSWELLBROOK

Surveyed	Drafted	Checked
PW	J.S	BJB

REGISTERED SURVEYOR

@A1 : 1:200
@A3 : 1:400

DO NOT SCALE

Original Size: A1

Client: MAITLAND CITY COUNCIL

Title: DETAIL SURVEY OVER PART OF LOT 445 DP 722263
WALKA WATERWORKS
SOUTH WILLARDS LANES OAKHAMPTON HEIGHTS

CAD File: 220336A | Ref No: 22/0336 | Date: 24/08/2022

Sheet No. 3/10

Revision .

M&P

REFER SHEET 3

REFER SHEET 5

REFER SHEET 7

MGA

INACCESSIBLE

APROX 0.8 DEEP

0 4 8 12 16 20m

REDUCTION RATIO – 1:200 (A1)
REDUCTION RATIO – 1:400 (A3)

REVISIONS						
No	REVISION	SVY	DFT	CHK	DATE
.	.	.	.	.	xx.xx.21

Monteath & Powys

PLANNING PROJECT MANAGEMENT SURVEYING 3D SPATIAL

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P (02) 4926 1388

NEWCASTLE SYDNEY GUNNEDAH MUSWELLBROOK

Surveyed	Drafted	Checked
PW	J.S	BJB

REGISTERED SURVEYOR

@A1 : 1:200
@A3 : 1:400

DO NOT SCALE

Original Size: A1

Client: MAITLAND CITY COUNCIL

Title: DETAIL SURVEY OVER PART OF LOT 445 DP 722263
WALKA WATERWORKS
SOUTH WILLARDS LANES OAKHAMPTON HEIGHTS

CAD File: 220336A | Ref No: 22/0336 | Date: 24/08/2022

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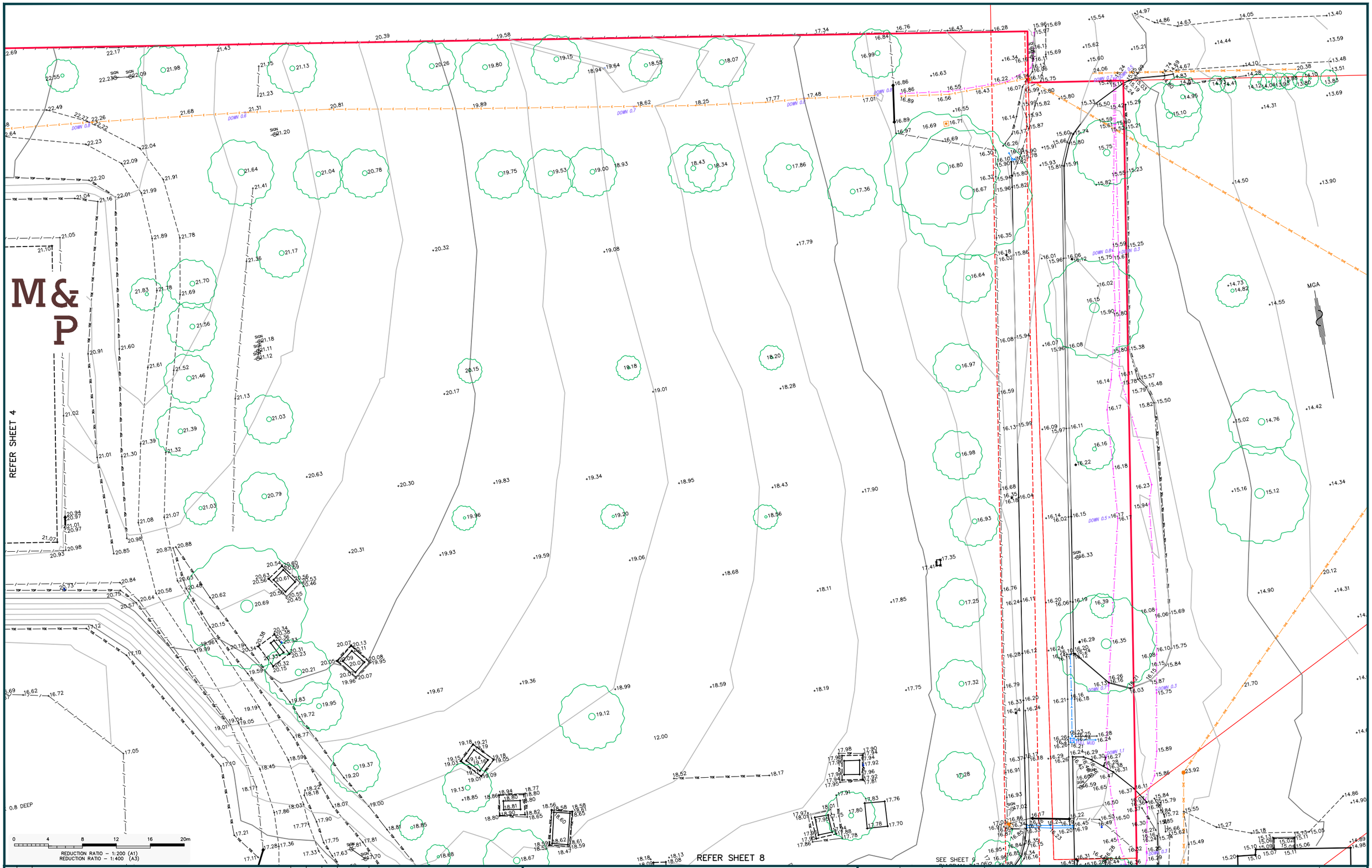
Revision •



REVISIONS

No	REVISION	SVY	DFT	CHK	DATE
.	.	.	.	.	xx.xx.21

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NEWCASTLE SYDNEY GUNNEDAH MUSWELLBROOK

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REFER SHEET 3

REFER SHEET 7

REFER DIAGRAM 'A'

MGA

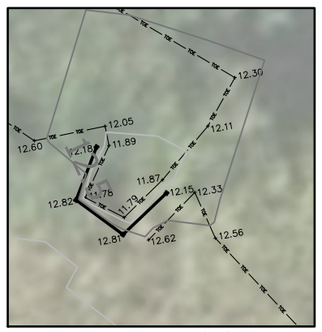

DIAGRAM 'A'
SCALE – 1:50

0 4 8 12 16 20m
REDUCTION RATIO – 1:200 (A1)
REDUCTION RATIO – 1:400 (A3)

REVISIONS						
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No	REVISION		SVY	DFT	CHK	DATE

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REGISTERED SURVEYOR

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DO NOT SCALE	A1

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0 4 8 12 16 20m

REDUCTION RATIO – 1:200 (A1)
REDUCTION RATIO – 1:400 (A3)

REFER SHEET 4

REFER SHEET 6

REFER SHEET 8

REFER SHEET 9

APROX 1.5 DEEP

INACCESSIBLY

APROX 0.8 DEEP

INACCESSIBLE

MGA

GAZEBO

PARTLY FILLED WITH WATER.

INACCESSIBLE

DOWN 0.3

DOWN 0.4

DOWN 0.3

DOWN 0.3

140048

M&P Monteath & Powys

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NEWCASTLE SYDNEY GUNNEDAH MUSWELLBROOK

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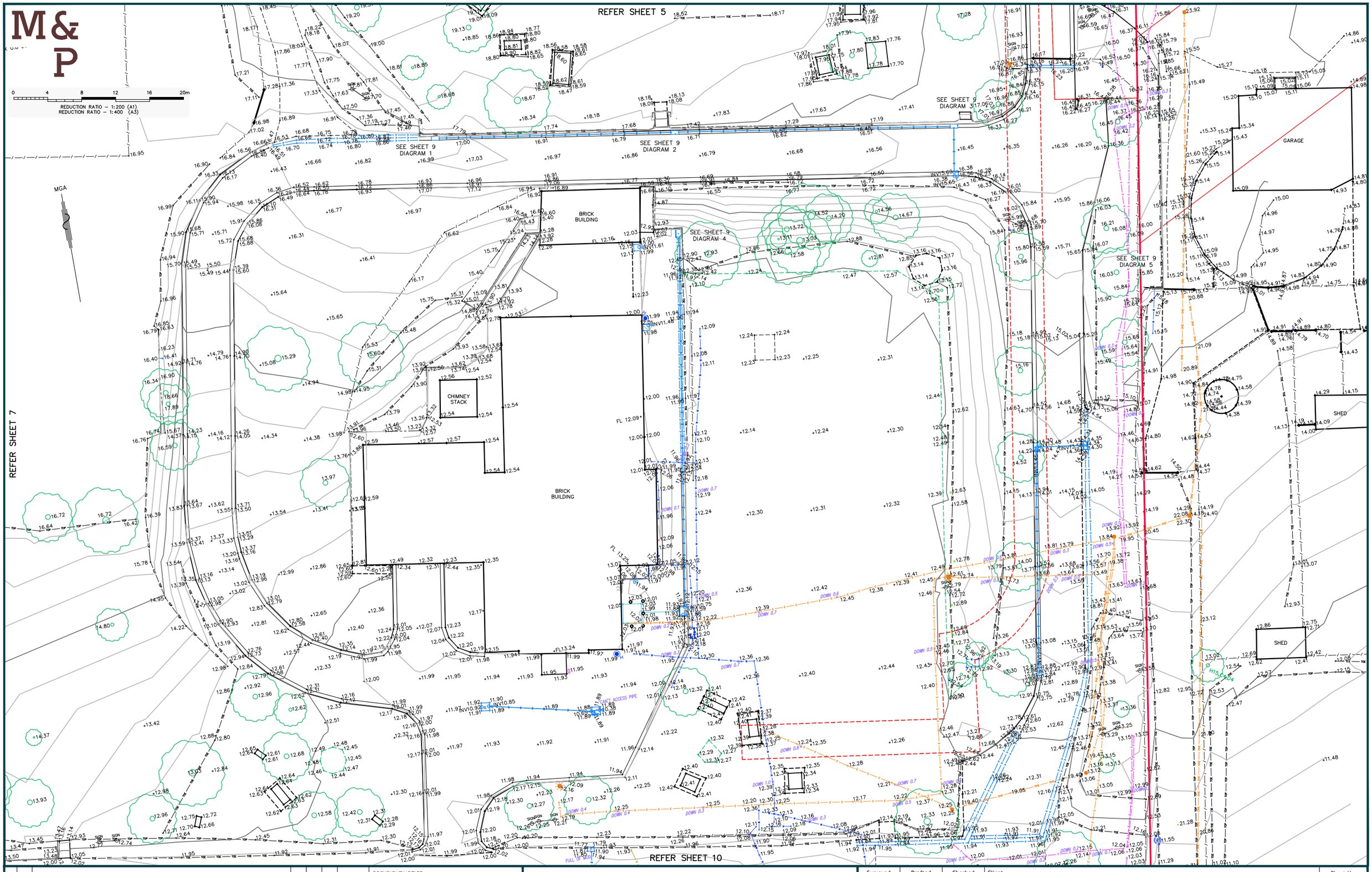
Revision .



REVISIONS						
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No	REVISION		SVY	DFT	CHK	DATE

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REFER SHEET 7

REFER SHEET 10

MGA

MINI RAILWAY STATION

DIAGRAM 1
SCALE 1:20

DIAGRAM 2
SCALE 1:20

DIAGRAM 3
SCALE 1:20

DIAGRAM 4
SCALE 1:20

DIAGRAM 5
SCALE 1:20

0 4 8 12 16 20m
REDUCTION RATIO – 1:200 (A1)
REDUCTION RATIO – 1:400 (A3)

REVISIONS						
No	REVISION	SVY	DFT	CHK	DATE
.	.	.	.	.	xx.xx.21

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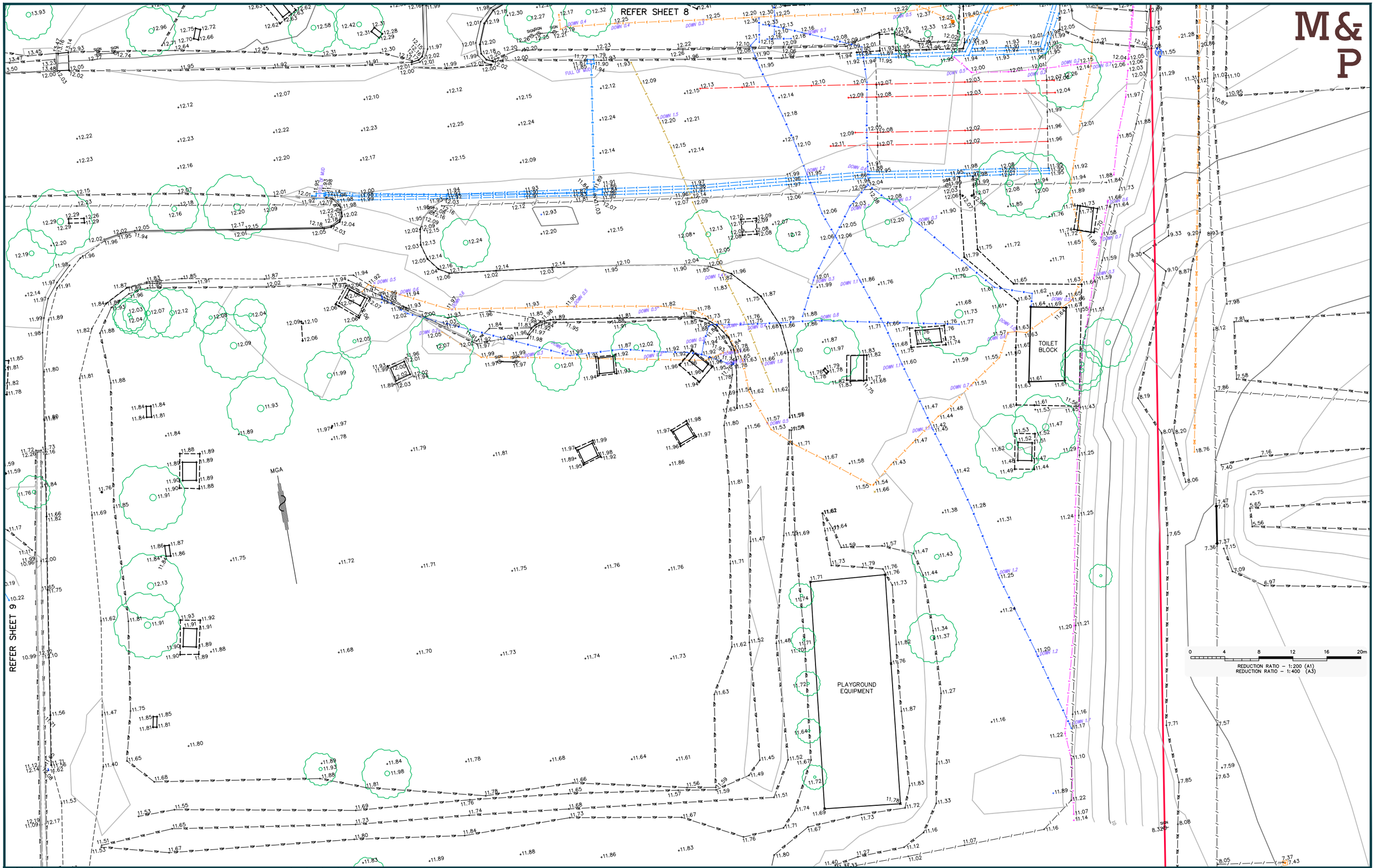

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REVISIONS						
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No	REVISION		SVY	DFT	CHK	DATE

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