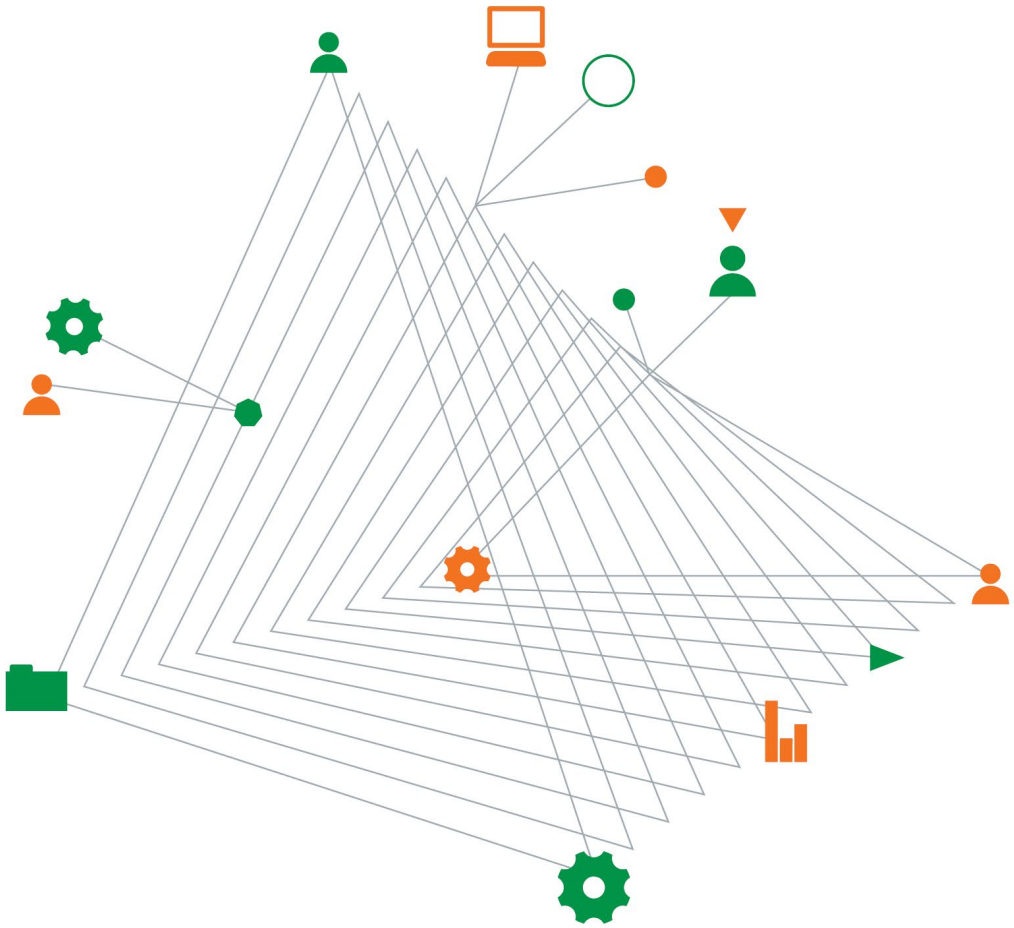
GHT Holdings Pty Ltd.

Remedial Action Plan, 107 – 117 Swan Street, Morpeth

26 May 2021



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Remedial Action Plan, 107 – 117 Swan Street, Morpeth

Prepared for
GHT Holdings Pty Ltd

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Executive Summary

This document contains a Remediation Action Plan (RAP) prepared by Coffey Services Australia Pty Ltd. (Coffey) for GHT Holdings Pty Ltd (GHT) for the proposed development of Senior Residences at 107 – 117 Swan Street, Morpeth NSW.

The RAP was commissioned by GHT to support a Development Application to the Maitland City Council (Council).

The proposed development is to be used as a retirement village (i.e. seniors residence), which will include construction of three two-storey apartment blocks, comprising a total of 11 three bed apartments.

Following the completion of a review and data gap assessment (Coffey ref: *Site Contamination Data Review and Sampling Analysis and Quality Plan for further Assessments – DA17-515 - 107-117 Swan Street, Morpeth, NSW 754-NTLEN271167-L01, dated 9 March 2020)*, Coffey concluded that further assessment works were warranted. Coffey provided the scope for the assessment and a Sampling and Analysis Quality Plan (SAQP) for the recommended works. GHT engaged Coffey to complete the required assessments in order to inform the Development Application being considered by the Council.

The additional assessment was reported in *Additional Site Contamination Investigation - 107 - 117 Swan Street, Morpeth NSW (Coffey ref: 754-NTLEN271167-R01, dated 26 May 2021)*. The assessment identified a hydrocarbon impacted area along the northern boundary of the site associated with historic petroleum underground storage tanks. Given the limitations presented by the location (between the boundary fence and the existing building structure) it was recommended that a Remedial Action Plan (RAP) be prepared and the impacted area delineated, remediated and validated following the demolition of the existing structure.

Ecological impacts related to heavy metals and TRH F3 were also identified within the site soils. As the majority of Site was proposed to be developed on hardstand with only selected areas identified for landscaping left uncovered, it was recommended that the ecological impacts be managed onsite. This will be done by excavating and removing impacted fill soils from proposed landscaping areas and retaining beneath hardstand surfaces.

This RAP has been prepared in accordance with the NSW EPA *Guidelines for Consultants Reporting on contaminated land: Contaminated land guidelines (2020) and Planning Guidelines for SEPP 55 State Environmental Planning Policy 55 – Remediation of Land* (SEPP 55).

The objective of the RAP is to provide guidance on the remediation and validation activities to be undertaken in order to render the site suitable for the proposed future Residential B land use for the development.

The NSW EPA (2020) *Consultants Reporting on Contaminated Land: Contaminated Land Guidelines* provides requirements that are to be considered in the preparation of RAPs. As such, the RAP addresses the following requirements:

- Document Control
- Executive Summary
- Objectives
- Scope of Work
- Site Identification
- Site History
- Site condition and surrounding Environment

- Remediation Criteria
- Results
- Site Characterisation
- Conceptual Site Model
- Remediation Options Assessment and Remediation Strategy
- Waste management
- Conclusion and Recommendation

Based on the proposed development and given the unknowns regarding the complete extent of the TRH impact along the northern boundary, the preferred remedial strategy is to delineate the extent on site of TRH contamination both vertically and horizontally, within an area bound by BH15 and BH20 (see attached Figure 1) followed by removal of the impacted material and validation of the excavated areas. Impacted material will be waste classified and removed offsite to a licenced facility.

Backfilling of the excavation following remediation is not intended, as the area will most likely be reconfigured during the site development works, which are expected to immediately follow the remedial works. Should there be a delay in the works programme then imported material may be required to backfill the excavations to control subsidence around the excavation.

The steps involved with the remediation of the site include:

- Delineation of the TRH impacted soils between BH15 and BH20 to define the extent of impact and the volume of material impacted.
- Delineation will be undertaken at a sampling density calculated to identify a hotspot with a diameter of 3.7m with 95% confidence. The relevant number of samples (20) have been calculated using Procedure A in the NSW EPA Sampling Design Guidelines 1995 (Sampling Guidelines). It is the intent of the delineation assessment to identify the extent of TRH impact and further assess the area for undetected contamination hotspots.
- Removal of the impacted material.
- Removal of fill materials from proposed landscaping areas and visual confirmation (validation) of natural residual materials.
- Waste classification of the impacted material followed by offsite disposal to landfill.

Following removal of soils, a suitably qualified and trained environmental scientist will collect soil samples from the excavations for validation purposes (northern boundary only).

This RAP must be read in conjunction with the attached '*Important Information about your Coffey Environmental Report*', which can be found attached to this report.

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Appendices

1. Introduction

Coffey Services Australia Pty Ltd (Coffey) was commissioned by GHT Holdings Pty Ltd (GHT) to undertake an Additional Site Contamination Investigation for the proposed development of senior residences at 107 – 117 Swan Street, Morpeth NSW (the Site), the site location is shown on Figure 1 in the Appendices.

Based on information provided by GHT, Coffey understands the proposed development is to be used as a retirement village (i.e. seniors residence), which will include construction of three two-storey apartment blocks, comprising a total of 11 three bed apartments.

A previous Phase Two Soil Contamination Assessment, dated 4th November 2019 and Remediation Action Plan (RAP), dated 26th July 2019 were prepared for the site by Pacific Environmental. Coffey reviewed these documents and a data gap assessment was reported in Coffey ref: *Site Contamination Data Review and Sampling Analysis and Quality Plan for further Assessments – DA17-515 - 107-117 Swan Street, Morpeth, NSW 754-NTLEN271167-L01, dated 9 March 2020*. Following the completion of the review and data gap assessment, Coffey concluded that further assessment works were warranted. Coffey provided the scope for the assessment and a Sampling and Analysis Quality Plan (SAQP) for the recommended works. GHT engaged Coffey to complete the required assessments in order to inform the Development Application being considered by the Maitland City Council (Council)

The additional assessment was reported in *Additional Site Contamination Investigation - 107 - 117 Swan Street, Morpeth NSW (Coffey ref: 754-NTLEN271167-R01, dated 26 May 2021)*. The assessment identified a hydrocarbon impacted area along the northern boundary of the site associated with historic petroleum underground storage tanks. Given the limitations presented by the location (between the boundary fence and the existing building structure) it was recommended that a Remedial Action Plan (RAP) be prepared and the impacted area delineated, remediated and validated following the demolition of the existing structure.

Ecological impacts related to heavy metals and TRH F3 were also identified within the site soils. As the majority of Site was proposed to be developed on hardstand with only selected areas identified for landscaping left uncovered, it was recommended that the ecological impacts be managed onsite. This will be done by excavating and removing impacted fill soils from proposed landscaping areas and retaining beneath hardstand surfaces.

This RAP has been prepared in accordance with the NSW EPA *Guidelines for Consultants Reporting on contaminated land: Contaminated land guidelines (2020) and Planning Guidelines for SEPP 55 State Environmental Planning Policy 55 – Remediation of Land* (SEPP 55). The objective of the RAP is to provide guidance on the remediation and validation activities to be undertaken in order to render the site suitable for the proposed future Residential B land use for the development.

1.1. Regulatory Guidelines

This RAP has been prepared in general accordance with the requirements of the following guidelines:

- National Environment Protection Council (NEPC) (1999) National Environment Protection (Assessment of Site Contamination) Measure (ASC NEPM), which was amended in 2013 (ASC NEPM 2013);
- NSW EPA (2020) Consultants Reporting on Contaminated Land: Contaminated Land Guidelines;
- NSW EPA (2014) Technical Note: Investigation of Service Station Sites;
- NSW EPA (1995) Sampling Design Guidelines; and
- NSW EPA (2014) Waste Classification Guidelines Part 1: Classifying Waste.

1.2. RAP Requirements

The NSW EPA (2020) *Consultants Reporting on Contaminated Land: Contaminated Land Guidelines* provides requirements that are to be considered in the preparation of RAPs. As such, the RAP addresses the following requirements:

- Document Control
- Executive Summary
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- Scope of Work
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- Results
- Site Characterisation
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- Waste management
- Conclusion and Recommendation

2. Site Information

2.1. Site Location and Identification

General site location is shown in Appendix B, Figure 1 with the relevant site information provided in Table 2-1.

Table 2-1: Summary of site details

Site Address	107 – 117 Swan Street, Morpeth NSW 2321
Current Site Ownership	GHT Holdings Pty Ltd
Property and Site Area	0.28Ha
Site Identification Details	Lot 1 & 3 DP 538510 and Lot 321 DP 1226898
Current Zoning	RU1 General Residential
Current Site Use	The Site is currently occupied by a derelict house (western portion) and vacant concrete and brick building slab (eastern portion), with grasses and trees in the southern vacant area of the Site. An excavation around the concrete building slab to approximately 1m depth has generated a stockpile of material (placed on building slab in the north eastern corner of the Site).
Proposed Site Use	Proposed three two-storey apartment blocks, comprising a total of 11 three bed apartments.
Adjoining Site Use	• North: Swan Street with commercial properties and the Hunter River beyond; • East: William Street followed by Commercial (veterinarian) and residential properties; • South: Residential Properties followed by Close Street; and • West; Market Street followed by Commercial and Residential Properties, including Noel and Daphne Unicomb Park.
Site Coordinates	371462 m E 6378377 m S (north-eastern boundary corner). *Taken from Google Earth.

2.2. Site topography and drainage

A review of Newcastle Coalfield 1:100,000 Regional Geology (Series Sheet 9231 and part of 9131, 9132 and 9232 Edition 1 1995) indicates the Site is located within the Tomago Coal Measures typically comprising sandstone, minor siltstone, claystone, coal and tuff.

Soil Landscape information was accessed through the NSW eSPade v2.1 online database (https://www.environment.nsw.gov.au/eSpade2WebApp). Regional soils are typically shallow to moderately deep (25 - <100 cm), imperfectly drained Brown and Yellow Kurosols (Yellow Podzolic Soils and Soloths); and moderately deep to deep (50 - <150 cm), imperfectly drained Red, Brown and Yellow Kurosols (Red and Yellow Podzolic Soils and Soloths).

Locally on the site, Coffey encountered:

- Fills comprising sandy gravels to clayey sand to depths ranging from 0.2m to 1.4m although generally less than 0.5m
- Residual soil clay to sandy clay high dark brown to black (potential remnant coal seam)

- Residual soil clay to sandy clay to gravelly sandy clay high white to pale brown overlying (potentially remnant tuff)
- Shale with minor iron stone beds

2.3. Regional Topography and Drainage

Available topographic information indicates the site is at an elevation of approximately 13 – 16m Australian Height Datum (AHD). The site is located on the southern side of Swan Street and is generally flat with a gentle slope down to the north.

The landform is described by undulating rises to rolling low hills. Slopes are 3 - 15%, local relief is 10 - 50 m and elevation is 10 - 90 m. Crests are broad (250 - 400 m). Sideslopes are long and gently inclined (350 - 750 m), with some very long footslopes up to 2000 m long. Occasional short steep sideslopes occur, with common terracetting. Drainage lines are deeply incised and narrow (2 - 3 m). Rock outcrop is generally absent.

Rain falling on the site is expected to infiltrate into the site soils. Excess run-off from the site is expected to flow to the north towards the Hunter River located approximately 65m from the site.

2.4. Regional Hydrogeology

Regional groundwater beneath the site is anticipated to be present in the fractured rock at depths less than 5mbgs. A shallow perched groundwater aquifer probably exists at the residual soil/ weathered rock interface, between 1 and 5 mbgs. This perched aquifer may be discontinuous and exist only after prolonged rainfall.

Regional groundwater flow is anticipated to follow the general slope of the region to the north, likely discharging into the Hunter River approximately 65m from the site.

3. Summary of Previous Reports

3.1. Phase Two Soil Contamination Assessment (Revision 2), 107-117 Swan Street, Morpeth, NSW, Pacific Environmental, 4 November 2019

The report presented the findings of a Phase Two Contamination Assessment (CA) undertaken at the Site by Pacific Environmental Pty Limited (PE). Coffey inferred from the report that the objective of the CA was to investigate the extent of contamination related to historical contaminating activities that occurred onsite. This included use of the site as a ferrous foundry and as a mechanics workshop/service station. The report also included an assessment of residual hydrocarbon contamination impact to local Council perimeter stormwater drainage resulting from previously undertaken remediation works associated with the removal of service station infrastructure at the Site. This was requested by Council.

The scope of works as reported in the CA was as follows:

- *"An inspection of the site on the 26th July 2018 and undertaking the drilling of nine (9) temporary soil sample inspection wells and the taking of thirteen (13) soil samples, including one (1) field duplicate), plus a field rinsate, laboratory prepared spike and blank;*
- *Have the sampled soils analysed by a NATA Certified laboratory for a range of analytes accepted by the NSW EPA and of sufficient spread to characterize the site soils;*
- *An inspection of the site on the 11th June 2019 and conducting an intrusive soil sampling of the areas around the site, with eight (8) additional soil samples from eight (8) temporary shallow sampling bores and two water samples from impounded site water (including one field duplicate);*
- *Have the sampled soils analysed by a NATA Certified laboratory for a range of analytes accepted by the NSW EPA and of sufficient spread to characterize the site;*
- *Review the site history to assist in characterizing the site and ensure that the sampling program is adequate;*
- *Report on the findings of the site investigation in accordance with the NEPM A Criteria."*

3.1.1. Soil Sampling

Sampling, to compete the scope for the CA was undertaken in July 2018. The sampling programme included the drilling of boreholes at nine (9) locations and the collection of thirteen (13) primary soil samples. The historical sampling locations are shown in the attached Figure 2. Quality assurance samples included, one (1) field duplicate, a rinsate blank and a laboratory prepared spike and blank sample pair. Samples were collected from a range of depths 0.3m – 2.7m below ground surface (bgs). It was also reported that:

"seven (7) inspection wells were drilled to 2.5m BGL to visually check for buried demolition waste, asbestos and field sampling with a PID meter (all readings were +/- 5% of background levels and all less than 5ppm)."

At the request of Council, additional sampling was undertaken on the 11th June 2019, to assess the impact of previously completed remediation works at the Site on the local Council perimeter stormwater drainage system. Surface soil samples were collected from six (6) locations along the Council drain as shown in the attached Figure 2. In addition, two surface water samples were collected from localised ponding in excavations onsite. Two samples were also collected from a stockpile onsite.

3.1.2. Results Summary

The site soils were assessed against the National Environment Protection (Assessment of Site Contamination) Measure 1999 (2013) (ASC NEPM) Health Investigation Levels and Health Screening Levels for a Residential A (access to site soils) exposure scenario. The data was also assessed against the Ecological Screening Levels (ESL's) for Urban Residential and Public Open Space land use. The contaminants of potential concern (COPC) examined included total recoverable hydrocarbons (TRH), Benzene, Toluene, Ethylbenzene and Xylene (BTEX), Polycyclic Aromatic Hydrocarbons (PAH), Organochlorine Pesticides (OCP), Organophosphorus Pesticides (OCP) and Heavy Metals (Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel and Zinc).

It was reported that contaminant concentrations exceeded the site assessment criteria as follows:

- *"**Sample B/B-D 0.7m BGL** which exhibited Lead concentrations of 1,900mg/kg and 1,400mg/kg (which are not considered significant after a 95% Confidence Limit Assessment); TRH F3 C16-C34 of 5,900mg/kg.*
- ***Sample F 0.3m BGL** which exhibits TRH F3 CD16-C34 concentration of 9,300mg/kg.*
- ***Sample I 0.4 BGL** which exhibits B(a)P concentration of 3.5mg/Kg (which is not considered significant after a 95% Confidence Limit Assessment).*
- ***Samples I2 and J2** exhibited excessive TRH F3 concentrations and indicate that the remediation stockpile has not, at 11th June 2019, reached a concentration of TRH F3 suitable for re-use on site. This level is expected to be achieved by early September 2019."*

3.1.3. Conclusions

The following was concluded in the report:

"After a review of the site in accordance with the NEPM Schedule B1 criteria the following findings are applicable:

- *The site soils have a significant history that may preclude the development or use of the site for the accepted criteria for residential development with access to soils or commercial/industrial development;*
- *The site exhibits no visual or documentary evidence that would preclude its meeting the NEPM A Criteria for analytes analysed, following remediation of hydrocarbons at the identified areas shown at **Appendix B**;*
- *Further intrusive investigation of the areas marked at **Appendix I** and the analysis of samples are to include:*
  - *TRH;*
  - *PAH;*
  - *Copper;*
  - *Tin;*
  - *Zinc.*
  - *Asbestos fibres.*

This program is to be undertaken when Heritage Approval for excavations is granted and when the existing residences are demolished.

- *Remediation action is recommended for the identified areas shown at Appendix A. Following this remediation (by bioremediation on the existing concrete slab the site will be suitable for residential development with access to the soils;*
- *The soils analysis reveals that the site soils are heavily and naturally affected by gum leaf that creates an illusion of hydrocarbon contamination beyond that indicated by TRH laboratory analysis without silica gel clean-up;*
- *The site remediation works have not impacted the adjoining street drainage system;*
- *The laboratory analysis of the two (2) water samples from the impounded water in the remediation excavations revealed no impact from the previous hydrocarbon contamination in the soils – reference* ***Appendix D- COMPARISION OF LABORATORY ANALYSIS WITH ELAVENT (sic) GUIDELINES****."*

3.2. Remediation Action Plan, 107-117 Swan Street, Morpeth, NSW, dated 26 July 2019.

A Remediation Action Plan (RAP) was prepared by PE in July 2019 to address the hydrocarbon contamination issues identified on site. The RAP recommended a preferred strategy of excavation of impacted site soils and bioremediation of the impacted resulting stockpiles on-site for proposed onsite reuse.

3.3. Site Contamination Data Review and SAQP for further Assessments – DA17-515 – 107-117 Swan Street, Morpeth NSW

Coffey reviewed the PE Phase 2 CA report and RAP discussed in Sections 3.1 and 3.2. Coffey confirmed areas requiring additional assessment including areas beneath existing building structures and areas excluded from previous investigations as result of heritage issues. One outcome of the data review was a change in the land use setting and site assessment criteria (SAC) and as a result the ASC NEPM guideline values proposed for the Site.

The PE CA (2019) adopted the ASC NEPM HIL/HSL[1] A and ESL[2] Urban Residential and Public Open Space as the site assessment criteria. The choice of Residential A as the SAC was considered by Coffey to be overly conservative for the proposed development i.e. a multi-unit complex with extensive areas of hardstand cover and limited access to existing site soils (boundary and decorative landscaping only). Also, the proposed development is primarily for senior residents and is not expected to have young children in residence full time.

Typically, the HIL/HSL A are applied to low density, residential land use scenarios with garden beds and accessible soil areas. The land use scenario is defined in Section 3.1 of the ASC NEPM Schedule B7, Derivation of Health-Based Investigation Levels as follows:

"HIL A - Residential scenario with garden/accessible soil (home-grown produce <10% fruit and vegetable intake and no poultry; includes childcare centres, preschools, primary schools"

The land-use scenario is further described in Section 3.2.1 of Schedule B7 as follows:

[1] Health Investigation Level (HIL); Health Screening Level (HSL)
[2] Ecological Screening Level (ESL); Ecological Investigation Level (EIL)

"Residential land use includes a variety of building densities, ranging from separate low-density dwellings to high-density unit blocks. The residential land use scenario considered in the derivation of the HIL A values is low-density residential, including a sizeable garden (referring to the presence of sufficiently large areas of soil in a garden that may be accessible on a daily basis by young children and adults)."

The development as proposed is a medium-density multi-unit residential complex constructed on a ground-level slab with a high proportion of the surface outside the buildings sealed by paving and hardstand parking. The complex does not include large areas of soil in a garden setting that is accessible by young children or adults. The current landscaping plan shows shrubs and trees planted around the boundary with a few decorative landscaping beds within the property boundary.

The land use scenario most relevant to the development was considered by Coffey to be Residential B, defined in Section 3.1 of Schedule B7 of the ASC NEPM as follows:

"Residential with minimal opportunities for soil access; includes dwellings with fully and permanently paved yard space such as units, high-rise buildings and apartments."

The Residential B scenario is further described in Section 3.2.2 of Schedule B7 as follows:

"The residential land use scenario considered for the HIL B values is high-density residential, not including a private garden. This land use scenario assumes typical residential unit blocks, consisting of multistorey buildings where living areas are on the ground floor (constructed on a ground level slab or above subsurface structures including basement car parks or storage areas).

Occupants of the buildings considered in the development of the HIL B values have access to yard spaces that are largely covered by permanent paving, with some small areas of landscaping or lawns. Opportunities for direct access to soil by residents of these buildings are therefore minimal but there may be some potential for residents to inhale, ingest or come into direct dermal contact with dust (particulates) derived from the soil on the site."

3.3.1. Results

Coffey compared the results of the 2018 investigation (relevant to the site suitability for the proposed use) against the HIL/HSL B values from the ASC NEPM. Coffey identified the following during the data review and comparison against the revised SAC:

Health Criteria Exceedances

The reassessment identified one exceedance of the HIL B for lead (1200mg/kg) as follows:

- B 0.7: 1900mg/kg

The reassessment also identified two exceedances of the HSL A/B for TRH F2 (110mg/kg) as follows:

- B-D 0.7: 170mg/kg (higher concentration from the duplicate pair (B/B-D))
- F 0.3: 130mg/kg

As the exceedances did not represent a hotspot (greater than 2.5 times the SAC) for either lead or TRH F2 at the impacted locations, the 95% $UCL_{AVERAGE}$ was calculated using the USEPA ProUCL 5.1 software package for Lead and TRH F2 respectively using the assessment data. The results were as follows:

- The 95% $UCL_{AVERAGE}$ for Lead was calculated to be: 1034mg/kg.
- The 95% $UCL_{AVERAGE\ for\ TRH}$ F2 was calculated to be: 110.4mg/kg.

Both TRH F2 and Lead were at or below the adopted health SAC for the site.

Ecological Criteria Exceedances

The CA identified exceedances of TRH F2 ESL (120mg/kg) at the following locations:

- B-D 0.7: 170mg/kg (higher concentration from the duplicate pair (B/B-D))
- F 0.3: 130mg/kg

The CA identified exceedances of TRH F3 ESL (300mg/kg) at the following locations:

- B-D 0.7: 10,000mg/kg (higher concentration from the duplicate pair (B/B-D))
- C 0.9: 460mg/kg
- D 0.7: 810mg/kg
- F 0.3: 9,300mg/kg
- I 0.4: 370mg/kg

Management Limits

The CA identified exceedances of TRH F3 Management Limits for Residential, parkland and public open space (2,500mg/kg (for coarse soil)) at the following locations:

- B-D 0.7: 10,000mg/kg (higher concentration from the duplicate pair (B/B-D))
- F 0.3: 9,300mg/kg

Suitability for Proposed Use

Human Health Suitability

The Site has been assessed against the ASC NEPM HIL/HSL B Residential with minimal access to soils land use criteria. None of the exceedances identified were a hot-spot i.e. greater than 2.5 times the relevant health-based guideline value and as such the average concentration for the assessed COPC were considered. 95% $UCL_{AVERAGE}$ concentrations for both lead and TRH F2 were calculated and compared to the respective health criteria. 95% $UCL_{AVERAGE}$ concentrations for both lead and TRH were at or below the relevant guideline values. From a health risk perspective, the site as assessed to date shows no unacceptable contaminant concentrations warranting further consideration. Site suitability however cannot yet be assessed as there are identified unassessed areas that will require consideration for further assessment. These include areas not accessible as a result of there being existing buildings requiring demolition and areas that were inaccessible as a result of heritage considerations. These areas will be assessed following the demolition of all existing site structures and surface clearance from a hazardous material perspective (i.e. bonded asbestos from the demolition activities). The planned assessment is described in section 5 of this report as part of the sampling and analysis quality plan (SAQP) for further assessments to be undertaken at the Site.

Ecological Impact Suitability

The Site has been assessed against the ASC NEPM ESL/EIL A/B Urban Residential and Public Open Space Criteria for suitability from an ecological perspective. Exceedances were identified in the TRH F2 and F3 parameters. The TRH F2 data was subjected to a 95% $UCL_{AVERAGE}$ calculation resulting in an average below the respective guideline value.

The TRH F3 component however showed multiple exceedances in the upper 0 – 1.0m bgs soil profile with concentrations that were well above the ESL A/B criteria (i.e. areas where further investigation

and/or management is warranted). Given the toxicity of the TRH F3 to soil invertebrates, management actions should be considered in relation to the future proposed layout of the Site. Most of the areas impacted will be capped by the developed site structures such as pavement, hardstand areas and the main foundation slabs for the building. There are however landscaped areas which will utilise existing site soils amended with compost. These areas should be assessed for TRH F3 impact with management and/or remediation considered should there be significant exceedances identified. The remainder of the Site can be managed as part of the development with the impacted areas essentially contained beneath site structures which preclude infiltration of rainfall.

The additional assessment of proposed landscaping areas should form part of the additional assessment works to be carried out following the demolition and removal of existing site structures and areas currently access limited as a result of heritage considerations.

Management Limits

The Site has been assessed against the ASC NEPM Management Limits for Residential, parkland and public open space. Exceedances were identified in the TRH F3 component only. Two (2) exceedances were identified in the upper 0 – 1.0m bgs soil profile with concentrations that were well above the relevant Management Limit (i.e. areas requiring additional investigation and/or management). The management actions should be considered in relation to the future proposed layout of the Site. The actions required will mirror those previously discussed for the TRH F3 ESL exceedances identified. As previously stated, most of the impacted areas will be covered by the developed site improvements such as pavement, hardstand areas and the ground floor slab for the building. The areas forming portions of the external landscaping will be assessed for TRH F3 impact with management and/or remediation considered should unacceptable contaminant concentrations be identified. The remainder of the Site can be managed as part of the development with the impacted areas essentially isolated beneath the impermeable site structures.

The proposed landscaping areas should form part of the additional assessment area following the demolition and removal of existing site structures and areas currently access limited as a result of heritage considerations.

3.3.2. Sampling and Analysis Quality Plan

Coffey proposed further assessments to complete investigations in previously unassessed areas of the Site. These include areas that will be accessible following the completion of demolition activities at the Site and areas currently access limited as a result of heritage concerns. Following the completion of demolition activities and the granting of access to the section of the Site currently affected by heritage considerations, an additional assessment will be required to fill the data gaps related to the fill beneath the former buildings and possible impacts from the demolition activities; and assess the contamination status of the fill in heritage areas. The assessment was detailed in the sampling and analysis quality plan (SAQP) the intent of which was to outline and guide the proposed investigative works.

3.4. Additional Site Contamination Investigation - 107 - 117 Swan Street, Morpeth NSW

Coffey Services Australia Pty Ltd (Coffey) was commissioned by GHT Holdings Pty Ltd (GHT) to undertake an Additional Site Contamination Investigation to address findings of Coffey's data gap assessment, as discussed in Section 3.3.

3.4.1. Sampling locations

Sample locations were selected in general accordance with the minimum recommend sampling density listed in Table A in the NSW EPA (1995) Contaminated Sites: Sampling Design Guidelines for the area being assessed. Nine (9) locations were previously sampled in the Phase 2 CA (PE 2019) and twenty-one (21) additional locations were sampled for the additional assessment (Coffey 2020). The total number of sample locations used in this assessment was in excess of the minimum recommended for site characterisation (9 samples on an evenly spaced square grid) for a 2,800m^2 site.

Twenty-one (21) boreholes (BH01-BH21) were drilled using a 5-tonne excavator with a 350mm auger attachment under supervision of a Coffey Environmental Scientist between 22nd June and 24th June 2020. Boreholes were advanced to approximately 2.0 mbgs with the logging of the soil profile undertaken at each location.

3.4.2. Analytical Schedule

Primary soil samples were submitted for analysis for a suite of chemicals of potential concern (COPC) as summarised in Table 3-1. Samples were selected to achieve characterisation of the soils at the site and targeting indicators of contaminations such as staining, noxious odours or elevated headspace screening results measured during sampling.

Table 3-1: Summary of Soil Analysis

Chemical of Concern	No. Primary Soil Samples
Heavy Metals	76
TRH	76
BTEX	76
PAH	76
Asbestos	26

Notes: Heavy Metals (arsenic, cadmium, total chromium, copper, lead, mercury (inorganic), nickel, zinc), TRH= total recoverable hydrocarbons, BTEXN= benzene, toluene, ethylbenzene, xylenes, naphthalene, PAH= Polycyclic aromatic hydrocarbons

3.4.3. Results

Field Headspace Screening

Soil samples were headspace screened for presence of volatile hydrocarbons using a PID. The PID readings were reported between 0.0 ppm and 1702 ppm, indicating that volatile hydrocarbons were likely to be present at reportable concentrations (excess of 100ppm).

Health-based Investigation and Screening Levels

Soil samples reported chemical concentrations less than the adopted Tier 1 health-based investigation and screening levels in samples analysed, except for the samples summarised in Table 3-2 (table includes data for historical samples). The exceedances represented individual sample locations assessed at a Tier 1 level. Site suitability was based on 95% UCL_{AVE} concentrations of all relevant sample data where not impacted by hotspot concentrations (i.e. greater than 2.5 times the relevant guideline value and standard deviation of data set more than 50% investigation level) or the use of Tier 2 assessments.

Table 3-2: ASC NEPM 2013 HIL-B/HSL A/B and HSL C exceedances[3] aligned with proposed development

Analyte (SAC)	Samples (Concentrations)	Context with Proposed Development
Lead (1200mg/kg)	• BH8 0.0-0.2 (2100mg/kg) • BH9 0.0-0.2 (1800mg/kg) • B 0.7 (1900mg/kg)	• BH8 below car park/pavement • BH9 landscaping area • B 0.7 below slab or pavement
Carcinogenic PAH (4mg/kg, measured as BaP_{TEQ})	• BH1 0.0-0.2 (40mg/kg) • BH5 0.0-0.2 (11mg/kg) • BH6 0.0-0.2 (5.7mg/kg) • BH7 0.0-0.2 (11mg/kg) • BH17B 0.0-0.2 (23mg/kg) • BH19 0.0-0.2 (28mg/kg) • BH21 0.0-0.2 (45mg/kg)	• BH1 below car park/pavement • BH5 landscaping area • BH6 landscaping area • BH7 landscaping area • BH17B landscaping area • BH19 below building slab • BH21 below building slab
TRH F1 (HSL A/B 90mg/kg) TRH F1 (HSL C NL)	• BH17B 1.8-2.0 (160mg/kg)	• BH17B landscaping area
TRH F2 (HSL A/B 110mg/kg) TRH F2 (HSL C NL)	• BH9 0.0-0.2 (300mg/kg) • BH13 0.0-0.2 (180mg/kg) • BH14 0.2-0.4 (2,298mg/kg) • BH19 0.0-0.2 (205.4mg/kg)	• BH9 landscaping area (HSL C NL) • BH13 below building slab • BH14 landscaping area (HSL C NL) • BH19 below building slab
Benzene (HSL A/B 0.5mg/kg (0 - <1m), 1mg/kg (1 - <2m), 2mg/kg (2 - <4m) Benzene (HSL C NL)	• BH17B 0.8-1.0 (4.5mg/kg) • BH17B 1.8-2.0 (4.7mg/kg) • BH17B 2.2-2.3 (9.3mg/kg)	• BH17B landscaping area

Notes: HSL A/B applicable to areas below building slabs, HSL C applicable to car parks, roads and open space areas.

Ecological Investigation and Screening Levels

The soil samples reported chemical concentrations less than the adopted ecological investigation/ screening levels except for the following samples summarised in Table 3-3 (table includes data for historical samples). The exceedances represent individual sample locations assessed at a Tier 1 level. Site suitability was based on 95% UCL_{AVE} concentrations of all relevant sample data or

- [3] cPAH exceedances identified in BH19 1.8-2.0 (4.6mg/kg) and BH21 1.3-1.5 (5.7mg/kg) are low-reliability and have been excluded. The impact is identified in the residual material and given the nature of the contaminant is most likely a result of cross-contamination from upper fill layer

implementation of appropriate contamination management protocols as part of the proposed development.

Table 3-3: ASC NEPM 2013 EIL/ESL (Urban Residential and Public Open Space) exceedances (applicable to landscape areas only)

Analyte (SAC)	Samples (Concentrations)
Lead (1100mg/kg)	• BH9 0.0-0.2 (1800mg/kg)
Copper (110mg/kg)	• BH3 0.0-0.2 (330mg/kg) • BH6 0.0-0.2 (140mg/kg) • BH7 0.0-0.2 (150mg/kg) • BH9 0.0-0.2 (120mg/kg) • BH16 0.0-0.2 (520mg/kg) • G 0.6 (4300mg/kg)
Zinc (260mg/kg)	• BH3 0.0-0.2 (890mg/kg) • BH5 0.0-0.2 (430mg/kg) • BH6 0.0-0.2 (540mg/kg) • BH7 0.0-0.2 (340mg/kg) • BH11 0.0-0.2 zinc (560mg/kg) • BH14 0.2-0.4 zinc (360mg/kg) • BH16 0.0-0.2 (530mg/kg) • BH21 0.0-0.2 (950mg/kg) • G 0.6 (1600mg/kg)
TRH F2 (120mg/kg)	• BH9 0.0-0.2 (300mg/kg) • BH14 0.2-0.4 (2298mg/kg)
TRH F3 (300mg/kg)	• BH5 0.0-0.2 (740mg/kg) • BH7_0.0-0.2 (480mg/kg) • BH8_0.0-0.2 (3,700mg/kg) • BH9_0.0-0.2 (4,400mg/kg) • BH11_0.0-0.2 (630mg/kg) • BH14_0.0-0.2 (320mg/kg) • BH14_0.2-0.4 (2,500mg/kg) • BH17B_0.0-0.2 (1,200mg/kg) • BH21_0.0-0.2 (810mg/kg)

Management Limits

Soil samples reported chemical concentrations below the adopted management limits with the exception of the following samples.

- BH8_0.0-0.2 C16-C34 (3700mg/kg)
- BH9_0.0-0.2 C16-C34 (4400mg/kg);
- BH13_0.0-0.2 C16-C34 (7000mg/kg);
- BH14_0.2-0.4 C10-C16 (2300mg/kg); and
- B 0.7 (10000mg/kg)
- F 0.3 (9300mg/kg)

Asbestos

Twenty-six (26) soil samples were analysed for the presence/ absence of asbestos fibres in soil. Each sample analysed reported no presence of free asbestos fibres in soil. It is noted that fragments of bonded asbestos cement sheet were observed within the house (not yet demolished) in the western portion of the site. Asbestos removal from and clearance of inside the house will need to be completed prior to demolition and following the demolition of the building on the site.

Preliminary Waste Classification

A preliminary in-situ waste classification was undertaken using analytical soil data reported following the laboratory analysis of 76 soil samples. Based on the laboratory results and field observations, Coffey assesses that the soil has a classification **General Solid Waste – (non-putrescible).**

Coffey notes that the in-situ waste classification is preliminary only. Excavations during development works may reveal soil conditions that differ from those encountered during the in-situ assessment, which may require further assessment prior to offsite disposal. An Unexpected Finds Protocol (UFP) should be implemented during excavation works at the Site.

3.4.4. Results Summary and Recommendations

3.4.5. Tier 1 Assessment

The site investigation data has been subjected to a Tier 1 (generic) screening evaluation to establish whether there is potential for unacceptable ecological or health risk associated with primarily heavy metal, cPAH and hydrocarbon impacts at the site. The generic screening criteria were selected based on the preliminary Conceptual Site Model for the Site.

The generic screening criteria are generally derived based on conservative assumptions relating to land use, receptor behaviour, site, building and soil characteristics. The ASC NEPM health investigation levels (HILs) HIL-B and Health Screening Levels (HSLs) HSL A/B were adopted based on the Residential B (minimum access to soils) exposure scenario.

3.4.6. Ecological Considerations

Exceedances of the generic Ecological Investigation Levels and Ecological Screening Levels (Urban Residential and Open Space) were recorded for lead, copper, zinc, TRH F1, F2, F3 and benzo(a)pyrene (BaP). The hydrocarbon exceedances are the most significant concern from a management perspective. TRH F1 and F2 were primarily found impacting soils along the northern boundary, a location suspected to contain residual hydrocarbon impact from historical use as a service station. The TRH F3 is more widely distributed across the site with multiple exceedances identified in the upper 1.0m soil layer. The comparison of site data to the generic screening criteria (ESL Urban residential and public open space) for TRH F3 summarised in Table 3-4.

Table 3-4: Tier 1 screening comparison of impact at different depths and the NEPM ESL Urban/Residential criteria

Chemical of concern	Tier 1 ecological screening criteria [mg/kg]	Depth range [m]	Number of soil samples	Concentration range [mg/kg]	95% UCL_{AVE} concentration [mg/kg]
TRH F3	300	0.0 – 1.0	52	<100 – 10,000	2420
		>1.0	24	<100 – 460	189

The proposed development will result in most of the Site being covered by a combination of buildings, roads and covered parking areas. The only areas with exposed soil will be the landscaping areas. The soils below the buildings and hardstand areas will be isolated and the ecological impacts related to soil quality on the site are not relevant. In the landscaping areas, soils containing TRH F3 at concentrations above the relevant ESL could potentially impact invertebrate populations. In order to manage this potential impact, landscaping will not use the fill soils onsite. The fill materials within landscaping areas must be excavated exposing the residual soil. The fill material so excavated must either be placed beneath buildings and other hardstand surfaces (pavements, roads and carparks) or disposed offsite to landfill.

The placement of fill soils beneath buildings and hardstand surfaces will also manage the heavy metal and BaP EIL exceedances. The TRH F1 and F2 will require further assessment and management, particularly along the northern boundary, where it is suspected residual hydrocarbon contamination exists as a result of the historical use of that area for a service station.

3.4.7. Health Considerations

None of the assessed soils reported heavy metals at concentrations that would be considered a hotspot (i.e. greater than 2.5 times the relevant HIL-B guideline value or standard deviation of data set more than 50% of the investigation level). The calculated 95% UCL_{AVE} concentrations were all below the respective HIL-B guideline values. There were therefore no exceedances of the Tier 1 investigation levels for the heavy metals assessed.

There were two measured exceedances of the HSL A/B for TRH F2 (BH13 0.0-0.2m (180mg/kg) and BH14 0.2-0.4m (2298mg/kg). All other samples were below the relevant generic HSL A/B adopting sand as representative of fill soils. There was one exceedance of the generic HSL A/B for TRH F1 (BH17B 1.8-2.0m (160mg/kg)). There were also exceedances of the generic HSL A/B for Benzene also at BH17B at three depths 0.8-1.0, 1.8-2.0 and 2.2-2.3mbgs. The TRH and benzene exceedances are most likely related to residual impact of the former service station operation along the northern site boundary. The underground fuel storage tanks were located within footpath just outside the perimeter of the Site (typical for the time period of operation) along the street frontage. It was reported in the PE Phase 2 assessment report that the tanks were removed in 1999, however, there appears to be some residual contamination along the northern boundary given the depths at which the exceedances have been identified.

The vertical impact would be minimised by the presence of weathered shale and ironstone at approximately 2.5 – 2.6mbgs across the site. High-plasticity residual clay was also present from approximately 0.5m bgs to 2.3 – 2.5m bgs. As a result, any petroleum contamination could potentially migrate vertically through the clay and into shale fractures (although the shale is relatively low permeability) and horizontally along the residual clay and weathered rock. The horizontal and vertical extent of the hydrocarbon impact along the northern boundary is an unknown and given that buildings will be constructed in the section of the site it is imperative to better understand the impact within the northern end of the site and develop a strategy for remediation/management if warranted.

Carcinogenic PAH (cPAH) measured as benzo(a)pyrene TEQ (BaP_{TEQ}) were identified across the site, primarily within the upper 1.0m soil layer. This is most likely a result of residual contamination in

fill materials related to the previous site usages including a foundry and mechanical workshop. The comparison of site data to the generic screening criteria (HIL-B) for BaP_{TEQ} is summarised in Table 3-5.

Table 3-5: Tier 1 screening comparison of impact at different depths and the NEPM HIL-B criteria (including historical PE data)

Chemical of concern	Tier 1 health screening criteria (1) [mg/kg]	Depth range (2) [m]	Number of soil samples	Concentration range (3) [mg/kg]	95% UCL_{AVE} concentration [mg/kg]
cPAH as BaP_{TEQ}	4	0.0 – 1.0	55	<0.6 – 45	9.03
		>1.0	21	<0.6 – 5.7	2.6

The 95% UCL_{AVE} BaP_{TEQ} in the 0.0 – 1.0mbgs (11.0mg/kg) exceeded the generic HIL-B site assessment criteria adopted for comparison. The 95% UCL_{AVE} BaP_{TEQ} concentration in the >1.0mbgs layer was below the generic HIL-B site assessment criteria.

Given the variable distribution of the BaP_{TEQ} in the fill material, remediation was not considered to be a practical approach as the delineation of multiple impacted areas would have resulted in a greatly increased sampling and analytical burden. As such, the exceedance of the Tier 1 (generic) guidance value triggered a Tier 2 (site specific) assessment as outlined in Section 2.4, Schedule B4 of the ASC NEPM. The Tier 2 assessment was undertaken, and the results are discussed in Section 3.4.8. The Tier 2 assessment provided a site-specific evaluation of potential human health risk and the development of site-specific risk-based criteria (RBC) for comparison with the site data. The RBC have been derived considering the specific conditions of the site as well as the intended users and specific exposure scenarios. The derived Tier 2 RBC's are more realistic than the generic Tier 1 screening levels but still provide appropriate protection of human health.

3.4.8. cPAH Tier 2 Assessment

Given the indication of potentially unacceptable human health risk from comparison of results against the generic Tier 1 site assessment criteria, a site-specific human health risk assessment (HHRA) of the cPAH impact was undertaken to investigate whether a potentially unacceptable health risk may exist for the future users of the proposed senior residences.

The purpose of this HHRA was to evaluate the potential impacts to human health associated with PAH impacted soil identified at the site via the derivation of site-specific risk-based criteria (RBC) for future receptor populations based on the proposed development. The HHRA addresses the following receptor populations:

- Future residents at the retirement village.
- Future commercial workers associated with the retirement village.
- Future workers who may be involved in maintenance of the site, including grounds keepers, and undertaking subsurface works such as utilities repairs or installation.
- Workers involved in construction of the retirement village undertaking subsurface works.

The health risk assessment was conducted in accordance with the '*National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013'* (NEPC, 2013), referred to herein as the NEPM and the '*Guidelines for Assessing Human Health Risks from Environmental Hazards*' (enHealth, 2012). The provisions within the NEPM are:

- Guideline on Site-Specific Health Risk Assessment Methodology, Schedule B4; and
- Guideline on Derivation Health-Based Investigation Levels Schedule B7.

Site-specific RBC were derived for future residential users and workers at the proposed seniors' residences. The relevant RBC's are presented in Table 3-6.

Table 3-6: RBC for direct contact exposure pathways with Carcinogenic PAH in soil/dust at the proposed seniors' residences

COPC	RBC senior resident (mg/kg)	RBC Child – short stay resident (mg/kg)	RBC Groundkeepers (mg/kg)	RBC Maintenance workers (mg/kg)	RBC Construction workers (mg/kg)
cPAH, measured as BaP_{TEQ}	52	20	57	270	1,000

3.4.9. Application of Site-Specific RBC

To apply the RBC to assess the non-threshold PAHs identified in residual soil at the site, the reported concentrations of carcinogenic PAHs should be multiplied by the respective TEF and the resulting values summed for comparison with the benzo[a]pyrene (BaP_{TEQ}) RBCL. It is noted that most laboratories do this calculation and report BaP_{TEQ}. This process has been followed using the data collected for the additional assessment.

It is recommended the RBC for future residents (including short-stay children) and grounds keepers is applicable to soils at the surface to approximately 0.5 m depth as potential exposure to this soil is considered to be the most sensitive of several scenarios evaluated in this HHRA. Maintenance and construction workers may be exposed to soils at depths 0.5 m or greater therefore the RBC for maintenance workers would be the most applicable to both groups of receptors.

The assessment of potential health risks associated with PAHs identified in shallow soils at the site to 0.5 m depth required comparison of the senior resident and short-stay child resident RBCs to the reported carcinogenic PAH concentrations.

The calculated maximum and 95% UCL BaP_{TEQ} concentrations for carcinogenic PAHs in surface soils to 0.5 m depth and the derived RBC for future senior residents and short-stay child residents, are presented in Table 3-7.

Table 3-7: BaP_{TEQ} concentrations in surface soils to 0.5 m and comparison with BaP_{TEQ} RBC for future retirement village residents

Receptor	RBC [mg/kg]	Soil concentration range of **BaP_{TEQ}** 0.0 – 0.5 mbgs [mg/kg]	**95% UCL soil** concentration **BaP_{TEQ}** [mg/kg]
Retirement village resident RBC: BaP_{TEQ} (mg/kg)	**52**	<0.6 – 45 (1)	12.5
Child – short stay resident BaP_{TEQ} (mg/kg)	**20**		

1. *Two exceedances of the RBC noted*

A comparison of the RBC derived to be protective of future retirement village residents (including short stay child residents) with reported BaP_{TEQ} concentrations in soils to 0.5mbgs in the recent investigations has been undertaken. This indicates the carcinogenic PAH concentrations are below the risk-based concentration for BaP_{TEQ} in all locations with the exception of four samples: BH1_0.0-0.2 (40 mg/kg), BH17B_0.0-0.2 (23 mg/kg), BH19_0.0-0.2 (29 mg/kg) and BH21_0.0-0.2 (45 mg/kg). A comparison of the retirement village resident and short stay child residential RBC with the

calculated 95% UCL BaP_{TEQ} concentration in soils to 0.5 mbgs indicates the carcinogenic PAH concentrations are well below the risk-based concentration for BaP_{TEQ}.

Whilst four individual locations exceeded the RBC for children, the potential exposures to retirement village residents and short-stay child residents are likely to be minimal as exceedances are located at two isolated locations in the north-east corner of the site, which are potentially within private open space areas, one location in the central area of the site within the footprint of the proposed buildings and one location near the central southern site boundary in the area of the proposed hardstand driveway.

The 95% UCL concentration is a more reasonable basis for overall exposures to future residents (including short-stay children) and the potential risk to these residents is considered to be low and acceptable, based on the available data, assumptions and exposure modelling.

The assessment of potential health risks to grounds keepers, maintenance workers and construction workers, associated with PAHs identified in soils below 0.5mbgs, has been conducted based on comparison of the derived RBC for those workers.

The maximum reported concentrations for the carcinogenic PAHs, and the calculated cPAH concentration (expressed as BaP_{TEQ}) in soils below 0.5 mbgs, are presented in Table 3-8.

Table 3-8: Determination of cPAH concentrations in soils and comparison with RBC for future maintenance and construction workers

Receptor population	RBC [mg/kg as BaP_{TEQ}]	Soil concentration range of cPAH [mg/kg] > 0.5 mbgs	95% UCL soil concentration cPAH [mg/kg] > 0.5 mbgs
Grounds keeper RBC: BaP_{TEQ}	**57**	0.6 – 5.7	1.54
Maintenance RBC: BaP_{TEQ}	**270**		
Construction RBC: BaP_{TEQ}	**1,000**		

A comparison of the RBC derived to be protective of future workers with the maximum reported BaP TEQ concentration in soils >0.5 mbgs in the recent DSI investigations indicates the carcinogenic PAH concentrations are below the BaPTEQ risk-based concentration for future maintenance and grounds keeping and as well as sub-surface construction works. Potential exposures to future workers are therefore considered to be acceptable based on the assumptions on the available data, exposure assumptions and exposure modelling.

3.4.10. Conceptual Site Model

Based on this investigation and the results of the HHRA, an updated conceptual site model (CSM) has been developed.

3.4.1. Areas of environmental concern and chemicals of concern

Table 3-9: Summary of potential AECs and COCs

AEC	Potentially Contaminating Activity	COCs	Likelihood of Contamination	Comments
Entire site	Former site activities impacting quality of fill in upper 1.0m layer	cPAH, TRH F3	Medium to High	cPAH and TRH F3 contamination identified in the Site soils at variable concentrations
Northern boundary in vicinity of former petroleum tanks and service station operation	Former site activities impacting quality of fill and residual soils to depths 2.2-2.3m bgs.	TRH and Benzene	Medium to High	TRH and benzene contamination identified along the northern boundary. Extent of impact unknown. Potential to have migrated horizontally along the boundary east-west and also south, beneath site buildings.

3.4.2. Potentially affected media, receptors and transport mechanisms

Table 3-10: Summary of potentially, receptors and transport mechanisms

Consideration	Information
Potentially Affected Media	Fill material and natural residual soil
Potential Transport Mechanisms & Exposure Pathways	Direct dermal contact with contaminated soil Incidental ingestion of contaminated soil Inhalation of contaminated soil as dust Inhalation of hydrocarbon vapour (northern boundary)
Potential Receptors of Contamination	**Construction/ maintenance workers** Potential exposure via dermal contact with soil and ingestion/inhalation of soil, dust generally; and potential exposure to hydrocarbon vapours for workers in shallow trench on northern boundary. **Future Residents** Potential exposure via dermal contact, and ingestion/ inhalation of soil, dust and hydrocarbon vapours in indoor air if ground floor buildings are close to the northern boundary. **Surface Water** Potential for surface water runoff to impact Hunter River (100m North and downgradient) during site development works

3.4.3. Exposure pathways

Table 3-11: Summary of the potential receptors and pathways of contaminants

Receptor	Point of Exposure	Exposure Pathway	
		Dust Inhalation	Direct Contact
Residents	Uncovered Areas (landscaping etc.)	Negligible or Incomplete	Potentially Complete
Grounds Keepers	Surficial Soils.	Negligible or Incomplete	Potentially Complete
Construction Workers	Surface and sub-surface soils exposed during the period of construction.	Potentially Complete	Potentially Complete
Maintenance Workers	1m deep sub-surface maintenance trench.	Potentially Complete	Potentially Complete

3.4.4. Results Summary and Recommendations

The results of the generic Tier 1 assessment undertaken at the Site identified exceedances of the health-based criterion for cPAH across the proposed development area. All other potential contaminants, except for TRH and Benzene, were assessed within the respective Tier 1 assessment criteria ($95UCL_{AVE}$ concentrations compared with the relevant guideline values). TRH and BTEX were identified along the northern boundary at levels that would represent hotspot concentrations requiring further assessment and management. In order to manage these risks, the preparation of a Remediation Action Plan (RAP) is recommended. The RAP must include the delineation of the hydrocarbon contamination identified at the northern boundary, a study of remediation options, selection of a preferred remediation strategy and validation of the Site as remediated.

To address the potentially unacceptable health risk posed by cPAH in soil, a Tier 2 Human Health Risk Assessment was undertaken to derive site-specific risk-based criteria for likely future activities and receptors on the site.

The site-specific risk-based criteria (RBC) for carcinogenic PAHs in soil were derived to be protective of future exposures to the more sensitive users of the site. Based on available data, exposure assumptions and constraints of the exposure assessment model, the calculated 95% UCL concentration of carcinogenic PAHs in:

Surficial soils to 0.5 mbgs at the site are below the derived retirement village residential RBC and short-stay child resident RBC for BaP_{TEQ} and, therefore, the potential health risks to future residents (including short-stay children) at the site to residual PAH impact in soils is considered low and acceptable; and

Soils deeper than 0.5 mbgs were below the BaP_{TEQ} RBC for grounds keepers, maintenance workers and construction workers, therefore, the potential health risks to future workers is considered low and acceptable.

A Tier 1 evaluation of Total PAH concentrations (relating to the non-carcinogenic PAHs) measured across the site were below the NEPM health screening criteria. Further, the concentration of both

carcinogenic and total PAHs across the site were below the NEPM health screening criteria relevant to future commercial works on the site.

The process for deriving the RBC conservatively assumed the bioavailability of PAHs in soils was 100 percent and that all landscaped areas where potentially exposed and not covered by any surface covering that would prevent or minimise direct contact. Whilst the 95% UCL concentration of carcinogenic PAHs was below the derived RBCs, four individual locations exceeded the short-stay child residential RBC. One of these locations is in the central area of the site within the footprint of the proposed buildings and on locations is near the central southern site boundary in the area of the proposed hardstand driveway. Two isolated locations are in the north-east corner of the site, which are potentially within private open space areas.

As a precautionary measure it is recommended that the landscaping in this area includes the placement of 0.5m of clean soil and/or mulch to minimise access to the impacted soil by residents.

It is recommended all subsurface works are managed via a site specific EMP in order to mitigate potentially impacted soils being brought to the surface where cross contamination or residential exposures may occur.

Coffey considers that the site can be made suitable for the proposed development within the assumptions of the Tier 2 Risk Assessment and the comparison of the investigation data with the calculated site-specific risk-based criteria and the implementation of the following recommendations:

- A Remediation Action Plan must be prepared for the delineation assessment, remediation and validation of the hydrocarbon impact identified along the northern boundary. The RAP must focus on the delineation of the hydrocarbon contamination and must contain requirements for further assessment works and procedures to remediate identified contamination and validate the Site as remediated.
- In order to manage the identified ecological exceedances (heavy metals and TRH (including the multiple exceedances of the ESL (Urban, Residential and Public Open Space) for TRH F3), existing fill soils are to be excluded from reuse within areas identified for landscaping. The fill materials must be excavated, and residual soils exposed prior to the commencement of landscaping activities. The excavated material is suitable for reuse beneath buildings and hardstand (pavement, car parks and roadways).
- Landscaping Plans must be prepared in line with the following recommendations:
  - Existing site fill soils will not be used within proposed landscape areas. Sandy fill material to be removed from landscaping areas to expose underlying natural residual silty clay material.
  - Imported soil mix (appropriate for proposed species) to proposed planting depth. Existing sandy-fill site soil to be first removed exposing underlying natural residual silty clay material.
- Validation of the excavated site fill and confirmed exposure of residual soil must be undertaken by a suitably qualified environmental scientist prior to landscaping. As this will most likely occur after the RAP has been executed and validated, an addendum report must be prepared for inclusion in the validation report.
- The stockpile SP1 currently located on the hardstand area in the north-eastern corner may be reused on site beneath buildings and hardstand (pavement, car parks and roadways). The stockpiled material must not be reused within the landscaping areas as the TRH F3 impacts are similar to the general site fill soils. Should the stockpile SP1 require offsite disposal the classification is in line with that outlined in Section 8.3 that the soil has been assessed as **General Solid Waste (SCC1/ TCLP1) – (non-putrescible).**
- Preparation of a site-specific Environmental Management Plan (EMP) for subsurface works in order to mitigate potentially impacted soils being brought to the surface where cross contamination or residential exposures may occur.

- Preparation of an Unexpected Finds Protocol (UFP) document to guide the management of unexpected finds during development including contaminated materials and heritage items.

4. Remediation Programme

4.1. Management of Ecological Exceedances

Exceedances of the generic Ecological Investigation Levels and Ecological Screening Levels (Urban Residential and Open Space) were recorded for lead, copper, zinc, TRH F1, F2, F3 and benzo(a)pyrene (BaP). The hydrocarbon exceedances are the most significant concern from a management perspective. TRH F1 and F2 were primarily found impacting soils along the northern boundary, a location suspected to contain residual hydrocarbon impact from historical use as a service station. The TRH F3 is more widely distributed across the site with multiple exceedances identified in the upper 1.0m soil layer. The comparison of site data to the generic screening criteria (ESL Urban residential and public open space) for TRH F3 summarised in Table 4-1.

Table 4-1: Tier 1 screening comparison of impact at different depths and the NEPM ESL Urban/Residential criteria

Chemical of concern	Tier 1 ecological screening criteria (1) [mg/kg]	Depth range (2) [m]	Number of soil samples	Concentration range (3) [mg/kg]	95% UCL_{AVE} concentration [mg/kg]
TRH F3	300	0.0 – 1.0	52	<100 – 10,000	2420
		>1.0	24	<100 – 460	189

The proposed development will result in most of the Site being covered by a combination of building structures, roads and covered parking areas. The soils below these areas will be isolated and the ecological impacts related to soil quality on the site are not relevant.

The only areas exposed will be the landscaping areas. In the landscaping areas, the possibility remains that soils containing elevated TRH F3 could potentially impact invertebrate populations. In order to manage this, landscaping will not be carried out within the fill soils onsite. The fill materials within landscaping areas must be excavated exposing the residual soil. The fill material so excavated must either be placed beneath buildings and other hardstand surfaces (pavements, roads and carparks) or disposed offsite to landfill.

4.2. Remediation of TRH Impacted Soils

Coffey has compared the sample analysis results of the historical data and more recent additional assessment data against the Health Investigation Level (HIL) B and Health Screening Level (HSL) A/B site assessment criteria (SAC). A TRH impacted area was identified along the northern boundary in locations near former petroleum UST's which have been previously removed. TRH F1 exceedances were identified at BH17, TRH F2 exceedances at BH9 and BH14 (Figure 1, Appendices). Management limits were exceeded at BH8, BH9, BH13 and BH14. It is recommended that the impact along the northern boundary is delineated (to define the extent of impact) (Figure 4-1), the impacted area remediated and validated to achieve a 95% UCL_{AVE} across the site that is below the HSL A/B site assessment criteria for TRH. A more detailed map of the proposed sampling locations has been provided in Figure 1, Appendices.

Figure 4-1: TRH Delineation Area along the Northern Boundary

4.3. Remedial goals

The broad remediation goals, with respect to contamination, are to identify management measures that would ensure the site is suitable for future Residential B land use.

4.3.1. Remediation hierarchy

The ASC NEPM 1999 (2013) provides a preferred hierarchy of options for site clean-up and/or management which is outlined as follows:

- If practicable, on-site treatment for the contamination so that it is destroyed, and the concentrations are reduced to below the adopted site clean-up criteria; or
- Offsite treatment of excavated soil, so that the contamination is destroyed, or the associated risk is reduced to an acceptable level.

If the above is not practicable:

- Consolidation and isolation of the soil on site by containment within a properly designed barrier; or
- Removal of contaminated material to an approved 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.

4.3.2. Remediation Options Assessment

A summary of potential options for remediation of the identified impacts is presented in Table 4-2.

Table 4-2: Remediation Options Assessment

Contamination Type	Comment	Remedial Options	Advantages	Disadvantages
Hydrocarbon Impact (Northern Boundary)	A TRH impacted area was identified along the northern boundary in locations near former petroleum UST's which have been previously removed.	• Delineation of the impact along the northern boundary to define the extent of impact • Remediation and Validation of the impacted area to achieve a 95% UCL_{AVE} across the site that is below the HSL A/B site assessment criteria for TRH. • Disposal Offsite to a Licenced Facility.	• Full assessment of the legacy contamination along the northern boundary • Removal of impacted material will remove on-going liability for contamination source • No long-term environmental management required	• Potential disposal cost of impacted material as the volume is currently unknown.
Heavy Metal and Long Chain Hydrocarbon (TRH F3) Impact in Landscaping Soils	Exceedances of the generic Ecological Investigation Levels and Ecological Screening Levels (Urban Residential and Open Space) were recorded for lead, copper, zinc, TRH F1, F2, F3 and benzo(a)pyrene (BaP). The hydrocarbon exceedances (TRH F3 in particular) are the most significant concern from a management perspective.	• Carcinogenic PAH measured as BaP_{TEQ} was subjected to a Tier 2 human health risk assessment and the site-specific guideline values calculated. The 95% UCL_{AVE} concentration of the BaP_{TEQ} was compared to the site-specific concentrations and the site was found to be within the guideline values for BaPTEQ.	• No remediation required as the spite-specific Tier 2 guideline values were not exceeded	
		• Excavate and dispose to landfill	• Eliminate the problem, removing legacy concerns	• High disposal cost as the site is generally impacted by TRH F3
		• Onsite Retention and Management	• Allows for the placement and isolation of impacted material below building slabs and hardstand areas including carparks etc. • Elimination of cost associated with offsite disposal	• Preparation of a Long-Term Environmental Management Plan is required to guide future excavations at the site and management of disturbed fill.

4.3.3. Preferred remedial strategy

Based on the proposed development and given the unknowns regarding the complete extent of the TRH impact along the northern boundary, the preferred remedial strategy is to delineate the extent on site of TRH contamination both vertically and horizontally, within an area bounded by BH15 and BH20 (Figure 4-1) followed by removal of unacceptable impacted material and validation of the excavated areas. Impacted material will be waste classified and removed offsite to a licenced disposal facility.

Backfilling of the excavation following remediation is not intended, as the area will most likely be reconfigured during the site development works, which are expected to immediately follow the remedial works. Should there be a delay in the works programme then imported material may be required to backfill the excavations to control subsidence around the excavation.

The steps to be followed are discussed in detail in Section 4.3.4.

4.3.4. Proposed remediation activities

The steps involved with the remediation of the site include:

- Delineation of the TRH impacted soils between BH15 and BH20 to define the extent of unacceptable impact and the volume of material impacted.
- Delineation will be undertaken at a sampling density calculated to identify a hotspot with a diameter of 3.7m with 95% confidence. The relevant number of samples (20) was calculated using Procedure A in the NSW EPA Sampling Design Guidelines 1995 (Sampling Guidelines).
- Removal of unacceptable impacted material.
- Removal of fill materials from proposed landscaping areas and visual confirmation (validation) of natural residual materials.
- Waste classification of the TRH impacted material followed by offsite disposal to landfill.
- Following removal of soils, a suitably qualified and trained environmental scientist will collect soil samples from the excavations for validation purposes (northern boundary only). This will be carried out as outlined in Section 4.3.5.

4.3.5. Delineation, excavation and removal of TRH impacted soils

The delineation works are outlined below:

- The contaminant impacts along the northern boundary (between BH15 and BH20) are to be delineated;
- The delineation sampling is to be carried out by a suitably qualified environmental consultant;
- Twenty (20) delineation samples will be collected from a 200m^2 area surrounding the impacted boreholes, with the extents bound by the closet boreholes to the east and west with no TRH impacts. The area will be divided into a 3.16m square grid;
- Delineation samples are to be taken from both the surface soils (0 – 0.2m) and at 0.5m intervals to 3.0m bgs;
- Samples will be headspace screened using a PID and the readings recorded;
- Each sample will be placed into a laboratory-supplied container and kept in ice-chilled eskies following collection;
- Delineation samples will be collected using a mobile tracked drill (split tube sampler);

- A clean pair of disposable nitrile gloves is to be worn when collecting each sample and the sampling tool will be cleaned after each sample;
- Sample locations are to be recorded with a hand-held GPS; and
- The delineation samples are to be dispatched to a NATA-accredited laboratory for TRH analysis. A field duplicate sample and field triplicate sample will also be collected and analysed at a rate of 1 pair of QC samples per 20 primary samples to assess field quality control procedures. An equipment rinsate sample will also be collected for each sampling day and analysed to assess field decontamination procedures.

Once the extent of TRH impact is assessed, the following works are to be carried out:

- The TRH impacted soils will be excavated and stockpiled on an impervious surface;
- The impacted material will be waste classified in accordance with the *NSW EPA Waste Classification Guidelines (2014)*. Contaminants of Potential Concern (COPC) will include, TRH, BTEH, PAH and Heavy Metals;
- The number of samples will be assessed based on the volume of the excavated stockpile in line with the guidance included in Section 4.5.3;
- A waste classification certificate will be prepared for the soils to be disposed offsite. The certificate will be prepared for the material using data collected from the delineation samples;
- The excavated soil is to be disposed offsite to the nearest licensed landfill by a suitably qualified contractor;
- Following removal of TRH impacted soil, validation soil sampling will be carried out by the environmental consultant in accordance with Section 4.4; and
- The results of the validation sampling are to be detailed and presented in a site validation report.

4.4. Remediation of TRH F3 Impacted Landscaping Areas

Areas proposed to be landscaped according to an approved Landscaping Plan must have all native fill materials excavated and removed. The fill materials will be excavated from the proposed landscaping areas until natural residual materials are confirmed visually by a suitably qualified person. Following the removal of the fill materials and visual confirmation of the presence of residual materials the area must be backfilled with a suitable landscaping mix. Visual confirmation of the validated areas including photographs must be included in the final site validation report. The landscaping areas must also be confirmed by survey for inclusion in the long-term environmental management plan.

4.5. Validation programme

Validation soil sampling will be undertaken as per the *NSW EPA Technical Note: Investigation of Service Station Sites (2014)* to confirm that impacted material has been removed. The validation sampling process is applicable only to the TRH impacted area along the northern boundary and is discussed in the sections below.

4.5.1. TRH Health Screening Levels

The current zoning is RU1 Residential and the development as proposed falls in line with the criteria. For the purposes of this report, health screening levels for Residential B use have been provided.

4.5.2. Health Screening Levels HSL

The HSL values from the NEPM ASC (2013) for the applicable land use (Residential B) for the site at different levels beneath a building are listed in Table 4-3.

Table 4-3: Summary of Health Screening Levels in Soil (HSL A/B)

Chemical	HSL A & B		
	0m to <1m (Sand)	1m to <2m (Clay)	2m to <4m (Clay)
Benzene	0.5	1	2
Toluene	160	NL	NL
Ethylbenzene	55	NL	NL
Xylenes	40	310	NL
Naphthalene	3	NL	NL
F1 (TRH C_6-C_{10} – BTEX)	45	90	150
F2 (TRH > C_{10}-C_{16} – Naphthalene)	110	NL	NL

4.5.3. Site validation methodology

In order to assess the effectiveness of the remediation works and assess the suitability of the site for future Residential B land use, validation of the site will be undertaken. This section summarises the scope of works for the validation programme.

Soil validation strategy

Validation soil sampling will be completed in accordance with the following guidelines:

- Australian Standard AS 4482.1 (1997) Guide to the Sampling and Investigation of Potentially Contaminated Sites;
- Coffey Environments Standard Operating Procedure for Soil Sample Collection; and
- ASC NEPM 1999 (2013), Schedule B2, Site Characterisation.

Following completion of the excavation works, a suitably qualified environmental scientist will collect a minimum of one sample per 25 square metres at the base of the remediated excavation.

Samples will be analysed for TRH as applicable. Where several validation samples or excavations continually fail the Investigation Levels, other validation technique (e.g. by use of statistics, etc.) may be undertaken. Alternatively, other remediation and/or management strategy can be adopted.

Where there may be uncertainty about waste classification or unexpected conditions are encountered during excavation, the material should be stockpiled on plastic sheeting or paved surface to minimise impact. Sampling to confirm waste classification should be undertaken as per the guidance included in Table 2, EPA Victoria Industrial Waste Resources Guidelines 2009 (IWRG702 – June 2009) for stockpile samples as reproduced in Table 4-4.

Table 4-4: Minimum Number of Samples for Stockpiles 200m^3 or less

Soil Volume m^3	No of Samples
up to 25	3
50	3
75	3
100	4
125	5
150	6
175	7
200	8
>200	1:25

For sample volumes > 200m^3 a sampling rate reduction can be applied subject to a comparison of the 95% UCL_{AVE} of the soil (IWRG702, 2009). The applicable sampling rate is dependent on the heterogeneity of the material being assessed. The sampling rates applicable to generally homogeneous material in excess of 200m^3 is included in Table 4-5.

Table 4-5: Minimum number of samples for soil volumes greater than 200m^3 (1:25 or 95%UCL)

Soil Volume m^3	No of Samples at 1:25m3	Minimum Number of Samples 95%$UCL_{average}$
300	12	10
400	16	10
500	20	10
600	24	10
700	28	10
800	32	10
900	36	10
1000	40	10
1500	60	10
2000	80	10
2500	100	10
3000	120	12 (1:250)
4000	160	16 (1:250)
4500	180	18 (1:250)
5000	200	20 (1:250)
>5000	1:25	1:250

The following steps will be undertaken in order to obtain representative validation samples for laboratory analysis:

- Samples will be collected from the remediated areas directly by hand or by using hand tools (stainless steel hand augers or shovels or trowels);

- Soil samples will be headspace screened for presence of volatile hydrocarbons using a PID;
- Samples will be placed into laboratory-supplied glass jars;
- Hand tools used during sample collection will be decontaminated between samples by rinsing with phosphate-free detergent and potable water;
- A clean pair of disposable nitrile gloves will be worn when handling samples;
- Samples will be placed into secure chilled containers after collection; and
- Samples will be submitted to a NATA-accredited laboratory under chain of custody conditions.

4.5.4. Quality assurance / quality control

DQIs for the project will be based on the field and laboratory considerations in NEPM Schedule B2 Appendix B, (NEPC, 2013). These comprise:

- Completeness – a measure of the amount of useable data (expressed as %) from a data collection activity;
- Comparability – the confidence (expressed qualitatively) that data may be equivalent for each sampling and analytical event;
- Representativeness – the confidence (expressed qualitatively) that data are representative of each media present on the site;
- Precision – a quantitative measure of the variability (or reproducibility) of data; and
- Accuracy – a quantitative measure of the closeness of reported data to the true value.

Laboratory analyses will be undertaken in laboratories which are NATA accredited for the analyses undertaken. The following laboratory QA/QC analyses will be undertaken:

- Laboratory duplicates – at least one per batch
- Matrix spike – at least one per batch or approximately at 5% of analyses
- Laboratory blank – at least one per batch or approximately at 5% of analyses
- Laboratory control samples – at least one per batch or approximately at 5% of analyses
- Surrogates – for relevant analytes

Specific indicators for field and laboratory QC samples are shown in Table 4-6.

Table 4-6: Data Quality Indicators for Analytical Results

Type of Quality Control Sample	Control Limit
Duplicate Samples	Relative Percentage Difference (RPD) within 50% for soil
Triplicate Samples	RPD within 50% for soil
Spikes	Recoveries within the following ranges • 70% - 130% for inorganics / metals • 60% - 140% for organics • or as specified in laboratory's quality plan
Blanks	Analytes not detected

4.5.5. Validation of TRH F3 Impacted Landscaping Areas

Following the removal of the fill materials and visual confirmation of the presence of residual materials the area must be backfilled with a suitable landscaping mix. Visual confirmation of the validated areas including photographs showing the residual material must be included in the final site validation report. The landscaping areas must also be confirmed by survey for inclusion in the long-term environmental management plan.

4.6. Imported Fill Requirements

Imported material should be assessed prior to importation and **must** meet one of the following material types:

- Virgin Excavated Natural Material (VENM);
- Suitable exempt material (such as ENM). This material will be assessed in accordance with NSW EPA **Invalid source specified.** The Excavated Natural Material Order 2014 and NSW EPA **Invalid source specified.** The Excavated Natural Material Exemption 2014;
- Other materials approved by NSW EPA resource recovery orders or resource recovery exemptions determined to be suitable for importation; or
- Some commercial material or quarry product may be used (e.g. road aggregate, re-cycled building materials, topsoil, mulch, etc.) with prior approval from a suitably qualified environmental consultant.

Material being imported to the site shall also be tracked and the following information shall also be recorded:

- Truck and/or bin registration number;
- Origin of material;
- Material type;
- Approximate volume;
- Relevant classification document;
- Proposed use onsite;
- Proposed location for use; and
- Observations of material and confirmation it matches approved material.

4.6.1. Reporting

Site validation report

A site validation report must be prepared, following the soil remediation works, summarising the results of the soil remediation and validation of the site. The report must be written in accordance with relevant sections of the NSW EPA *Guidelines for Consultants Reporting on contaminated land: Contaminated land guidelines (2020)*. The validation report must provide a statement as to the suitability of the site for the proposed land use.

The validation report must also include evidence of the disposal of material removed from the site (e.g. waste disposal dockets).

5. Site management during Remediation

The management strategies for environmental issues that may arise during site works are discussed in the sections below. These strategies are considered a minimum requirement to be followed by the remediation contractor before and during remediation activities. It is envisaged that the remediation contractor will develop site specific environmental work plans for soil removal.

5.1. Air emissions

As TRH F1 and TRH F2 are the primary COCs, the likelihood of volatile contamination being present on the site exists. As such, vapours are considered likely to be generated during remedial works. The site boundaries will be monitored for the presence of noxious odours and PID and LEL monitoring will be undertaken during the excavation works. If vapour levels become a potential nuisance to neighbours, stockpiles will require specific management to minimise the impact of noxious emissions and nuisance odours. Management options include the use of plastic or geotextile covering and/or the use of vapour reducing foam.

5.2. Dust

The remediation works will involve excavation of the subsurface, movement of soils, and general vehicular movements across the site. As such, dust generation is considered a potential environmental impact to the surrounding environment and the public.

The following management measures should be implemented to prevent dust impacts.

- A communications and complaints register should be kept on site to ensure that concerns of local residents and workers are recorded and addressed.
- Boundary fences should be maintained around the perimeter of the site to prevent dust from migrating laterally from these areas.
- Excavated soils should be watered as required to minimise the potential for dust generation.
- If dust migration from excavation areas is observed to go beyond a site boundary due to high winds, the works should be delayed or limited during these periods.
- Trucks removing material from the site should have loads covered.
- Vehicular movements entering and exiting the site should be kept to a minimum.
- Works should be reduced during times of high winds.

Stockpile Areas

Based on the proposed remedial strategy, stockpiling of soils is considered likely. The following procedures are to be followed:

- Stockpiles should be regularly watered to minimise dust generation.
- Stockpiles should be covered with high-density polyethylene (HDPE) sheeting or equivalent, after being created in order to minimise the potential for dust generation and generation of runoff.
- Stockpile heights should not exceed the heights of the boundary fences.

5.3. Noise controls

Noise will be generated during site works and is considered a potential environmental issue. The noise that will be generated is anticipated to be mainly derived from earthworks activities. It is anticipated that the level of noise generated will not exceed that of a typical construction site.

Noise limitations imposed by Council are to be adhered to. This may include restrictions on working days and hours, and acceptable noise levels.

A noise monitoring programme may be required if noise cannot be easily managed. This may include noise surveys at the source and at surrounding properties.

5.4. Working hours

Working hours would need to be consistent with Council requirements. These are usually 7am to 6pm Monday to Friday and 8am to 1pm on Saturdays, with no activity on Sundays and public holidays.

5.5. Site access restrictions

During the delineation, remediation and validation works it will be necessary to restrict site access solely to authorised staff and contractors who have appropriate levels of personal protective equipment and hazard awareness.

Temporary site fencing and appropriate signage is to be maintained, and unauthorised personnel should not be able to access the site unintentionally.

6. Occupational health and safety

6.1. Health and safety plans

Prior to the commencement of site works, Coffey will prepare a Health, Safety, Security and Environmental (HSSE) Plan. The HSSE Plan will include the following information:

- Likely hazards and control measures;
- Emergency assembly areas;
- Emergency contact numbers;
- Site security procedures;
- First aid wardens on the site; and
- Procedures for the safe handling of chemicals and contaminated soil and groundwater.

The HSSE Plan should be reviewed when new tasks are undertaken. The HSSE Plan should be updated as required to cover the tasks undertaken.

In addition, subcontractors engaged by Coffey should prepare Safe Work Method Statements (SWMS) for their activities. The SWMS should contain the following information:

- The steps of the activity to be performed;
- Hazards and perceived risks for each step of the activity;
- Control measures to be adopted to eliminate or minimise the hazards; and'
- The persons responsible for implementing control measures.

7. Licenses and approvals

7.1. Licenses and approvals

The remediation works are classified as Category 2 as per Clause 16 of SEPP 55 with a requirement of 30 days' notice to Council prior to commencement of the works. Council may impose site-specific conditions on remediation works.

The volume of material being removed from the site should be documented by the client and/or the remediation contractor, supported by material tracking sheets and waste disposal dockets if available.

8. Unexpected Finds Protocol

8.1. Purpose

This procedure outlines a methodology for consistent response and management of unexpected finds during proposed enabling, early and development works. This procedure considers heritage obligations under the Heritage Act 1977 (NSW), National Park and Wildlife Act 1974 (NSW), Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Cth) and the Coroners Act 2009 (NSW).

8.2. Scope

This procedure applies to all contractors and sub-contractors conducting excavation works at the Site or in support of works being conducted. These include bulk earthworks activities, the installation of service trenches and stormwater drains. This procedure is also applicable for unexpected heritage finds as unexpected heritage items may be unearthed during excavation works.

8.3. Applicable Legislation and Procedures

- Heritage Act 1977 (NSW);
- National Parks and Wildlife Act 1974 (NSW);
- Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Cth);
- Coroner's Act 2009 (NSW); and
- Unexpected Archaeological Finds 2012 (RMS).

8.4. Types of Unexpected Finds

For this procedure an 'Unexpected find' is defined as any unanticipated potential contamination or archaeological material not identified during previous assessments. An unexpected find may include:

- Contaminated materials;
- Buried infrastructure (e.g. underground storage tanks, pipes, footings);
- LNAPL/DNAPL contamination;
- Asbestos;
- Potential acid sulphate soils;
- Aboriginal and Non-Aboriginal Heritage artefacts; and
- Human skeletal remains.

8.5. General Initial Response

If during enabling, early or development works, there is any unexpected find the following applies;

- Cease Work Immediately and notify the Site Supervisor;
- Identification and classification of the find (Aboriginal/European Heritage, buried infrastructure, possible ACM, Contaminants);
- Evacuate and Isolate the area;

- Provide PPE to workers as required (for contaminated material including Underground Storage Tanks (UST's, pipes, asbestos containing material (ACM);
- Photograph the find and mark the identified location using a GPS;
- Install temporary fencing and signage;
- Notify the GHT HSE Representative;
- Toolbox to all site staff; and
- Notify GHT and engage specialist consultants as required.

8.6. Management of Asbestos

Asbestos places worker health at risk when elevated levels of asbestos fibres are breathed into the lungs. The Safework NSW guideline for Managing Asbestos in or On Soil, 2014 states the following regarding asbestos exposure:

"The likelihood of exposure occurring depends upon the potential for the asbestos material to release fibres, whether the asbestos material is contained or covered, and any operational control measures or personal protective equipment which have been applied to limit the generation and/or inhalation of airborne fibres.

Non-friable asbestos, previously referred to as 'bonded asbestos', in sound condition represents a low human health risk. However, friable asbestos materials or damaged, crumbling bonded asbestos, have the potential to generate, or be associated with, free asbestos fibres and therefore must be carefully managed to minimise the release of asbestos fibres into the air."

If in situ soil (surface/fill) or stockpiled material is suspected to contain asbestos, the Site Supervisor should be informed immediately. It should be assumed that the soil is asbestos impacted and work immediately ceased. A suitably qualified environmental consultant or licensed asbestos assessor should be contacted to sample the material for confirmation of asbestos presence and type (friable or bonded).

If confirmed, the Site Supervisor must ensure the implementation of asbestos control measures including but not limited to:

- Identifying contaminant boundaries as determined by an independent licensed asbestos assessor or suitably qualified environmental consultant;
- Minimize disturbance to in situ soils or stockpiles containing potential ACM until the asbestos management procedures have been implemented;
- Isolating, securing and clearly identifying the area of potential ACM impact site using signs and barriers;
- Application of dust reduction/control measures such as spraying of water and application of wetting agents;
- Providing workers with appropriate personal protection equipment (PPE) based on the suspected level of contamination and the control measures implemented;
- Sampling of the suspected contaminated materials and/or air monitoring; and
- Provide a site toolbox talk focused on the provision of information to workers on hazards and safe work practices to minimise airborne dust exposure.

A licensed asbestos assessor should be engaged, and a comprehensive assessment conducted as required. If asbestos is confirmed, any impacted material must be removed by a licensed asbestos removalist and a clearance certificate obtained from a licensed asbestos assessor.

8.7. Skeletal Remains

During the progression of excavation works bones (human and animal) may be unexpectedly exhumed. If the bones are clearly human in origin, work will cease, access will be prevented to the immediate area by installing barriers and contact the local police immediately. The police may take control of the site for investigative purposes. The bones are not to be touched or disturbed. The coroner will assess the bones to determine if they are under 100 years old. If the bones are assessed to be over 100 years old they are managed, human or otherwise, as heritage items.

If the origin of the bones cannot be immediately identified as human, a suitably qualified Archaeologist or Anthropologist should be engaged to undertake an assessment of origin. Approval from the coroner, police, Aboriginal groups, Office of Heritage, Anthropologist or the client may be required before bones can be removed.

8.8. Contaminated Materials

In the event suspected contaminated materials (UST's, footings, pipes, flowing free phase hydrocarbons, oily wastes odorous or suspicious looking soils etc.) are discovered, steps must be taken to assess the materials and minimize potential impact on the environment. Upon discovering the items work will cease and an assessment of immediate risks carried out by the Site Supervisor and Project Manager. Following the initial assessment, a suitably qualified environmental consultant will be engaged to assess the short and long-term risks to human health and the environment and provide options for mitigation, management and/or and disposal. Contaminated materials must be disposed at a licensed facility under an appropriate waste classification in accordance with the NSW EPA Waste Classification Guidelines (2014).

8.9. Potential Acid Sulphate Soils (PASS)

Based on the proposed depth of remedial works and the geology of the site, PASS materials are not expected to be encountered during excavation.

9. References

Coffey (2021) Additional Site Contamination Investigation - 107 - 117 Swan Street, Morpeth NSW

Coffey (2020) Site Contamination Data Review and SAQP for further Assessments – DA17-515 – 107-117 Swan Street, Morpeth NSW

National Occupational Health and Safety Commission (2005) Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres 2nd Edition, 3003 - 2005.

NEPC (2013) *National Environmental Protection (Assessment of Site Contamination)* Measure 1999, as amended in 2013, National Environment Protection Council.

NSW EPA (1995) *Sampling Design Guidelines*

NSW EPA (2014) *Technical Note: Investigation of Service Station Sites*

NSW EPA (2020) *Consultants Reporting on Contaminated Land: Contaminated Land Guidelines*

NSW Workcover (2013) Managing Asbestos in or on Soil.

Pacific Environmental (2019) Phase Two Soil Contamination Assessment (Revision 2), 107-117 Swan Street, Morpeth, NSW.

Safe Work Australia (2011) Code of Practice: How to Manage and Control Asbestos in the Workplace.

Safe Work Australia (2011) Code of Practice: How to Safely Remove Asbestos.

Standards Australia (1999) AS4482.2 Guide to the investigation and sampling of sites with potentially contaminated soil Part 2: Volatile Substances.

Standards Australia (2005) AS4482.1 Guide to the investigation and sampling of sites with potentially contaminated soil Part 1: Non-volatile and semi-volatile compounds.

Important information about your **Coffey** Environmental Report

Introduction

This report has been prepared by Coffey for you, as Coffey's client, in accordance with our agreed purpose, scope, schedule and budget.

The report has been prepared using accepted procedures and practices of the consulting profession at the time it was prepared, and the opinions, recommendations and conclusions set out in the report are made in accordance with generally accepted principles and practices of that profession.

The report is based on information gained from environmental conditions (including assessment of some or all of soil, groundwater, vapour and surface water) and supplemented by reported data of the local area and professional experience. Assessment has been scoped with consideration to industry standards, regulations, guidelines and your specific requirements, including budget and timing. The characterisation of site conditions is an interpretation of information collected during assessment, in accordance with industry practice,

This interpretation is not a complete description of all material on or in the vicinity of the site, due to the inherent variation in spatial and temporal patterns of contaminant presence and impact in the natural environment. Coffey may have also relied on data and other information provided by you and other qualified individuals in preparing this report. Coffey has not verified the accuracy or completeness of such data or information except as otherwise stated in the report. For these reasons the report must be regarded as interpretative, in accordance with industry standards and practice, rather than being a definitive record.

Your report has been written for a specific purpose

Your report has been developed for a specific purpose as agreed by us and applies only to the site or area investigated. Unless otherwise stated in the report, this report cannot be applied to an adjacent site or area, nor can it be used when the nature of the specific purpose changes from that which we agreed.

For each purpose, a tailored approach to the assessment of potential soil and groundwater contamination is required. In most cases, a key objective is to identify, and if possible quantify, risks that both recognised and potential contamination pose in the context of the agreed purpose. Such risks may be financial (for example, clean up costs or constraints on site use) and/or physical (for example, potential health risks to users of the site or the general public).

Limitations of the Report

The work was conducted, and the report has been prepared, in response to an agreed purpose and scope, within time and budgetary constraints, and in reliance on certain data and information made available to Coffey.

The analyses, evaluations, opinions and conclusions presented in this report are based on that purpose and scope, requirements, data or information, and they could change if such requirements or data are inaccurate or incomplete.

This report is valid as of the date of preparation. The condition of the site (including subsurface conditions) and extent or nature of contamination or other environmental hazards can change over time, as a result of either natural processes or human influence. Coffey should be kept appraised of any such events and should be consulted for further investigations if any changes are noted, particularly during construction activities where excavations often reveal subsurface conditions.

In addition, advancements in professional practice regarding contaminated land and changes in applicable statues and/or guidelines may affect the validity of this report. Consequently, the currency of conclusions and recommendations in this report should be verified if you propose to use this report more than 6 months after its date of issue.

The report does not include the evaluation or assessment of potential geotechnical engineering constraints of the site.

Interpretation of factual data

Environmental site assessments identify actual conditions only at those points where samples are taken and on the date collected. Data derived from indirect field measurements, and sometimes other reports on the site, are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact with respect to the report purpose and recommended actions.

Variations in soil and groundwater conditions may occur between test or sample locations and actual conditions may differ from those inferred to exist. No environmental assessment program, no matter how comprehensive, can reveal all subsurface details and anomalies. Similarly, no professional, no matter how well qualified, can reveal what is hidden by earth, rock or changed through time.

The actual interface between different materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but

steps can be taken to reduce the impact of unexpected conditions.

For this reason, parties involved with land acquisition, management and/or redevelopment should retain the services of a suitably qualified and experienced environmental consultant through the development and use of the site to identify variances, conduct additional tests if required, and recommend solutions to unexpected conditions or other unrecognised features encountered on site. Coffey would be pleased to assist with any investigation or advice in such circumstances.

Recommendations in this report

This report assumes, in accordance with industry practice, that the site conditions recognised through discrete sampling are representative of actual conditions throughout the investigation area. Recommendations are based on the resulting interpretation.

Should further data be obtained that differs from the data on which the report recommendations are based (such as through excavation or other additional assessment), then the recommendations would need to be reviewed and may need to be revised.

Report for benefit of client

Unless otherwise agreed between us, the report has been prepared for your benefit and no other party. Other parties should not rely upon the report or the accuracy or completeness of any recommendation and should make their own enquiries and obtain independent advice in relation to such matters.

Coffey assumes no responsibility and will not be liable to any other person or organisation for, or in relation to, any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report.

To avoid misuse of the information presented in your report, we recommend that Coffey be consulted before the report is provided to another party who may not be familiar with the background and the purpose of the report. In particular, an environmental disclosure report for a property vendor may not be suitable for satisfying the needs of that property's purchaser. This report should not be applied for any purpose other than that stated in the report.

Interpretation by other professionals

Costly problems can occur when other professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, a suitably qualified and experienced environmental consultant should be retained to explain the implications of the report to other professionals referring to the report and then review plans and specifications produced to see how other professionals have incorporated the report findings.

Given Coffey prepared the report and has familiarity with the site, Coffey is well placed to provide such assistance. If another party is engaged to interpret the recommendations of the report, there is a risk that the contents of the report may be misinterpreted and Coffey disowns any responsibility for such misinterpretation.

Data should not be separated from the report

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, laboratory data, drawings, etc. are customarily included in our reports and are developed by scientists or engineers based on their interpretation of field logs, field testing and laboratory evaluation of samples. This information should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

This report should be reproduced in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties.

Responsibility

Environmental reporting relies on interpretation of factual information using professional judgement and opinion and has a level of uncertainty attached to it, which is much less exact than other design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. As noted earlier, the recommendations and findings set out in this report should only be regarded as interpretive and should not be taken as accurate and complete information about all environmental media at all depths and locations across the site.

Appendix A - Figures

revision no.	description	drawn	approved	date
A	ORIGINAL ISSUE			

MAP PROJECTION: GDA2020 MGA ZONE 56

2.5 0 5 10

Scale (metres) 1:250

drawn	SR / AW
approved	PW
date	15/09/2020
scale	AS SHOWN
original size	A3

coffey
A TETRA TECH COMPANY

client: GHT HOLDINGS PTY LTD

project: REMEDIATION ACTION PLAN
107-117 SWAN STREET, MORPETH, NSW

title: BOREHOLE LOCATION PLAN

project no: 754-NTLEN271167-R03 | figure no: FIGURE 1 | rev: A

PLOT DATE: 15/09/2020 10:23:24 AM DWG FILE: F:\1. PROJECTS\1. SYDENEN\VOTHER OFFICES\NTL-ENNTLEN271167\CAD\754-NTLEN271167-R03.DWG

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