ACID SULFATE SOILS MANAGEMENT PLAN

237 WHARF ROAD, NEWCASTLE, NSW

Prepared for TAMBA PTY LTD

Prepared by RCA AUSTRALIA

RCA ref 16019-201/1

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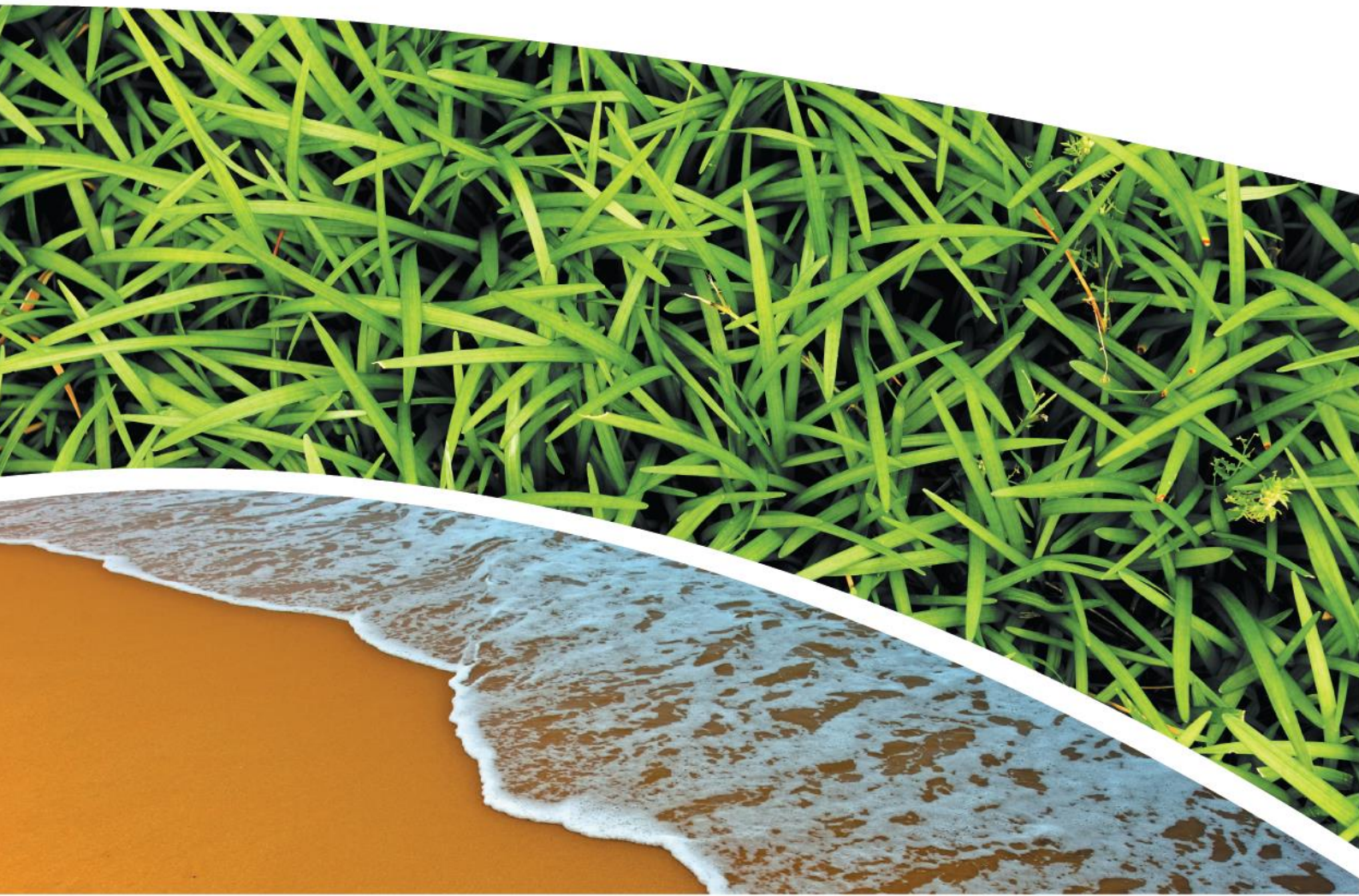
GEOTECHNICAL • ENVIRONMENTAL



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RCA ref 16019-201/1

20 June 2023

Tamba Pty Ltd
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Attention: Mr Brock Hall

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ACID SULFATE SOILS MANAGEMENT PLAN
237 WHARF ROAD
NEWCASTLE, NSW

1 INTRODUCTION

This report presents an Acid Sulfate Soils Management Plan (ASSMP) to be implemented at 237 Wharf Road, herein referred to as the site. The existing building will be demolished and a multistorey residential complex will be constructed. The proposed development includes a basement carpark and excavated soil will require removal from site.

The purpose of this ASSMP is to manage and mitigate risks to the environment from ASS during the proposed works. The objective of this ASSMP is to provide guidelines for the builder to identify ASS, neutralise ASS and characterise soils for re-use or waste disposal. This management plan has been prepared in accordance with the relevant guidelines (Ref [1, 2]).

This management plan has been undertaken at the request of Phil Duncan of Tamba Pty Ltd.

1.1 SCOPE OF WORK

The scope of work for this ASSMP was as follows:

- Outline the sampling requirements for the characterisation of the acid sulfate nature of the site soils.
- Consider the potential impacts to and from the ASS as part of the proposed development.
- Outline the management measures to be implemented during construction.

- Identify the verification requirements to assess the suitability of soil for use based on ASS properties.

2 SITE IDENTIFICATION AND DESCRIPTION

The site is identified as 237 Wharf Road, Newcastle NSW, Lot 1 DP747803 and Lot 102 DP736173.

The site currently comprises a three (3) storey commercial complex with a sub-level carpark over the majority of the site area. The periphery of the site is landscaped with native and exotic trees, mulch and some groundcover vegetation. The surface elevation is presently at approximately 2 – 4mAHD[1] with the floor of the carpark at 1.35mAHD.

Additional site details are shown in **Table 1**. **Drawing 1**, **Appendix A** shows the locality and the layout of the site.

Table 1 *Site Details*

Current zoning (Ref [3])	B4: Mixed Use. It is noted that the LEP has implemented new terminology such that mixed use is referred to as MU1[2].
Size of site	Approximately 2,300m^2.
Land use to the: North	Wharf Road and passive recreational foreshore adjacent Hunter River.
South	Former heavy railway corridor, light rail route and Hunter/Scott Street.
East	Carpark and further passive recreational land.
West	Commercial land use and further medium / high density residential land use.
Nearest sensitive receptor (human health)	Medium / high density residential approximately 60m to the south (across rail and Scott Street) and approximately 70m to the west.
Nearest sensitive receptor (environmental)	Hunter River approximately 40m to the north.

2.1 PROPOSED DEVELOPMENT

The proposed development comprises a basement carpark at approximately 0.4m Australian Height Datum (AHD) with six (6) residential storeys above with a total height of 20m above the surface. An in-ground pool will be situated on the 'podium level' approximately two (2) metres above the adjacent street level.

The development will require:

[2] [1]The zoning maps and LEP don't currently match and RCA are awaiting clarification.

- Demolition of the existing structure. Excavation of soils to approximately 1m below the carpark floor.
    - RCA have estimated a quantity of 1,804 m^3 (1,804tonne).
- Construction of the residential development.

The outline of the proposed development is presented on **Drawing 2**, **Appendix A**.

3 SITE CONDITIONS

3.1 GEOLOGY, SOIL LANDSCAPES AND ACID SULFATE SOILS MAPPING

The 1:100,000 Newcastle-Hunter Area Coastal Quaternary Geology sheet indicates that the site is situated on modern fill on top of Quaternary deposits, comprising[3] gravel, sand, silt, clay and 'Waterloo Rock'.

The Newcastle soil landscape map indicates that the site is within the Hamilton soil landscape, comprising deep, well-drained weak podzols, with some deep, well drained brown podzolic soils on fans[4]; the majority of the site is a 'recently' incised channel which has been excavated by human activity.

Estuarine sediments of coastal NSW from the Holocene geological age contain iron pyrite, the main constituent of ASS. Holocene sediments are found below 0m Australian Height Datum (AHD) and up to 5m AHD typically in coastal and floodplain areas. The sediments can be divided into classes based on their oxidised state. If the pyritic material above the water table is being oxidised and has a pH <4 it is called an actual ASS. Generally, if pyritic material is below the water table and has not been oxidised, it is termed a potential ASS and generally has a pH of >4. The pH of ASS has the potential to become much lower when the soil is exposed to oxygen. Sediment which after the addition of hydrogen peroxide, has a pH <3 and/or undergoes a pH depression >1 could be defined as potential ASS based on the criteria (Ref [1]).

The Newcastle (Ref [4]) ASS risk map indicates that the majority of the site is in an area with a low probability of ASS at depths of greater than 3m below the ground surface (mbgs). The northwest corner of the site that is mapped with ASS having a high probability of occurrence – between 1 and 3mbgs. The risk mapping is presented on **Drawing 3**, **Appendix A**.

3.2 SURFACE AND SUBSURFACE CONDITIONS

Drainage at the site is expected to comprise a combination of surface infiltration and runoff to Wharf Road. The Hunter River flows west to east, with tidal influence from east to west, approximately 40m north of the site, across Wharf Road.

[3] Newcastle 1:250000 Geological Series Sheet S1 56-2

[4] Alluvial Fan: fan-shaped deposit formed when a river or flash flood slows down and sediment rapidly settles.

The subsurface conditions have not been assessed as the site is covered by hardstand and the existing building however based on the geological and soil landscape mapping is expected to comprise fill material overlying alluvial sands, silts and clays.

The Water NSW database[5] indicated that the standing water level of four (4) bores (GW203132, GW201490, GW201489 and GW201491) located within 500m of the site ranged from 2.0 to 2.1mbgs. It is noted that groundwater levels and soil moisture conditions are likely to fluctuate with variations in climatic and site conditions and may be influenced by tidal flows due to the proximity of the site to Newcastle Harbour. The logs of the wells indicate that GW203132, to the northwest of the site, was installed within 'fill' material (for which information is not provided) whereas the other three (3) wells to the south west of the site were installed in sandy silt fill material and sand (fine to coarse) overlying clay at approximately 4.5m below the surface.

4 PROCESS FOR ASSESSMENT OF ASS

Based on the risk mapping it is considered that there is potential for ASS to be present from as shallow as 1mbgs with soils comprising an alluvial source.

An inspection undertaken at the site has indicated that it is low lying land in proximity to the Hunter River with generally flat topography except where altered by building construction and landscaping. The flora of the site has been cultivated for landscaping purpose and comprises a mixture of native and exotic tree species, groundcover and some lawn.

As specific assessment of the presence of ASS has not been undertaken, such that this ASSMP has been written as a precautionary document, and the risk mapping is not necessarily precise because it is based on limited data, RCA recommend that sampling of soils at the site is undertaken prior to the commencement of excavation at the site. If there are no ASS present, no management specific to ASS will be required and further the excavated material may be able to be classified as excavated natural material (ENM) in accordance with the NSW EPA Order (Ref [5]) which would permit the use of the excavated soil at a site with regulatory approval to receive ENM. If ASS is present, management measures as detailed in this Plan will be required and excess soil will require treatment prior to being removed to a licensed waste disposal facility; currently there is no permissible beneficial use of ASS after treatment. **Section 4.1** details the additional sampling requirements for material classification.

Assessment of the presence of acid sulfate soil is to be undertaken at a minimum of four (4) locations in accordance with the guidelines (Ref [1]) at 0.5mbgs and every 0.5m to 1m below the intended depth of excavation. Where individual soil units or soil horizons are encountered with a thickness of less than 0.5m, additional samples are to be collected to ensure that at least one sample is collected from each unit or horizon (Ref [1]). In the event that dewatering will be required as part of the construction, soil sampling should extend to at least one metre below the depth of the lowest estimated groundwater drawdown (Ref [1).

[5] www.realtimedata.waternsw.com.au

Alternatively samples may be undertaken from stockpiles of excavated material, noting the requirements for stockpiles in **Section 6.2**, at a frequency of 1/25m^3 with a minimum of three (3) samples or at a frequency of 1/250m^3 if the material is homogeneous with a minimum of ten (10) samples and subject to confirmation by statistical assessment that material is homogeneous (if not, additional samples are to be analysed to the frequency of 1/25m^3).

Samples are to be analysed for initial pH, oxidised pH, chromium reducible sulfur (CRS) and the liming rate to neutralise the detected acidity. Screening analysis, which is subject to interference from organics and is a conservative measurement of ASS, may be used to assist to reduce the number of samples however RCA notes that the absence of the full analytical suite at all locations and depths may impede the classification of soil for removal from site.

Actual ASS are present when the pH is <4pH units.

Potential ASS are present when the initial pH is >4pH units however the oxidised pH is <4pH units and / or the CRS results are greater than the relevant action criteria. Based on the guidelines (Ref [1]) as reproduced in **Table 3**, the anticipated soil types and the estimated excavation quantity (greater and less than 1,000 tonnes), RCA considers that the relevant criteria will be 0.03%S and 18mol H$^+$/tonne.

Table 2 *Texture based ASS based 'action criteria.'*

Type of Material		**Action Criteria if 1 to 1,000 tonnes of material is disturbed**		**Action Criteria if more than 1,000 tonnes of material is disturbed**	
		Existing + Potential Acidity		**Existing + Potential Acidity**	
Texture range	Approx. clay content (%)	Equivalent sulfur (%S) (oven-dry basis)	Equivalent acidity (mol H+/tonne) (oven-dry basis)	Equivalent sulfur (%S) (oven-dry basis)	Equivalent acidity (mol H+/tonne) (oven-dry basis)
Coarse texture (Sands to loamy sands)	<5	0.03	18	0.03	18
Medium texture (Sandy loams to light clays)	5 - 40	0.06	36	0.03	18
Fine texture (Medium to heavy clays and silty clays)	>40	0.1	62	0.03	18

Existing + Potential acidity = Total Actual Acidity + S% = Net acidity (Ref [1]).

4.1 MATERIAL (WASTE) CLASSIFICATION

Any material being removed from site is classified as waste; due to the potential for fill to be located at site it is considered that there are two (2) options as outlined in Section 4:

- ENM – 98% natural material, hasn't been processed and does not comprise ASS or contain asbestos. Sampling and analysis must be in accordance with the NSW EPA Order (Ref [5]) and further must meet the criteria specified in the Order.

- Removal to licensed waste disposal facility. The classification is based on the NSW EPA guidelines (Ref [6]).

Sampling can be undertaken at the same time as the ASS assessment as detailed in **Section 4** or at a later stage with due consideration to potential delays to the development and noting holding times for analytes.

Sampling is to be undertaken at nine (9) locations at the surface (or immediately below concrete bedding sands) and every metre to the depth of excavation. Alternatively, samples could be undertaken in stockpile with the number to be determined based on the quantity as per the Order (Ref [5]) as reproduced in **Table 3** below.

Table 3 *Sampling Frequency for Material Classification from Stockpiles*

Quantity (tonnes)	Number of Samples*
<500	3
500 – <1,000	4
1,000 – <2,000	5
2,000 – <3,000	7
3,000 – <4,000	10

* Each sample must comprise two (2) discrete samples plus a five (5) part composite sample.

Analysis is to be undertaken for pH, electrical conductivity, benzene, toluene, ethylbenzene, xylene (BTEX), total recoverable hydrocarbons (TRH), metals (arsenic, cadmium, chromium, copper, nickel, lead, zinc, mercury), asbestos and foreign materials. For in-situ classification all analysis is to be undertaken from discrete samples whereas for stockpile sampling, the discrete samples are to be analysed for BTEX, TRH, PAH and asbestos and the composited sample if to be analysed for pH, electrical conductivity, metals and foreign materials.

Where ASS is not present, results of the analysis are to be compared to the ENM criteria in the Order (Ref [5]) as reproduced in **Table 4**; the maximum average criterion applies to the average concentration from all samples for the material whereas the absolute maximum applies to each individual sample.

Where ASS is present and / or the results do not meet the ENM Order criteria, results are to be compared to the waste criteria as reproduced in **Table 4** noting that if Tier 1 criteria are exceeded, additional testing of leachate may enable the (generally) higher Tier 2 criteria to be used for classification. The criteria apply to the data set and the 95% $UCL_{average}$ can be used as long as the standard deviation is <50% of the criterion and there are more than ten (10) samples.

Table 4 *Material Classification Criteria*

Analyte	Maximum Average	Absolute Maximum	Tier 1		Tier 2			
	mg/kg unless noted otherwise		Solid Concentration (mg/kg)		Leachate Concentrations (mg/L)		Solid Concentrations (mg/kg)	
	Concentration for ENM Characterisation		GSW	RSW	GSW	RSW	GSW	RSW
Benzene	NA	0.5	10	40	0.5	2	18	72
Toluene	NA	65	288	1,152	14.4	57.6	518	2073
Ethylbenzene	NA	25	600	2,400	30	120	1080	4320
Total Xylenes	NA	15	1,000	4,000	50	200	1800	7200
TRH C_6-C_9			650	2,600	NA	NA	650	2,600
TRH C_{10}-C_{36}	250	500	10,000	40,000	NA	NA	10,000	40,000
Benzo(a)pyrene	0.5	1	0.8	3.2	0.04	0.16	10	23
Sum of reported PAH	20	40	200	800	NA	NA	200	800
Arsenic	20	40	100	400	5	20	500	2000
Cadmium	0.5	1	20	80	1	4	100	400
Chromium (total)	75	150	100	400	5	20	1900	7600
Copper	100	200	NA	NA	NA	NA	NA	NA
Mercury	0.5	1	4	16	0.2	0.8	50	200
Lead	50	100	100	400	5	20	1500	6000
Nickel	30	60	40	160	2	8	1050	4200
Zinc	150	300	NA	NA	NA	NA	NA	NA
Electrical Conductivity	1.5dS/m	3dS/m	NA	NA	NA	NA	NA	NA
pH	5 to 9pH units	4.5 to 10pH units	NA	NA	NA	NA	NA	NA
Rubber, plastic, bitumen, paint, paper, cloth, wood	0.05%	0.10%	NA	NA	NA	NA	NA	NA
Asbestos	Nil	Nil	Presence of asbestos will require classification as ‘special waste’.					

Values outside the presented pH range are deemed non-compliant for ENM.

5 ACID SULFATE SOILS MANAGEMENT PLAN

The following sections have been developed based on the presumption that ASS will be encountered at the site; if testing in accordance with **Section 4** indicates that soils proposed to be disturbed by the works are not ASS these sections do not apply.

The guidelines (Ref [1]) state that a management plan should include measures or procedures which:

- Prevent the oxidation of pyrite (avoiding the disturbance of ASS or changes to groundwater levels).
- Treat or manage ASS.
- Prevent, control or minimise the discharge of ASS leachate to the surrounding environment.
- Allow for neutralisation of acid leachate from ASS.

As the proposed development requires excavation as part of the design, the oxidisation of soil (if ASS is present) by disturbance at the site cannot be avoided. The depth of some excavations may encounter groundwater which has not been assessed and is presumed to be potentially acidic based on the ASS mapping.

5.1 ACTIVITIES THAT WILL IMPACT ON ACID SULFATE SOILS

The following outlines specific proposed activities that have the potential to disturb ASS and thereby require the controls as detailed in this management plan. Whilst the following information relates to specific activities, all activities that disturb ASS should be considered as potentially acid-generating and treated accordingly.

5.1.1 EXCAVATIONS

The excavation of the basement carpark and the footings will generate spoil which may be ASS that will require management.

While the footings may be backfilled at time of excavation it is anticipated that the basement carpark will remain open for a period of time while the concreting is being undertaken such that there is the potential for acid to be generated and therefore the water in the excavation could become acidic until the potential acid generation of the exposed soil is exhausted.

5.1.2 CHANGES TO GROUNDWATER TABLE

Any activities that have the potential to lower the water table (e.g., excavation dewatering, use of groundwater) may enhance the oxidation of the surrounding soils. This can result in exposure of previously saturated sediments allowing oxidation of potential ASS and acid generation.

The excavation and removal of natural material can also create changes in the groundwater table.

It is anticipated that some dewatering will be required during the works at the site as groundwater was present at a depth of approximately 2.0-2.1mbgs in bores located within a 500m radius of the site.

5.1.3 WATER ACIDIFICATION

Acidic drainage may be generated from stockpiles of potential ASS which can then impact on waterways. It is considered that temporary stockpiling of soils may be required.

Some of the spoil is expected to be saturated such that if the material is potential ASS and oxidises, the water draining from the material may become acidic.

Groundwater may be acidified due to oxidisation of soil excavated above, and below, the groundwater table.

Excavation below the groundwater table is anticipated during the excavation of the basement.

5.1.4 EXPOSURE AND OXIDATION OF IMPORTED FILL MATERIAL

There is no importation of fill included in the proposed development beyond that required for landscaping of the podium level. The source of the fill will require verification that it is not ASS prior to importation.

5.2 ASS TREATMENT METHODS

RCA have considered the available options for treatment and recommend neutralisation as the primary treatment method. It is not considered that avoidance of the ASS can be achieved given the design includes a basement carpark although it is noted that soils excavated beyond the extent of the current footprint at depths of less than 1mbgs, and potentially to 3mbgs, may not comprise ASS.

Neutralisation requires the application of lime or other such neutralising agent, in a controlled manner. Lime is applied to stockpiled soils using a rotary hoe or similar which also acts to aerate and mix the soils. Application of lime and aeration is undertaken until a neutral pH is achieved. Once neutralised, soils can be disposed of to a licensed waste disposal facility (Ref [6]) subject to waste classification as outlined in **Section 4.1**. Treated material cannot be classified for re-use off-site under the current resource recovery orders (Ref [5]).

Any excavation or exposure of ASS at the site will need to be managed as follows:

- Excavated soils should be stored in a plastic lined (or appropriate permeability equivalent) bunded area on site until lime treated.
- Exposed potential ASS soil can be lime treated in-situ (within 24 hours of exposure) and tested to confirm acidity neutralised.

The liming rate will be derived from the sample results following classification in accordance with the procedure outlined in **Section 4**.

It is noted that separation of pyrite may be undertaken by an experienced contractor prior to neutralisation. However, RCA is uncertain of the appropriateness of this method and as such has not considered further.

Burial of the excavated material has not been considered a current option as there is not considered to be sufficient room within the site to facilitate burial. In the event the quantity of ASS identified, following assessment as per **Section 4**, was minimal and there was sufficient depth of soil without ASS to allow for the burial of the ASS quantity with 1m of cover the consideration of burial as an option could be revisited.

6 ACID SULFATE SOIL MANAGEMENT AND MONITORING REQUIREMENTS

The implementation of this Plan will be the responsibility of the appointed construction contractor.

The following requirements are considered necessary to protect the environment from potential impacts by acid sulfate soils.

A summary of the management plan is presented in **Table 5**.

6.1 GENERAL EXCAVATIONS

Where assessment (refer **Section 4**) has identified ASS to be present, excavation or exposure of these soils should be backfilled within twenty four (24) hours to prevent the oxidisation of soils within the excavations. Where excavation/exposure will stand open for longer than twenty-four (24) hours, sampling of soil may be undertaken to inform the requirement for lime application to neutralise potential ASS effects or the recommended value as derived from the assessment (refer **Section 4**) can be utilised The lime is to be worked into the profile with a rotary hoe or with a small (<5tonne) excavator. The distribution of lime throughout the profiles is to be certified by the works supervisor prior to the continuation of the building construction.

In the case of surplus soils, i.e., soils that cannot be returned to the excavation, these must be stockpiled in a designated and prepared area as detailed below in **Section 6.2** and either classified as ASS or assessed as per the process outlined in **Section 4** to identify whether the soils comprise potential ASS.

No water shall be permitted to leave the excavation without testing and treatment. Installation of bunds around the area to prevent surface water entering the excavation/exposed area will assist in minimising the potential for groundwater overflowing the excavation.

6.2 STOCKPILED SOILS

Spoil generated from areas and depths identified to be ASS must be placed in containment areas comprising:

- Bunding with the bund height designed for a 1 in 10 year, one hour storm duration capacity. The bund must allow for drainage to catch pond and also prevent surface waters from the surrounding lands from entering the soil treatment/ stockpile area and catch pond.
- A low permeability base must be provided (such as clay base or impermeable liner) for the storage area and the catch pond. The catch pond volume should be calculated by:
    - CPV = Stockpile flat area (m2) x 10-3(m/mm) x rainfall rate (1 in 10 year, mm/hour) x rainfall duration (1 in 10 year, hour)
- The base of the bunded area should be further dosed with agricultural lime (1kg/m^2) as a precautionary measure to minimise acidity of the leachate.

Covers should be available to place over the stockpiled material in the event rainfall may occur to minimise the generation of leachate however stockpiles should not be covered continuously as this will impede the neutralisation process.

The treatment area should be in a flat area of sufficient size to accommodate the expected quantity of excavated soil, away from sensitive environments and be divided into a minimum of two (2) areas separated by a bund wall. One area is for treatment and one for stockpiling the treated soils until it is confirmed by laboratory testing that neutralisation has been achieved. The treatment bund should at least be able to contain twice the amount of soil expected to be excavated during the neutralisation period.

Following excavation:

- Soil is to be transported to the bunded area and spread to no more than 0.3m thick.
- Treatment should occur within 24 hours of excavation.
- Treatment is to be undertaken by the application of agricultural lime at a rate determined by the assessment in **Section 4**.
    - Lime should be applied to the top of the material and mixed into the material with a rotary hoe, excavator or similar.
    - Thorough mixing and aeration are essential and multiple attempts may be required to achieve appropriate treatment.

Additional soil and lime layers can be added if required to a maximum of three (3) layers.

Following neutralisation work, validation samples must be collected to confirm that treatment has been successful:

- These samples are to be collected at rate of one per 25m^3 (with a minimum of three (3) samples) and screened pH and oxidisable pH. The sample with the biggest change in pH is then to be analysed for CRS levels.
- The criteria for validation are detailed in **Table 2** previously and the pH must be between 6.5 and 8.5.
    - Allow a week for the analysis to be completed.
- Remove soil that meets the criteria from the bunded area and remove from site in accordance with the waste classification (as derived from testing outlined in **Section 4.1**).

If pH and / or the CRS of treated soil exceeds the criteria (Ref [1] and **Table 2**) then the soil must be re-dosed with the required extra amount of lime based on the laboratory recommendations, or longer aeration/oxidation time allowed if there is sufficient acid neutralising capacity (ANC) due to added lime present to treat the potential acidity.

No leachate (if it occurs) must be allowed to leave the bunded area without treatment. The dewatering requirements must be followed when dewatering is required.

6.2.1 OFF SITE DISPOSAL

All material removed from site must be tracked to demonstrate that it has been suitably managed, transported and placed in accordance with the requirements of the NSW waste legislation. Documents to be maintained comprise:

- Load sheets – truck registration being loaded, time loaded, approximate quantity, description of material being loaded, details of person doing the recording.
- Dockets from the licensed waste facility.

- Truck dockets as maintained by the driver transporting the goods.

These records should be kept in readiness for provision to a regulatory authority upon request.

6.3 WATER MANAGEMENT

The following water management controls should be implemented:

- Redirection of overland flows away from work areas where possible by the use of bunds or dish drains.
- Collection of surface water from the work areas within sedimentation dams.
- Extraction of groundwater is not to be undertaken for longer than forty-eight (48) hours or as otherwise determined by a groundwater study so as to prevent oxidisation of soil beneath the natural water table depth.
- Extracted groundwater is to be retained for testing.

Monitoring of the pH in water within excavations or sedimentation dams is to be undertaken on a daily basis and recorded in a log. If the monitoring programme shows the pH of the water in the excavations has fallen below pH 6.5 then the water will require treatment by lime dosing to achieve a target pH of 6.5 to 8 prior to removal of water.

Discharge of groundwater at the site is not considered feasible and as such disposal to stormwater or sewer under a licence[6] may be necessary, noting that characterisation of groundwater contamination may be required prior to granting of the licence.

6.4 IMPORTATION OF FILL MATERIAL

Any soil materials brought into the site for use as fill are to be:

- Sourced from a reputable supplier operating under an environmental protection license (such as a quarry) and providing material that does not comprise 'waste'.
- Virgin Excavated Natural Material (VENM) as defined by the Protection of the Environment Operations Act.
    - VENM is to be sourced from a reputable supplier familiar with the requirements of the guidelines and be accompanied with appropriate certification. The history of the source site must show that the site has not been previously contaminated and that there is no potential for the material to comprise ASS.
    - A visual inspection material is to be conducted by the works supervisor (or delegate) to confirm material is consistent with the material documented in the VENM classification prior to the acceptance of the material at site. Any material which is inconsistent with the certification is to be refused and returned to source.
- Excavated Natural Material (ENM).

[6] Permission to allow drainage from treated stockpiles to water bodies must be sought from the relevant authorities and would require a licence in accordance with Chapter 3 (Environment Protection Licence) and Part S3 (Water Pollution) of the Protection of the Environment (Operations) Act (1999).

  - ENM is to be classified in accordance with the NSW EPA Order (Ref [5]) and the certification must include a statement that there is no potential for the material to comprise ASS.
  - A visual inspection material is to be conducted by the works supervisor (or delegate) to confirm material is consistent with the material documented in the ENM classification prior to the acceptance of the material at site. Any material which is inconsistent with the certification is to be refused and returned to source.
- Suitable for use as fill under another resource recovery order (Ref [5]) and including a statement that there is no potential for the material to comprise ASS.
  - A visual inspection material is to be conducted by the works supervisor (or delegate) to confirm material is consistent with the material documented in the classification prior to the acceptance of the material at site. Any material which is inconsistent with the certification is to be refused and returned to source.

All imported material is to be tracked from source to placement including:

- Certification documents for each source.
- Verification of truck movements from source to site.
- Confirmation that material was visually verified as being consistent that described in the certification documents upon arrival.
- Volumes imported.

These records should be kept in readiness for provision to a regulatory authority upon request.

6.5 POST CONSTRUCTION

Based on RCA's understanding of the site works it is not anticipated that post construction monitoring will be required as long as soil treatment is verified as complete in accordance with this Plan and that underground structures are designed in accordance with the soil conditions.

6.6 REPORTING

A record of treatment of ASS, leachate and extracted groundwater (where undertaken) should be maintained by the contractor and should include the following details:

- Date of works.
- Location at which works were undertaken.
- Time stockpile has been exposed prior to treatment.
- Neutralisation process undertaken.
- Lime rate utilised.
- Results of soil and leachate and water monitoring.
- Dockets from licensed waste facility material was removed to.
- Dewatering activities, date and volume, and monitoring of all pH levels recorded by location.

- Information of implementation of any contingency measures (refer **Section 7** below) and additional treatment if undertaken.

A final report is to be provided upon completion of the works presenting the monitoring regime and results and confirming that appropriate management of ASS has occurred during the works.

Table 5 *Summary of ASS Management Plan*

Activity	Impact	Control	Monitoring	Monitoring Timeframe	Contingency
Excavation	Oxidation of PASS	Pre-excavation analysis	pH, %Scr	Prior to start of excavation	
		Backfilling within twenty-four (24) hours.	Site supervisor	Continuous during excavations	Neutralisation[1]
Stockpiling of Excavated Soils		Designated stockpile location and neutralisation[1]	Soil samples 1/25m^3 (minimum of three (3)) Analysed for pH and %Scr levels	After mixing and aeration.	Additional lime and/or time to allow neutralisation. More thorough mixing methods.
Groundwater Drawdown	Oxidation of potential ASS and subsequent acidification of groundwater	No groundwater extraction to be undertaken >24 hours without detailed groundwater assessment to determine potential for drawdown.	Site supervisor	Continuous during excavations	Cessation of works and detailed groundwater assessment to determine potential for drawdown.
Removal of Water from Excavations	Acidification of water following excavations	Redirection of surface water by bunds Collection of waters from within excavations	pH[3]	Daily while water present	Neutralisation
Imported fill material[2]	Importation of ASS	Certification during sourcing of material	Inspection upon arrival to verify consistent with certification.	Continuous during importation	Source new material

1 Refer to **Sections 5.2** of this report.

2 Refer to **Section 6.4** of this report.

3 Additional analyses will be required for offsite discharge.

7 PLANNING AND CONTINGENCY

Consideration of the management requirements detailed above must be undertaken to ensure that the appropriate procedures are in place and that there is sufficient time allocated for tasks such as treatment and validation testing to be undertaken. The following are considered to require consideration:

- Whether personnel with the appropriate experience with the implementation of the measures within this ASSMP can be provided or whether an external consultant is required.
- Whether groundwater drawdown is required as part of project works. If so, a detailed groundwater assessment is to be undertaken to assess the appropriate rates to ensure drawdown does not occur and potentially result in oxidisation of acid sulfate soils and subsequent acidification of the groundwater.
    - For short term groundwater extraction appropriate receptacles to store water for testing and/or treatment to be obtained. The final fate of the water is to be determined and permissions sought from regulatory authorities. Contingency planning for requirement to store groundwater even if not anticipated and to store additional volume, or for longer duration, than that anticipated.
- Minimisation of time that excavations are open or areas are disturbed, in that infrastructure is ready to install at the time of excavation being undertaken. Contingency planning in the event that there is a requirement to treat soil within an excavation.
- Estimation of the quantity of excavated soil such that the containment area is sufficient to allow stockpiling of all soils prior to confirmation of treatment. Contingency planning in the event that additional volume of soil is excavated.
- Design of the containment area such that the requirements can be met. Contingency planning for wet weather events and/or flooding, for additional soil volume and generation of leachate requiring treatment.
- Covering of stockpiles during periods of heavy / prolonged rainfall to minimise the potential for leachate generation.
- The quantity of lime which will be required for the neutralisation of PASS / ASS including an allowance for redosing.
- Allocation of sufficient time for testing, treatment and validation of soil such that it does not become a constraint on the project. Contingency planning for re-treatment of soil in the event that initial treatment was not successful.
- Confirmation that proposed sources of fill have certification or can be certified prior to importation to site. Procedures for on-site verification of material upon arrival and contingency planning for loads to be rejected prior to placement at site and removal of unsuitable material after placement on to site.

Further, all works are to be conducted with due regard to erosion and sediment controls to minimise potential impacts to nearby sensitive receptors, including stormwater drains and the Hunter River.

8 LIMITATIONS

This report has been prepared for Tamba Pty Ltd in accordance with the agreement with RCA. The services performed by RCA have been conducted in a manner consistent with that generally exercised by members of its profession and consulting practice.

This report has been prepared for the sole use of Tamba Pty Ltd for the specific purpose and the specific development described in the report. The report may not contain sufficient information for purposes of other uses for parties other than the Tamba Pty Ltd. This report shall only be presented in full and may not be used to support objectives other than those stated in the report without permission.

The information in this report is considered accurate at the date of issue regarding the current conditions of the site. The conclusions drawn in the report are based on interpolation between test pits. Conditions can vary between test locations that cannot be explicitly defined or inferred by investigation.

Yours faithfully
RCA AUSTRALIA

Mark Laidlaw
Senior Environmental Scientist
(B.S. Geo, M.S. Geo, PhD Enviro. Sci.)

REFERENCES

[1] Acid Sulfate Soils Management Advisory Committee, Wollongbar, NSW, Australia (Stone, Y, Ahern, CR and Blunden, B), *Acid Sulfate Soils Manual 1998*, 1998.

[2] Government of Western Australia Department of Environmental Regulation. *Identification and investigation of acid sulfate soils and acidic landscapes*, 2015.

[3] Newcastle Local Environment Plan 2012 under the Environmental Planning and Assessment Act 1979, current version 26 April 2023.

[4] Department of Land and Water Conservation, *Newcastle Acid Sulfate Soil Risk Map*, Edition Two, December 1997.

[5] NSW EPA, *Current Orders and Exemptions,* [Online: available at https://www.epa.nsw.gov.au/your-environment/recycling-and-reuse/resource-recovery-framework/current-orders-and-exemption].

[6] NSW EPA, *Waste Classification Guidelines, Part 1; Classifying Waste*, November 2014.

Appendix A

Drawings

LEGEND

Approximate site boundary

Note: Aerial image taken from Nearmap, 15 January 2023
(used in accordance with commercial licence)

0 5 10 20 30 40
metres

N

RCA AUSTRALIA
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SITE LAYOUT AND LOCALITY PLAN
ACID SULFATE SOILS MANAGEMENT PLAN
237 WHARF ROAD
NEWCASTLE

CLIENT	Tamba Pty Ltd			RCA Ref	16019-201/1
DRAWN BY	ML	SCALE	1:750 (A3)	DRAWING No 1	REV 0
APPROVED BY	FB	DATE	19/06/2023	OFFICE	NEWCASTLE

LEGEND

Approximate site boundary

Basement carpark extent

Note: Aerial image taken from Nearmap, 15 January 2023
(used in accordance with commercial licence)
Proposed building footprint drawing supplied by Tamba Pty Ltd
Drawn by EJE Architectute
(Drawing 13892_A12 - Basement Floor Plan)

0 5 10 20 30 40
metres

N

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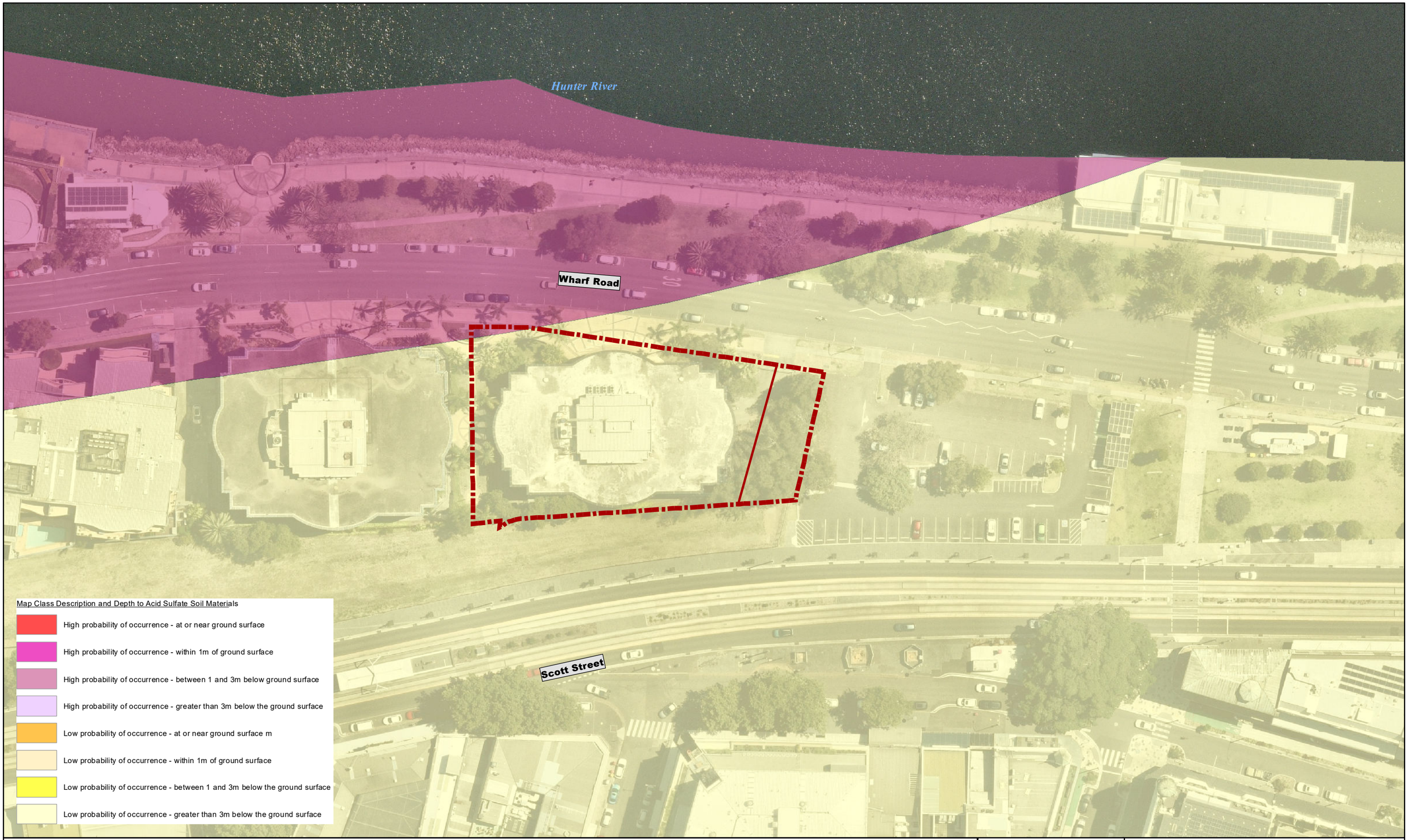
PROPOSED DEVELOPMENT FOOTPRINT ACID SULFATE SOILS MANAGEMENT PLAN 237 WHARF ROAD NEWCASTLE

CLIENT	Tamba Pty Ltd			RCA Ref	16019-201/1
DRAWN BY	ML	SCALE	1:750 (A3)	DRAWING No 2	REV 0
APPROVED BY	FB	DATE	19/06/2023	OFFICE	NEWCASTLE



Map Class Description and Depth to Acid Sulfate Soil Materials

- High probability of occurrence - at or near ground surface
- High probability of occurrence - within 1m of ground surface
- High probability of occurrence - between 1 and 3m below ground surface
- High probability of occurrence - greater than 3m below the ground surface
- Low probability of occurrence - at or near ground surface m
- Low probability of occurrence - within 1m of ground surface
- Low probability of occurrence - between 1 and 3m below the ground surface
- Low probability of occurrence - greater than 3m below the ground surface

LEGEND

Approximate site boundary

Note: Aerial image taken from Nearmap, 15 January 2023
(used in accordance with commercial licence)

0 5 10 20 30 40
metres

N

RCA AUSTRALIA
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ACID SULFATE SOIL RISK MAP
ACID SULFATE SOILS MANAGEMENT PLAN
237 WHARF ROAD
NEWCASTLE

CLIENT	Tamba Pty Ltd			RCA Ref	16019-201/1
DRAWN BY	ML	SCALE	1:750 (A3)	DRAWING No 3	REV 0
APPROVED BY	FB	DATE	19/06/2023	OFFICE	NEWCASTLE