Acid Sulfate Soil Management Plan

Multi-Storey Residential Development

260 Macarthur Avenue, Hamilton

Lot 6 on SP326594

Project: Site 18 (Site 18A)

Prepared for:
Wade Fraser
Silverstone Developments
Level 4, 26 Commercial Road
Newstead QLD 4006

Email: wfraser@silverstonedevelopments.com.au

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1.0 INTRODUCTION

This Acid Sulfate Soil Management Plan (ASS MP) has been prepared for a proposed multi-storey residential development at 260 Macarthur Avenue, Hamilton. The proposed development includes two 9 -12 level unit buildings over a shared single-level inground basement. Bulk excavation to approximately 1.8 m AHD is anticipated. This ASS MP is for proposed Site 18, currently known as Lot 6 SP326594. Core Consultants Pty Ltd (Core) have previously prepared an ASS MP for the adjacent Lot 5 SP326594 (ref. J002466-002-R-Rev1, dated August 2024).

This ASS MP references the results of a previous investigation undertaken by Core (ref. J002466-005-R-Rev0 –Geotechnical and Acid Sulfate Soils Investigation.

The procedures contained within this ASS MP should be updated and revised to address conditions encountered that vary from those indicated by investigations or where alternative construction methodologies are adopted.

The ASS MP was prepared with consideration of the following documents:

- State Planning Policy, July 2017.
- State Planning Policy – State Interest Guideline Water Quality April 2016 (Policy 9).
- *Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines V5.1,* 2024. Dear SE, Williams KM, McElnea AE, Ahern CR, Dobos SK, Moore NG, and O'Brien LE. Department of Resources and Department of Environment, Science and Innovation, Queensland.
- *National acid sulfate soils identification and laboratory methods manual*, National Acid Sulfate Soils Guidance, Water Quality Australia, June 2018.
- *National acid sulfate soils sampling and identification methods manual,* National Acid Sulfate Soils Guidance, Water Quality Australia, June 2018.
- Environmental Protection Act 1994.
- Environmental Protection Policy (Water) 2009.

A copy of the ASS MP and associated forms, registers and records shall be kept on site during the construction stage of the development.

2.0 OBJECTIVE

The objective of the ASS MP is to mitigate or control potential impacts relating to the disturbance of ASS.

3.0 PROPOSED DEVELOPMENT

It is understood that the proposed development consists of the following:

- Two 9 - 12 level unit buildings over a shared single-level inground basement.
- Bulk excavation of a basement to approximately R.L 1.8 m;
- Detention Tanks;
- Access off Karakul Road for basement parking;
- Easement through Lot 6 SP326594 creating a separation between Site 18A (in discussion) and 18B (future Development); and
- Communal open space on ground level.

Architectural plans for proposed Site 18B (Lot 6 on SP326594) are in process of finalisation, site 18A are shown in Images 1 to 3 below.

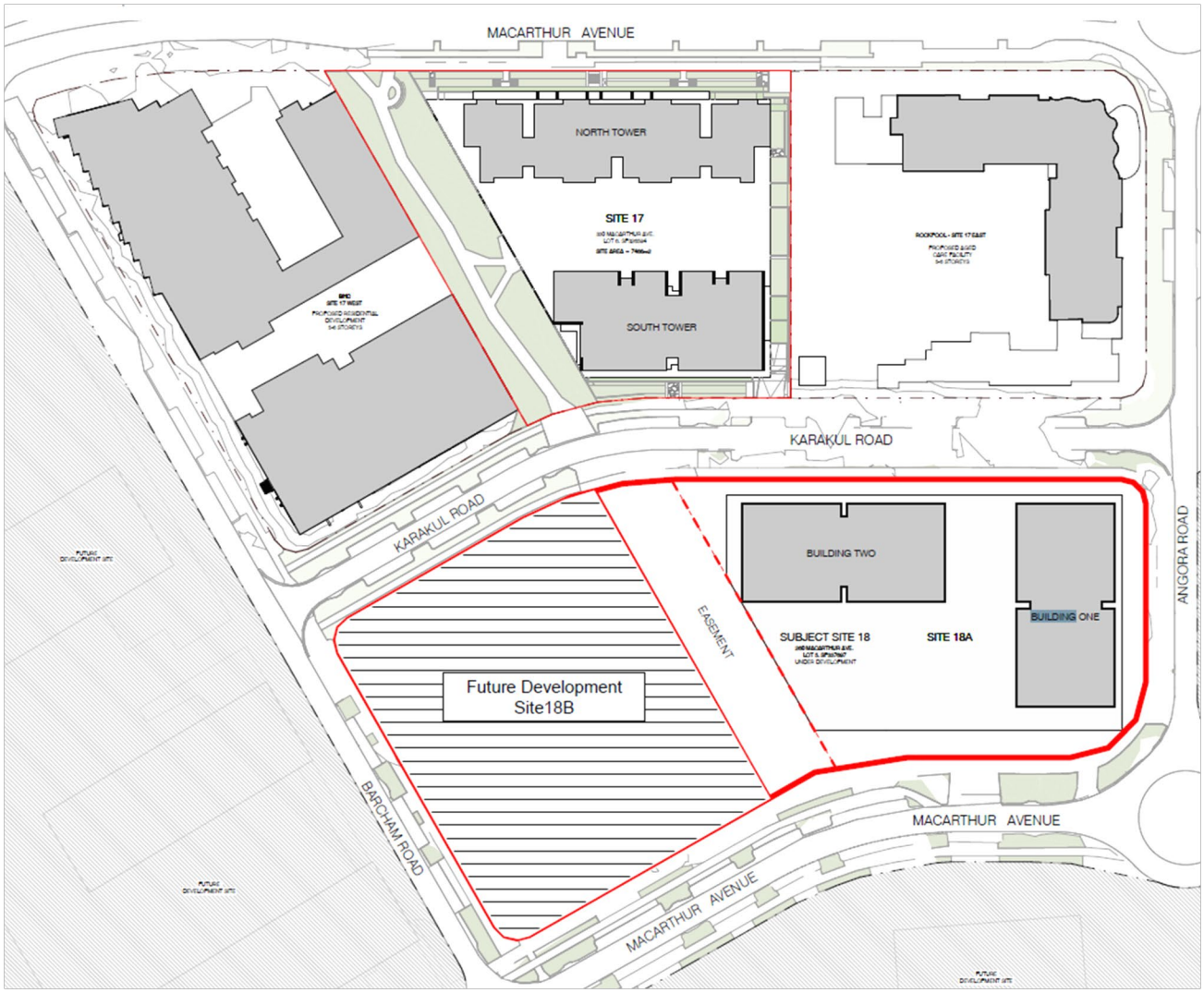

Image 1: Extract from proposed precinct development plan (Carr 24047).

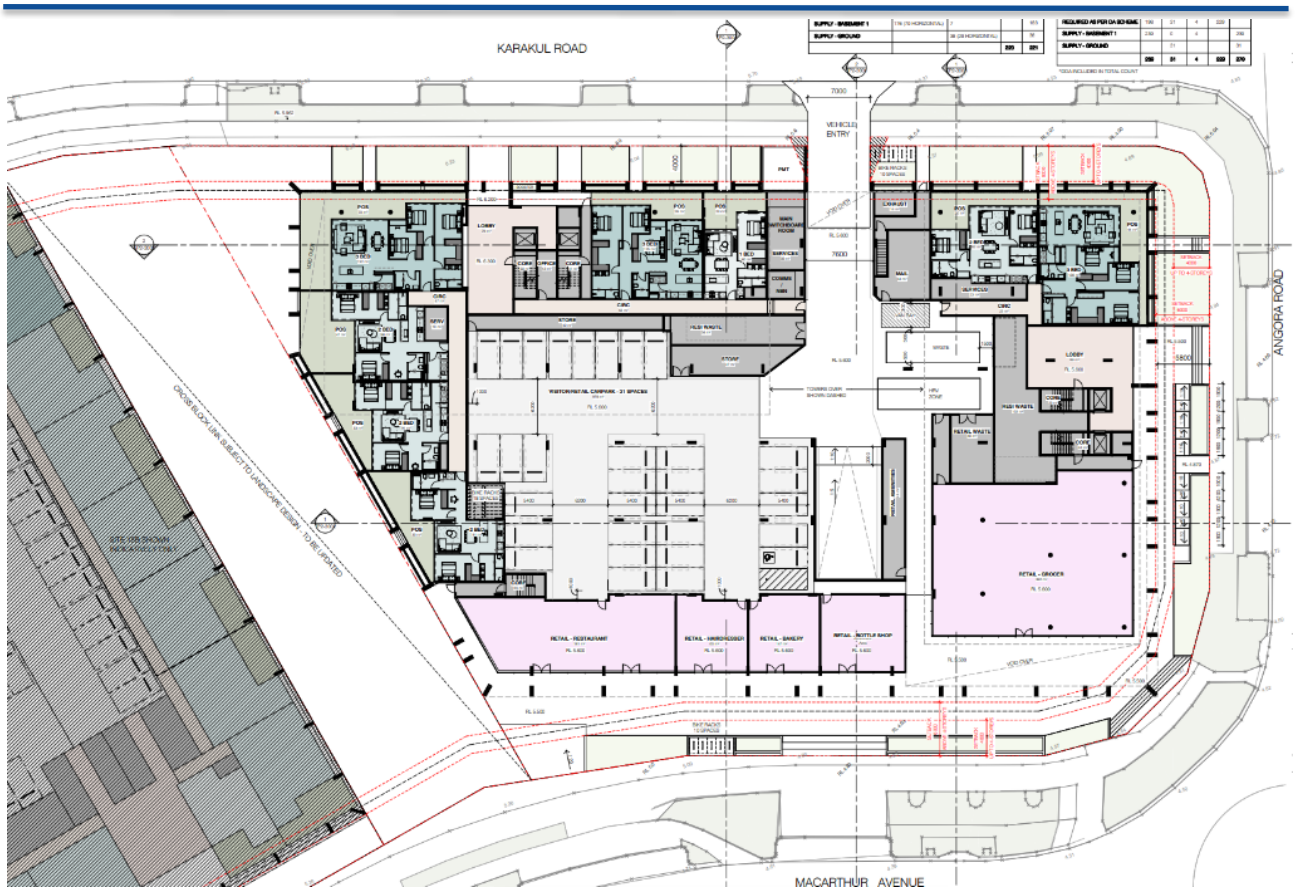

Image 2: Extract from proposed development plan at ground level (Carr 24047-TP2-1002).

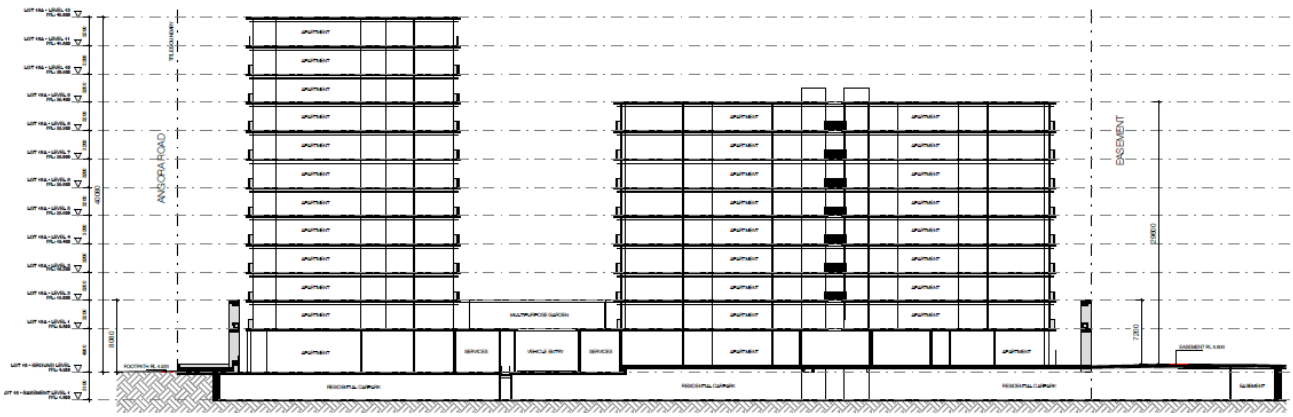

Image 3: Extract from proposed development Section plan (Carr 24047-TP2-3002).

4.0 SITE DESCRIPTION

The site (proposed Site 18A) is located at 260 Macarthur Avenue, Hamilton. It comprises Lot 6 on SP326594 and covers an area of approximately 14,740 m^2 with the Site 18 split into 18A (eastern portion) and 18B (future development). The site location is shown in Image 1 below.

Image 4: Site location (Aerial image sourced from Nearmap, Annotations by Core).

At the time of the investigation, the site was entirely fenced and comprised an area of grass, bitumen sealed carparking area, concrete pads, a single storey warehouse and a few established trees along the south western boundary. Lot 6 was used for storage of construction equipment with multiple shipping containers observed and metal structure beams stacked over the bitumen hardstand areas. Light poles, in working order, were evident across the site.

The elevation of the site ranges between about RL 4.3 m and 5.0 m Australian Height Datum (AHD), generally sloping down towards the southern boundary.

Karakul Road bounds Site 18 (6 on SP326594) to the north and east, followed by Site 17 (Lot 5 on SP326594). To the south east the site is bounded by Angora Road, with Sales and Display Centre for Northshore developments. Macarthur Avenue bounds the south followed by Northshore Tennis and carparking facility. To the west Barcham Road form the western boundary, followed by Northshore industrial development areas. The Brisbane River is located approximately 150 m to the south, with the cruise terminal approximately 200 m to the south west. Access is currently available from Karakul Road and Angora Road.

Site conditions at the time of our investigation are shown in Photograph 1 and 2 below.

Photograph 1: Site 18 (Lot 6 SP326594) looking northwest towards the Corner of Karakul Road and Barcham Road.

Photograph 2: Site 18 looking east towards Angora Road.

4.1 Subsurface Conditions

The subsurface conditions encountered during the previous Core investigation generally comprised the following:

- Fill, typically firm or stiff gravelly sand with clay, to about 1 to 1.2 m BGL, over
- Fill/dredge spoil comprising soft clay (material likely dredged from the adjacent Brisbane River channel), to depths of possibly about 5 m BGL, although very similar to and difficult to differentiate from the underlying alluvium,
- Upper alluvium, generally comprising interbedded loose sand and firm clay to about 15 m to 20 m BGL, over
- Lower alluvium, generally loose to medium dense sand and stiff clay, becoming medium dense or dense gravel from about 30 m to 32 m BGL.

The upper fill and dredge spoil is considered ‘uncontrolled’ because of lack of geotechnical inspection and density testing records.

Groundwater seepage was encountered in the auger boreholes at about 2 m BGL at proposed Site 18 (Lot 6 SP326594). Ordinarily near the Brisbane River where sands are present, groundwater levels would be tidally dominated and occur at or around high tide level about RL 1 m to 1.5 m and rise temporarily and locally due to ingress after rainfall. It is understood the storm tide level for this site is about RL 3.1 m. Groundwater conditions can vary over distance and time and apart from tide and rainfall be influenced by changes to surface and subsurface drainage conditions and human influences.

5.0 OVERVIEW OF ASS ENVIRONMENTAL ISSUES

This section provides a brief overview of environmental issues related to ASS associated with the excavation stage of the proposed development.

The results from the previous Core investigation indicate high levels of potential acidity are distributed throughout the soil profile (up to 3.0 m BGL). The results also suggest high acid neutralising capacity (ANC) levels, most likely from small shells, and as such we have considered the net acidity excluding ANC.

The SPP14 Guidelines require that the level of treatment for management of ASS is based on treatment of all existing and potential acidity. The results of the laboratory testing have been accumulated in an Acid-Base Account to give the Net Acidity for each sample in units of mol H^+/tonne as presented in Table D1 (excluding ANC), attached. This value has been calculated from sulfur trail potential acidity (S_{Cr}) plus actual acidity (TAA).

Liming rates has been calculated in kg $CaCO_3$/t and kg $CaCO_3$/m³ using a factor of safety (fineness factor) of 1.5 and an assumed bulk density of 1.8 tonne/m³. Consideration of the tabulated laboratory results indicates that high levels of potential acidity are fairly uniformly distributed throughout the soil profile.

Due to the difficulty in mixing the soft silty clay material, it is considered that adoption of a uniform liming rate, not exceeding the 90th percentile of relevant test results for 'net acidity', i.e., 50 kg $CaCO_3$/m³, will be sufficiently conservative to limit the risk of environmental impact. Soils have been separated into two types the surface Gravelly Clay Fill to 0.75m BGL and the lower alluvial Clays and dredging spoil from 0.75 m BGL. Table 6 below provides the recommended liming rates calculated for each soil type.

Table 1: Recommended Liming Rates

Soil Type	Colour	Bottom of Layer, Depth Range	Treatment Rate**
Gravelly Clay (Fill)	Brown	0.0 – 0.75 m BGL	Nil
Alluvial Clays / Fill Dredging Spoil	Grey, dark grey, dark brown and black	0.75 – 3.0 m BGL*	50 kg $CaCO_3$/m³

Note: * Maximum depth of ASS sampling and analysis
** Liming rate based on 90th percentile values.

5.1 Groundwater

Groundwater seepage was encountered in the auger boreholes at about 2 m BGL during drilling and was measured at standing depths in groundwater monitoring wells MW1 and MW2 at approximately 1.95 m and 2.02 m bgl respectively (RL 2.45 m to 2.52 m AHD). Ordinarily near the Brisbane River where sands are present, groundwater levels would be tidally dominated and occur at or around high tide level about RL 1 m to 1.5 m and rise temporarily and locally due to ingress after rainfall. It is understood the storm tide level for this site is RL 3.1 m (i.e. below basement level). Groundwater conditions can vary over distance and time and apart from tide and rainfall be influenced by changes to surface and subsurface drainage conditions and human influences.

All groundwater seepage (if encountered) and stormwater collected in excavations should be directed to a holding point for regular monitoring and treatment as necessary before discharging off site.

The background groundwater quality for the site is:

- Neutral conditions (pH 7.09 to 6.51).
- Electrical conductivity reported brackish conditions.
- Alkalinity (Bicarbonate as $CaCO_3$) was reported in groundwater (MW01 & MW02) above 200mg/L.
- Elevated heavy metals were reported including iron, aluminium and calcium. MW01 has high levels of total aluminium, total and dissolved iron and calcium. This is common in these groundwater environments and potentially due to high turbidity.

Water quality monitoring should be undertaken for the full duration of earthworks activities in accordance with Procedure C (Appendix A).

5.2 Potential Environmental Impacts

Potential environmental impacts associated with ASS disturbance during earthworks and construction for the proposed development are summarised below in Table 2 along with the level of risk and management strategies to mitigate the risk.

Table 2: Potential Environmental Impacts.

Activity	Issue	Level of Risk to the Environment	Mitigation Strategies
Proposed Earthworks	Acid formation and transport due to bulk disturbance (by excavation) of potential acidity.	These works present a high risk.	Lime neutralisation treatment of excavated ASS and verification testing.
	Release of acidic and/or metals impacted waters from within excavations to surface waters.	medium to high level risk	Regular water quality monitoring and treatment (if required) prior to discharge off-site.

5.2.1 Summary of ASS Management Requirements

Provided the proposed ASS management procedures are effectively implemented and monitored throughout the construction phase of the development, it is considered that there should be limited internal or external ASS environmental impacts attributable to soils with potential acidity.

The relevant issues, which are of significance when considering potential acidity management for the earthworks phase of this development, are:

- Treatment and validation of excavated soils with potential acidity.
- Stockpiling, handling and transport of soils with potential acidity.
- Potential adverse impacts to groundwater or surface water quality on site or within the surrounding environment arising from the disturbance of soils with potential acidity (if not managed correctly).

6.0 MANAGEMENT PROCEDURES

The management procedures required to address the potential ASS issues associated with the earthworks phase of the proposed development are presented in Appendix A, and include the following:

- Procedure A: Management of ASS.
- Procedure B: Treatment and Verification of Excavated ASS.
- Procedure C: Monitoring of Water Quality.

7.0 RESPONSIBILITIES

This section outlines the responsibilities to manage, document and report on ASS issues for the project.

- The *Project Manager* is responsible for ensuring that all requirements of the ASS MP are met during the project.
- The *Site Supervisor* is responsible for ensuring the strategies and procedures prescribed in the ASS MP are implemented at the site in accordance with the specified performance criteria.
- The *Environmental Manager* is responsible for reviewing compliance with the ASS MP and development of actions to address non-conformance.

- All other site personnel are responsible for implementing strategies and procedures prescribed in the ASS MP, as applicable to their work activities.

8.0 NON-CONFORMANCE AND CORRECTIVE ACTION

Any non-conformance to the ASS MP must be addressed as soon as is practical. The personnel responsible for the non-conformance must be notified immediately for purposes of issuing rectification instructions.

9.0 AUDITING

The Environmental/Construction Manager (EM) will be responsible for ensuring that an auditing program is implemented for construction and treatment works. The audit program shall aim to ensure compliance with the ASS MP and relevant statutory requirements.

The EM shall appoint an experienced ASS practitioner to conduct regular auditing of activities and ASS management measures. Given the expected earthworks period a monthly auditing schedule is recommended. The frequency of these audits may gradually decrease if a high level of compliance with the ASS MP is evident.

The audit shall take the form of a visual inspection of the works and associated control measures and a review of monitoring data. A written record of auditing undertaken shall be maintained, including details on the date of the audit, activities undertaken, observations made and any non-conformances identified. A copy of the audit report shall be forwarded to the EM within 2 days of the audit.

10.0 COMMUNITY RELATIONS

Concerns raised by the community (or other parties) in relation to ASS will be directed to the EM for action.

The EM shall maintain a concerns register recording the following information:

1) Details: Name, address and phone number of party raising the concern.
2) Nature of concern: Detail of issue, date of incident, people involved, and location.
3) Action taken or required: Any action proposed or undertaken to address the concern, including time and date.
4) Response to action: Was the complainant satisfied with the outcome of the actions taken, if not, what else needs to be done, or is it outside the scope of the development works.
5) Prevention or re-occurrence: What action has been taken by the nominated responsible person to ensure the problem will not re-occur.

11.0 TRAINING

All site staff and contractors will be required to undergo a site induction covering all the elements of the ASS MP. The induction will aim to instil environmental awareness in personnel, and:

- Introduce and explain the duty of care required under the *Environmental Protection Act 1994.*
- Introduce the ASS MP and responsibilities it places on all contractors and consultants.
- Explain the various subordinate components of the ASS MP and the reporting and monitoring procedures of the ASS MP and how they work.
- Explain how to use the environmental procedures and plans in the ASS MP.

The content of the induction program will be endorsed and presented by the Site Supervisor, or delegate.

12.0 LIMITATIONS

Your attention is drawn to the document 'Limitations', which is included in Appendix B of this report.

Core Consultants Pty Ltd

Yours sincerely,

Christie Johnson
BEng(Env(Hons)) MIEAust
Geo-Environmental Engineer

Cameron Kay
BSc (EnvScience) MEIANZ CEnvP
Director / Principal Environmental Consultant

CJ/CK/cj

A.B.N. 75 603 384 050

Appendix A
Acid Sulfate Soil Management Procedures

A1. GENERAL

The procedures outlined below are provided for the management of the excavation, stockpiling, handling and transport of acid sulfate soils (ASS). The following options are proposed for the treatment of soils:

- On-site at an ASS treatment area.
- Off-site at an approved ASS treatment area/site.

ASS materials should be transported to an ASS treatment area as soon as practicable. The Site Supervisor or their delegated representative will be responsible for the excavation, stockpiling, handling and transport of excavated ASS materials. The Site Supervisor or their delegated representative will also be responsible for the supervision and management of the treatment area and for ensuring that the excavated ASS is remediated and verified in accordance with the ASS MP and associated procedures.

A2. OBJECTIVES

1) Appropriately manage the stockpiling, handling and transport of confirmed and suspected ASS materials.

2) Comply with conditions of licences, permits or other approvals issued for the project.

A3. STATUTORY REQUIREMENTS AND GUIDELINES

1) Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines V5.1, 2024. Dear SE, Williams KM, McElnea AE, Ahern CR, Dobos SK, Moore NG, and O'Brien LE. Department of Resources and Department of Environment, Science and Innovation, Queensland.

2) National acid sulfate soils identification and laboratory methods manual, National Acid Sulfate Soils Guidance, Water Quality Australia, June 2018.

3) National acid sulfate soils sampling and identification methods manual, National Acid Sulfate Soils Guidance, Water Quality Australia, June 2018.

4) Environmental Protection Act 1994.

5) Environmental Protection Policy (Water) 2009.

A4. MANAGEMENT MEASURES

A4 (A). MANAGEMENT OF EXCAVATIONS

An earthworks strategy shall be developed to plan and track movement, treatment and verification of ASS materials. This includes the location of the proposed off-site treatment area/site if off-site treatment is proposed.

All waters collected from groundwater (if encountered) and surface water inflow into excavations via seepage and runoff must be retained, monitored and appropriately treated to comply with the appropriate discharge criteria (Procedure C) prior to discharge off site or re-use on site.

A4 (B). STOCKPILING, HANDLING AND TRANSPORT OF ASS

Wherever practical the earthworks handling should involve transport directly from cut to treatment areas (both on or off-site). Stockpiling of untreated soils with potential acidity should be avoided. The recommended maximum time period for which soils can be temporarily stockpiled without treatment is 18 hours (overnight) for coarse sandy material, and 3 days (e.g., a weekend, 66 hours) for fine-textured silty clay material.

All confirmed ASS materials encountered during excavations will be transported to the designated ASS treatment area. Accurate details of material movements must be kept by the Site Supervisor or their delegated representative with respect to volumes, origin, material type and destination.

Due care is to be taken when transporting saturated/supersaturated soils and sediments (e.g., wet, silty/sandy material).

Any ASS materials that cannot be transported in the time frame detailed above must be stockpiled on site on a suitably prepared storage area, and the following additional management measures should be followed:

- Stockpiles are to be contained by bunds with stormwater runoff directed to a collection sump. Bunds are to be constructed from low permeability materials that are not ASS.
- A guard layer of neutralising agent (minimum 5 kg/m^2) should be spread across the soil surface prior to placement of the stockpile. The rate of neutralising agent applied should be based on 0.3 times the average total potential plus existing acidity for every 1 m height of soil in the stockpile.
- The surface area of the stockpile is to be minimised by shaping and possibly capping or covering to prevent moisture loss and rainfall entry.

A5. RESPONSIBILITIES

During stockpiling, handling and transport the following levels of responsibility shall exist:

- The Site Supervisor or their delegated representative is responsible for ensuring that the requirements of the ASS MP are communicated to site staff.
- The Site Supervisor or their delegated representative is responsible for ensuring the management strategies and procedures prescribed in the ASS MP are implemented at the site.
- All other site personnel are responsible for implementing and undertaking the management strategies and procedures prescribed in the ASS MP, as applicable to their work activities.

A6. MONITORING AND REPORTING

Records shall be kept by the Site Supervisor or their delegated representative to verify volumes of soils excavated and transported for treatment.

In addition, specific details regarding volumes, origin, material type and destination in conjunction with a photographic record of site development works associated with soil movements should be maintained by the Site Supervisor or their delegated representative.

The Site Supervisor or their delegated representative shall be responsible for ensuring that the excavated ASS materials are managed in accordance with details provided above.

B1. GENERAL

The procedures outlined below are provided for the on-site treatment and verification of identified ASS materials located across the proposed development site to be excavated during earthworks and construction. If off-site treatment is the preferred method, then the approved off-site treatment facility must have an approved ASS MP to receive the material excavated.

B2. OBJECTIVES

- Appropriately treat and manage ASS materials to minimise adverse effects on the natural and built environment (including infrastructure).
- Comply with conditions of licences, permits or other approvals issued for the project.

B3. STATUTORY REQUIREMENTS AND GUIDELINES

1) Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines V5.1, 2024. Dear SE, Williams KM, McElnea AE, Ahern CR, Dobos SK, Moore NG, and O'Brien LE. Department of Resources and Department of Environment, Science and Innovation, Queensland.
2) National acid sulfate soils identification and laboratory methods manual, National Acid Sulfate Soils Guidance, Water Quality Australia, June 2018.
3) National acid sulfate soils sampling and identification methods manual, National Acid Sulfate Soils Guidance, Water Quality Australia, June 2018.
4) Environmental Protection Act 1994.
5) Environmental Protection Policy (Water) 2009.

B4. TREATMENT MEASURES

B4 (a) Earthwork Strategy

An earthworks strategy shall be developed to plan and track movement, treatment and verification of confirmed ASS materials.

B4 (b) Treatment Facility

A treatment area shall be constructed within the site in general accordance with the requirement detailed in Soil Management Guidelines, 2024 (refer Image 1 below). If off-site treatment is the preferred option, then the off-site location must also have a treatment area constructed and an approved ASS MP to receive and treat ASS material. The results of the ASS investigation and liming rates must also be provided to the off-site treatment site.

The onsite treatment areas (if applicable) must also have the following additional requirements:

- The treatment area should be located within a suitable area on non-ASS materials.
- The treatment area shall be prepared by stripping vegetation, topsoil and soil containing significant amounts of organic material and compacting the surface with a smooth drum roller. An area of at least 1 m width shall be left between the treatment area and bunds to allow collection of runoff and direction to sumps. Refer to Procedure C for monitoring and treatment requirements applicable to collected waters.
- A guard layer of fine ground agricultural lime shall be applied to the treatment areas prior to placement of soils at a minimum rate 10 kg/m^2 for each 1 m height of soil to be treated, due to the difficulty in mixing soft clays.
- Reapplication of the guard layer will be necessary under areas of repeated temporary stockpiling.

The treatment facility shall be inspected daily and maintained to prevent escape of soils or water from the facility.

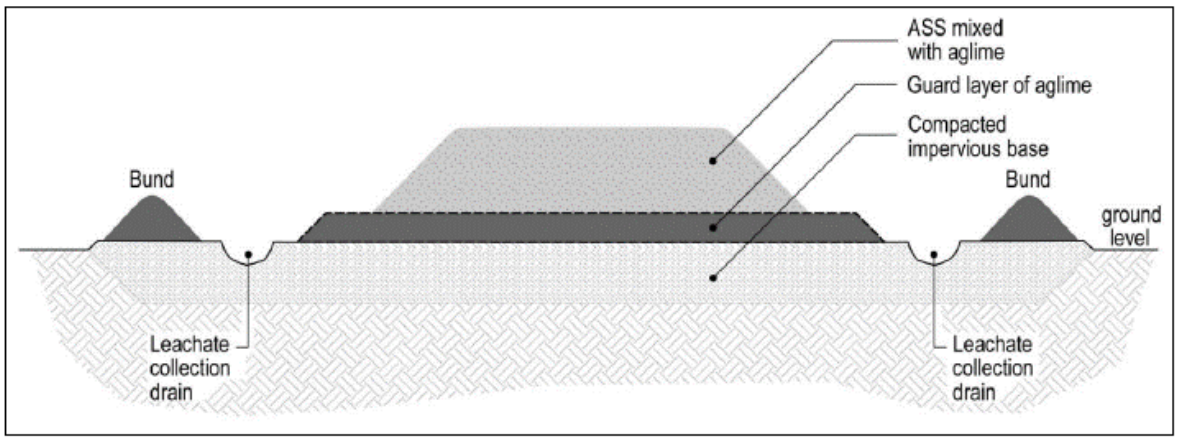

Image 1: Schematic cross-section of a treatment pad

B4 (c) ASS Treatment

Excavated ASS materials shall be stockpiled into identified treatment lots (not more than 250 m^3) within the treatment area where the material shall be spread in layers and allowed to dry (if required). The overall layer thickness shall be in layers with a maximum 300 mm loose thickness.

Where required, drying shall be enhanced by mechanical methods (rotary hoe, disc plough, etc) to create a relatively homogenous, friable material prior to addition of lime for neutralisation.

Maintain soil moisture through the following methods: controlled irrigation; covering with plastic to reduce evaporation; or application of lime soon after excavation of moist soils. These measures will improve the dispersion of lime throughout the soil profile.

Add and thoroughly mix lime (again using appropriate mechanical means e.g., a disk plough or harrows) using the calculated liming rate.

B4 (d) Liming Rates

Liming rates have been calculated in kg $CaCO_3/m^3$, using a factor of safety (fineness factor) of 1.5 and an assumed bulk density of 1.8 tonne/m^3.

Calculation of liming rates are presented in Table B1, below.

Table B1: Liming Rates

Soil Type	Colour	Bottom of Layer, Depth Range	Treatment Rate**
Gravelly Clay (Fill)	Brown	0.0 – 0.75 m BGL	Nil
Alluvial Clays / Fill Dredging Spoil	Grey, dark grey, dark brown and black	0.75 – 3.0 m BGL*	50 kg $CaCO_3/m^3$

Note: * Maximum depth of ASS sampling and analysis
** Liming rate based on 90th percentile values.

B4 (e) Verification Testing

Verification samples shall be collected for treated material at a rate of 1 sample per 250 m^3. The samples shall be formed by compositing materials from three randomly selected locations. Samples shall be collected over the full thickness of the treated lot. The Chromium Suite shall be conducted on each sample to confirm net acidity by Acid Base Accounting.

B5. PERFORMANCE CRITERIA

To confirm adequate lime treatment, laboratory testing must demonstrate the following:

- A neutralising capacity of more than 1.5 times the sum of existing plus potential acidity, all measured in the same units (and using a minimum safety factor of 1.5).
- A pH_{KCL} value of equal or greater than 6.5.

B6. CONTINGENCY MEASURES

Additional lime treatment and further verification testing shall be conducted where adequate neutralisation is not initially indicated.

B7. PERFORMANCE INDICATORS

Table B2: Performance Indicators

Item	Performance Indicator
Earthworks strategy	■ An appropriate earthworks strategy has been prepared to track characterisation, treatment and verification of each earthworks lot.
Liming rates	■ Correct liming rates are applied.
Treatment verification	■ Verification samples collected for each identifiable 250 m^3 of treated material. ■ If verification shows material has a positive net acidity, additional treatment has been employed.
Non conformance	■ All non-conformances are reported and rectified.

B8. MONITORING AND REPORTING

Records shall be kept to verify volumes of soils transported to the treatment facility.

The Site Supervisor shall be responsible for ensuring that lime neutralisation and verification tests are completed for each 250 m^3 of excavated ASS material.

The Site Supervisor shall maintain a register of testing results and a record of inspections.

A summary report of all test results and inspections shall be complied by the Site Supervisor each week and retained on site.

C1. GENERAL

The procedures outlined below are provided to monitor and manage water quality in open excavations and run-off collection in treatment areas. Contingency measures are also provided for treatment and discharge of minor amounts of water.

C2. OBJECTIVES

- Appropriately monitor waters entering open excavations.
- Appropriately manage waters to be discharged from open excavations.
- Appropriately monitor and treat (if required) run-off collected in treatment areas.
- Appropriately monitor groundwater to identify water quality changes that may indicate ASS impact.
- Comply with conditions of licences, permits or other approvals issued for the project.

C3. STATUTORY REQUIREMENTS AND GUIDELINES

1) State Planning Policy, July 2017
2) State Planning Policy – State Interest Guideline Water Quality April 2016 (Policy 9)
3) *Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines V5.1,* 2024. Dear SE, Williams KM, McElnea AE, Ahern CR, Dobos SK, Moore NG, and O'Brien LE. Department of Resources and Department of Environment, Science and Innovation, Queensland.
4) National acid sulfate soils sampling and identification methods manual, National Acid Sulfate Soils Guidance, Water Quality Australia, June 2018.
5) Environmental Protection Act 1994.
6) Environmental Protection Policy (Water) 2009.

C4. IMPLEMENTATION MEASURES

The following provides a list of the environmental control measures for management of surface water and groundwater at the site:

- Water quality monitoring will be undertaken in accordance with Section C5.
- All surface water run-off and groundwater seepage (if encountered) within excavations is to undergo monitoring to determine if treatment is required for quality correction prior to off-site discharge, or reuse on site.
- Agricultural lime or caustic soda will be kept on site at all times for pH adjusting of waters before discharging.
- Discharge to surface waters, sewers or stormwater should meet with the requirements and conditions of the disposal permit issued for the project.
- Two groundwater monitoring wells shall be installed external to the proposed excavation (and in locations where they won't be disturbed by the surrounding building works). Groundwater monitoring wells shall be monitored four times over a period of two months before earthworks and construction commence to establish baseline levels of the following parameters:
  - Field measurements of pH, redox potential (Eh or ORP), dissolved oxygen, standing water level and electrical conductivity (EC)
  - Laboratory measurements chloride, sulfate, total acidity, total alkalinity, dissolved aluminium (filtered), and dissolved iron (filtered).

C5. INSPECTION AND MONITORING

C5 (a) Surface Water Monitoring

Waters from dewatering (if required) and all surface water run-off and groundwater seepage within excavations shall be monitored prior to discharge during bulk earthworks and construction works. Surface water shall be monitored for pH, dissolved oxygen, suspended solids, oil, grease floating scum, litter and total and dissolved aluminium and iron.

Surface water not meeting the performance criteria specified in Section C6 will require treatment prior to discharge.

C5 (b) Groundwater Monitoring

- During construction (excavation works) monitoring of groundwater shall comprise monthly monitoring of the following:
  - Field measurements of pH, redox potential (Eh or ORP), standing water level and electrical conductivity (EC).
  - Laboratory measurements chloride, sulfate, total acidity, total alkalinity, and total and dissolved aluminum and iron.
- Post construction monitoring comprising four groundwater monitoring events over a period of two months for the following parameters:
  - Field measurements of pH, redox potential (Eh or ORP), standing water level and EC.
  - Laboratory measurements chloride, sulfate, total acidity, total alkalinity, dissolved aluminium (filtered), and dissolved iron (filtered).

Extension of the post construction monitoring program beyond this will be determined by a suitably qualified Environmental Consultant following review of post construction results.

C6. PERFORMANCE INDICATORS

C6 (a) Surface Water Performance Indicators

The following adopted performance indicators, refer table C1, are considered as acceptable outcomes in relation to ASS and disposal of all waters including stormwater run-off, groundwater seepage and leachate from ASS will achieve the following quality prior to release from the site.

Table C1: Adopted Performance Indicators.

Parameters	Units	Performance Indicator
pH	pH	Within the range of 6.5 to 8.5 pH units
Suspended Solids	mg/L	< 50 mg/L
Dissolved Oxygen	mg/L	> 6.0 mg/L
Oil, grease, floating scum, litter	n/a	No visible plume or evidence
Dissolved Iron	mg/L	< 1000 µg/L (National ASS Guidelines)
Dissolved Aluminium	mg/L	< 150 µg/L (National ASS Guidelines)

C6 (b) Groundwater Performance Indicators

Table C2: Groundwater Baseline Performance Range.

Parameters*	Units	Baseline Performance Range	Site Specific Criteria
pH	pH	Neutral conditions	Baseline - 0.3 pH unit change below the lower baseline range and an upper limit of 8.5
Aluminium (dissolved)	mg/l	Yet to be determined	+/- 10% of baseline range
Aluminium (total)	mg/l	Yet to be determined	+/- 10% of baseline range
Iron (dissolved)	mg/l	Yet to be determined	+/- 10% of baseline range
Iron (total)	mg/l	Yet to be determined	+/- 10% of baseline range

* Note that total acidity/alkalinity & chloride:sulfate ratio should also be monitored, but no performance limits are set

C7. CONTINGENCY MEASURES

All surface waters (any waters collected in excavations) and precipitates that cannot be contained and treated for discharge off site are to be removed and disposed of through trade waste or another lawful method.

C8. MONITORING & REPORTING

The Site Supervisor shall be responsible for ensuring all on-site monitoring listed in section C5 is conducted at the required frequency.

The Site Supervisor shall maintain a register of all on-site testing results and a record of inspections.

A summary report of all test results and inspections shall be compiled by the Site Supervisor each week and submitted to the Project Manager.

The Site Supervisor shall inform the Project Manager of non-compliance upon detection. The Project Manager shall inform Council of such non-compliances as soon as practicable and instigate an assessment of the impact.

Appendix B
Limitations

LIMITATIONS

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core
consultants pty ltd

Head Office | **Sunshine Coast**
Unit 1 / 18 Lysaght Street
Coolum Beach Qld 4573

T 07 5475 5900

Brisbane
Unit 3 / 31 Londor Close
Hemmant Qld 4174

T 07 3569 2907

E info@coreconsultants.com.au

www.coreconsultants.com.au