



Acid Sulphate Soil Management Plan

Brymer Development

CMW Geosciences Ltd

Prepared by:

SLR Consulting New Zealand

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1.0	5 August 2026	L. Lutes	C. Newland	N. Mather
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Basis of Report

This report has been prepared by SLR Consulting New Zealand (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with CMW Geosciences Ltd (CMW, or the 'Client'). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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SLR disclaims any responsibility to CMW and others in respect of any matters outside the agreed scope of the work.

Statement of Qualifications and Experience

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I hold the qualification of Bachelor of Environmental Science degree from the University of Royal Roads in Victoria, British Columbia, Canada.

I have over ten years of experience in preliminary and detailed site investigations and remediation.

I confirm that, in my capacity as author of this report, I have read and abide by the Environment Court of New Zealand Practice Note 2023, and in particular section 9 the Code of Conduct for Expert Witnesses.

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I confirm that, in my capacity as reviewer of this report, I have read and abide by the Environment Court of New Zealand Practice Note 2023, and in particular section 9 the Code of Conduct for Expert Witnesses.

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I confirm that, in my capacity as approver of this report, I have read and abide by the Environment Court of New Zealand Practice Note 2023, and in particular section 9 the Code of Conduct for Expert Witnesses.



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Acronyms and Abbreviations

ANC	Acid Neutralizing Capacity
AASS	Actual Acid Sulfate Soil
ASS	Acid Sulfate Soil
ASSMP	Acid Sulfate Soil Management Plan
CaCO ₃	Calcium Carbonate
CRS	Chromium Reducible Sulphur
EPA	Environmental Protection Authority
FeS ₂	Pyrite (Iron Disulfide)
H ₂ S	Hydrogen Sulphide
H ₂ SO ₄	Sulfuric Acid
m bgl	Meters below ground level
MfE	Ministry for the Environment
mg/kg	Milligrams per kilogram
m ³	Cubic meter
NAG	Net Acid Generation
NAPP	Net Acid Producing Potential
NEPM	National Environment Protection Measure
NESCS	National Environmental Standards for Assessing and Managing Contaminants in Soil
PASS	Potential Acid Sulfate Soil
pH	Potential of Hydrogen (acidity/alkalinity level)
pH _F	Field pH
pH _{FOX}	Peroxide Oxidation pH
SLR	SLR Consulting New Zealand Ltd
SPOCAS	Suspension Peroxide Oxidation Combined Acidity and Sulphur
SNAS	Sulfate – Soluble Actual Sulfate
TAA	Titrateable Actual Acidity
TPA	Titrateable Peroxide Acidity
TSP	Total Sulphur Percentage
WRC	Waikato Regional Council
%S	Percent Sulphur
ΔpH	Change in Potential of Hydrogen (acidity/alkalinity level)



1.0 Introduction

CMW Geoscience Ltd has engaged SLR Consulting New Zealand Ltd (SLR) to prepare this Acid Sulphate Soils Management Plan (ASSMP) to support the fast-track lodgement for the Brymer Farms Limited (Bryer Farms) residential development project (the Project). The Project is located on 81 hectares of pastoral land located between Brymer Road, Rotokauri, and Whatawhata Road, State Highway 23, Hamilton (the Site). The legal description of the Site is Lot 1 DP 87291; Lot 22 DP 79526; Part Lot 2 DP 18355 / Allotment 365 Pukete PSH.

Refer to **Figure 1** for the Site Location and Layout Plan.

1.1 Project Description

The Brymer Farms Limited development (the Project) is a comprehensively planned, multi-staged residential development providing for the urbanisation and subdivision of the Site. The Project is the subject of a Notice of Decision by the Minister, dated 4 September 2025, to refer the Project. It seeks the land use, environmental, subdivision and associated infrastructure consents required to enable the development to be delivered progressively and in a coordinated manner.

The Project will provide approximately 1,043 residential units, including approximately 248 apartment units, across a range of housing typologies and densities. Housing will comprise a mix of terraced, duplex and detached dwellings, conventional and compact residential lots, irregular lots, and eight larger rural-residential lots. This range of typologies is intended to provide housing choice while enabling the development pattern to respond appropriately to the physical characteristics, environmental features and constraints of the Site.

The Project master plan also provides for two mixed-use commercial sites, identified as C1 and C2, which will form a neighbourhood scale commercial component within the development. C1 will provide approximately 910 m² of ground-floor commercial gross floor area (GFA), with 24 two-bedroom apartments above. C2 will provide approximately 1,274 m² of ground-floor commercial GFA, with 16 two-bedroom apartments above. Both commercial sites will incorporate basement car parking, dedicated vehicle access, servicing areas and landscaping. Collectively, C1 and C2 will provide approximately 2,184 m² of commercial GFA and 40 apartments, supporting the day-to-day needs of residents and contributing to a mixed-use neighbourhood environment.

The Project will be supported by the necessary transport and three-waters infrastructure. Water supply and wastewater servicing will connect to the IAWAI reticulated networks, with internal reticulation and associated infrastructure established progressively as the Project development is staged. This may include pump stations, storage, reservoirs and mains, where required. Stormwater will be managed through an integrated stormwater management system, with discharge ultimately occurring to the receiving environment within the Waikato District. The stormwater system will incorporate appropriate treatment, attenuation and conveyance measures and will integrate, where appropriate, with proposed wetlands, watercourses, stormwater reserves and other water-sensitive design features throughout the Project development.

Implementation of the Project will require staged development related earthworks to establish suitable building platforms, a well-connected road network, infrastructure corridors, reserves and other components of the master plan. These works will include Site formation, cut and fill, retaining, erosion and sediment control, and other enabling works required to facilitate the staged subdivision and development of the Site. The proposal will also require the undergrounding of existing power lines within the Applicant's site.



A significant component of the Project is the provision and enhancement of open space and ecological values. The development will provide an integrated network of public and recreational open spaces, pedestrian connections, wetlands, watercourses, stormwater reserves, landscaped areas and retained vegetation. Environmental and ecological mitigation and offsetting will also be provided where required to address effects arising from the Project development and to support the protection, restoration and enhancement of ecological values across the Site and wider receiving environment. Where appropriate, these measures will be integrated with the development's open-space and stormwater networks.

The overall open-space and movement network will connect with the surrounding urban environment and existing reserves, including Rakautahi Park, Brymer Glen Reserve, Brymer Park and Te Kootii Park. These connections will provide links between residential neighbourhoods, commercial and community areas, recreational spaces and the wider transport network.

Overall, the Project is a large scale, comprehensively planned urban development that will enable approximately 1,043 residential units, including approximately 248 apartments, together with approximately 2,184 m² of commercial GFA. The Project encompasses the subdivision and development of the land and the associated development related earthworks, transport and access infrastructure, water supply and wastewater connections to the IAWAI reticulated networks, stormwater management and discharge, ecological mitigation and offsetting, landscaping, open space, recreation, and other supporting infrastructure necessary to establish the new community.

The Project will be implemented through a multi-staged consenting and development framework, enabling subdivision, land use and infrastructure works to proceed progressively while ensuring that each stage is appropriately serviced and integrated with the wider development and surrounding environment.

The Project development will be subject to a comprehensive suite of proposed conditions of consent, including a design guide, developed with input from the Applicant's relevant technical and environmental specialists. These conditions will provide the framework for managing the construction, staging, servicing and operation of the development, including earthworks, transport, three-waters infrastructure, stormwater discharges, ecological effects and offsetting, landscaping and open space, and other potential environmental effects associated with the Project.

Collectively, the master plan, supporting technical assessments and proposed conditions of consent provide an integrated framework for the staged delivery and management of the Project, including measures to avoid, remedy or mitigate adverse environmental effects and, where appropriate, provide environmental offsets.

1.2 Background

Acid sulphate soils (ASS) are naturally occurring soils, sediments and peats that contain iron sulphides. The two forms include actual acid sulphate soils (AASS), which have already undergone oxidation and are highly acidic, and potential acid sulphate soils (PASS), which are unoxidised but can cause potential acidity issues upon exposure to oxygen.

Waikato Regional Council (WRC) commissioned an assessment of ASS risk in the Waikato Region, following the observation of several adverse environmental impacts attributed to the presence of ASS.

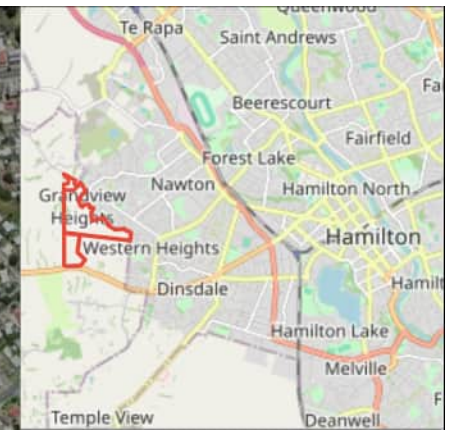
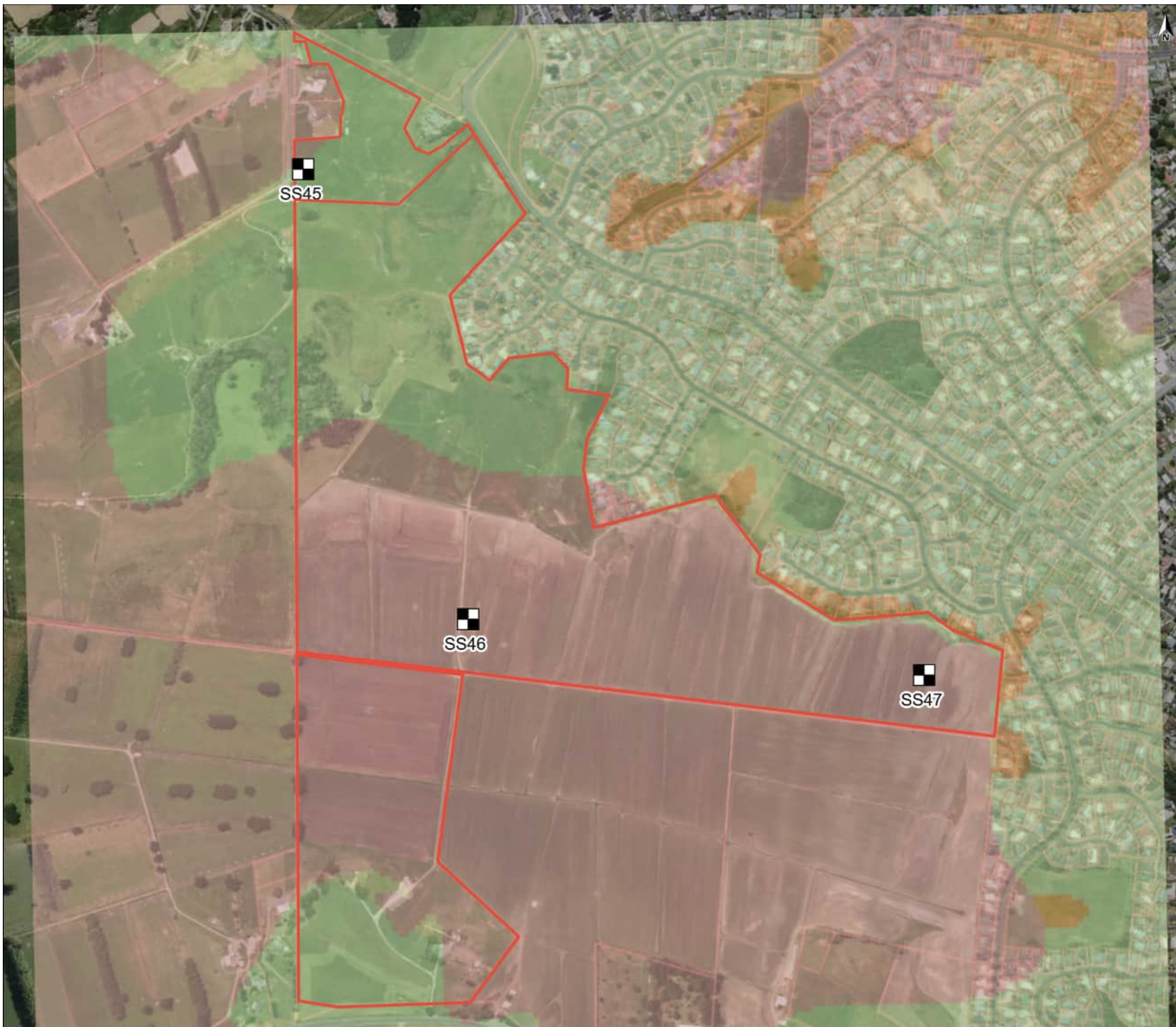
The Waikato Region comprises two primary basins, specifically the Waikato Basin and the Hauraki Basin. The two basins consist of marine coastal deposits which, when combined with erosion and drainage channels from elevated volcanogenic areas, can contribute to the presence of sulphur in sediments and create suitable conditions for ASS generation.



A map identifying the probability of occurrence of ASS in the Waikato Region is included in the WRC 2024 report and has been overlaid with the ASS sample locations and Probability Map (refer to **Figure 1**, in **Appendix A**). The map indicates that the middle of the proposed Site development is located within areas with a high probability of ASS occurrence, and negligible probability in the northernmost and southernmost portions of the Site.

In addition to the regional mapping, CMW undertook a desktop study and geotechnical investigation of the Project, reviewing geological and geotechnical information to refine the areas of highest ASS risk. CMWs elevation desktop study and test pit logs are presented in **Appendix A**.





- Legend**
- Site Boundary
 - Low Risk
 - Medium Risk
 - High Risk
 - Sample Locations
 - ASS Probability Map

0 100 m 200 m
LINZ CC BY 4.0 © Imagery Basemap contributors



Produced by **Datanest.earth**

Title: Site Location and Layout Plan		
Client: CMW Geosciences		Size: A4
Project: Brymer Development DSI	Drawn: LL	Figure No.: 1
Date: 05-08-2026	Checked: NM	
Proj No: 810.031825.00001	Scale: 1:9500	Version: 1.0

1.3 Report Purpose

This ASSMP has been prepared to support the proposed Brymer Farms residential development and the fast-track consent requirements. It outlines a preliminary approach for the identification, testing, and management of potential acid sulphate soils (PASS) / actual acid sulphate soils (AASS) that may be encountered during future earthworks and construction activities.

This ASSMP includes proposed soil sampling and analytical testing in areas of low to moderate-risk acid-generating potential (0.25 – 2.00 metres below ground level (m bgl)) to further refine management protocols, and sets out indicative management and monitoring measures for these areas. These measures are intended to guide earthworks contractors and inform any future updates to the plan as further Project-specific data becomes available.

1.4 Objectives

The primary objective of this ASSMP is to ensure the PASS or AASS at the Project is confirmed through an appropriate testing schedule prior to or during Project development. Where PASS or AASS are identified, this ASSMP outlines measures to manage the material in accordance with best practice and relevant regulatory requirements.

The specific objectives of this ASSMP are to:

- Implement a testing programme to further characterise the presence and extent of AASS and/or PASS at the Project
- Assist in preventing the generation and discharge of acid drainage.
- Avoid off-site migration of acidic or metal-laden leachate.
- Comply with applicable regulatory requirements, including:
 - Waikato Regional Plan Rule 5.2.5.
 - Resource consent conditions.
- Support the safe excavation, treatment, and disposal of impacted soils.
- Set out procedures required under resource consents, specifically to:
 - a) Treat and/or manage acid sulfate soils excavated from the site (including support for safe excavation, treatment, and disposal).
 - b) Treat and/or manage the risk of discharges of impacted water.
 - c) Manage any potential impacts from actual acid sulfate soils that will remain in-situ.
 - d) Set a standard for the re-use of treated soils on site.

This ASSMP provides information on the following procedures (if required):

- Soil sampling methodology.
- Mitigation and control measures.
- A monitoring programme.
- Contingency procedures for unexpected ASS discovery or treatment failure.



1.5 Consultation

Consultation will be undertaken to ensure the ASSMP aligns with the expectations and requirements of the relevant consenting authority and stakeholders. Such as:

- Project kick-off meeting to include the following:
 - Review of the previous ASS Investigation to identify potential acid-generating risk areas.
 - Review of this ASSMP based on the 2025 ASS Investigation.
 - Potential for further screening tests (both field and lab) to assess the level of risk and inform a finalised ASSMP
- Inform contractors and Project Operators: This ASSMP has been prepared to provide guidance to any future contractor undertaking earthworks within areas of PASS. The plan will be provided to the contractor(s) for implementation and training purposes prior to the commencement of works.

Additional consultation may be undertaken as the project progresses and if further Project-specific information becomes available. This report will be updated as required based on the outcomes of future consultation.

1.6 Consent Condition Framework

Consents will be issued from WRC to support the Project development. An outline of the conditions related to ASS management will be summarised and addressed in this ASSMP once made available.



2.0 Guidance and Standards

This ASSMP has been developed to provide general guidance on the identification, treatment, and management of PASS and AASS that may be encountered during construction activities.

The management approach is informed by industry best practices and technical guidance. These documents have been referenced to ensure the ASSMP aligns with established procedures for environmental protection and compliance.

- Ahern, C.R., McElnea, A.E., & Sullivan, L.A. (2004). *Acid Sulfate Soils Laboratory Methods Guidelines*. Queensland Department of Natural Resources, Mines and Energy, Indooroopilly, Queensland, Australia.
- Dear, S.E., Ahern, C.R., O'Brien, L.E., Dobos, S.K., McElnea, A.E., Moore, N.G., & Watling, K.M. (2014). *Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines* (4th ed.). Department of Science, Information Technology, Innovation and the Arts, Queensland Government, Brisbane.
- EPA Victoria (2009). *Publication 655.1: Acid Sulfate Soil and Rock*. Environment Protection Authority Victoria, Melbourne.
- Environment Protection and Heritage Council and the Natural Resource Management Ministerial Council (2011). *National Guidance for the Management of Acid Sulfate Soils in Inland Aquatic Ecosystems*, Canberra, ACT.
- International Organization for Standardization (2018). *ISO 31000:2018 - Risk Management - Guidelines*. ISO, Geneva.
- Ministry for the Environment (MfE) *National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health* (NESCS) under the Resource Management Act 1991.
- Mulvey, P. (2004). *Acid Sulfate Soil: A Review of Methods, an Interpretation of Chemistry and Derivation of Hazard Assessment* (Technical Paper 17). Department of Environment and Heritage, Australian Government.
- National Environment Protection Council (NEPC) (2013). *National Environment Protection (Assessment of Site Contamination) Measure 1999 (Amended 2013)*. National Environment Protection Council Service Corporation, Adelaide.
- New Zealand Government (1991). *Resource Management Act 1991 (RMA)* - Sections relating to discharges of contaminants and duty to avoid, remedy, or mitigate adverse effects (Sections 15 and 17).
- Stone, Y., Ahern, C.R., & Blunden, B. (1998a/b). *Acid Sulfate Soils Manual & Assessment Guidelines*. Acid Sulfate Soils Management Advisory Committee (ASSMAC), NSW Agriculture, Wollongbar, NSW.
- Water Quality Australia (WQA) (2018a). *National Acid Sulfate Soils Guidance: National Acid Sulfate Soils Sampling and Identification Methods Manual*. Department of Agriculture and Water Resources, Canberra ACT.
- WQA (2018b). *National Acid Sulfate Soils Guidance: National Acid Sulfate Soils Identification and Laboratory Methods Manual*. Department of Agriculture and Water Resources, Canberra, ACT.
- WQA (2018c). *Acid Sulfate Soils Guidance: A Synthesis*. Department of Agriculture and Water Resources, Australian Government, Canberra ACT.



- Waikato Regional Council (2023). *Waikato Region Acid Sulfate Soils Preliminary Risk Assessment*. Hamilton, New Zealand.
- Waikato Regional Council - *Waikato Regional Plan - Rule 5.2.5: Implementation Methods - Cleanfilling* and Overburden* Disposal*.
- Waikato Regional Council (2025) – *Waikato Regional Council's acid sulphate soils technical guidance*. Hamilton, New Zealand.

These references form the basis for precautionary soil management, especially where ASS risk is suspected based on regional geology, topography, and land use history.



3.0 Potential Issues

3.1 Identification of Acid Sulphate Soils

3.1.1 General

ASS are the common name given to naturally occurring sediments and soils containing iron sulphides (principally iron sulphide or iron disulphide or their precursors).

PASS, when left undisturbed in a waterlogged state, typically do not present a significant risk. However, when PASS is drained or excavated, they become oxygenated and produce AASS which can result in the mobilisation of metals and nutrients that presents a risk to public and private infrastructure and the surrounding environment.

AASS and PASS are often found in the same soil profile, with AASS generally overlying PASS horizons. AASS are soils containing highly acidic soil horizons or layers resulting from the aeration of soil materials that are rich in iron sulphides. This oxidation results in soils of $\text{pH} \leq 4$, when measured in dry season conditions, and are usually yellow/orange in colour with red mottling.

PASS are soils which contain iron sulphides or sulfidic material which have not been exposed to air and oxidised. The field pH (pH_F) of these soils in their undisturbed state is $\text{pH} > 4$ and may be neutral or slightly alkaline. PASS soils usually appear as dark grey, dark brown, or medium to pale grey to white in colour.

3.1.2 Visual Identification

A visual assessment of topography and geomorphology, combined with the information collected during the desktop assessment, should provide an indication of areas most likely to have ASS occurrence. A list of soil, water and vegetation indicators suggestive of the presence of ASS materials is summarised in **Table 1**.

Table 1: Summary of Common Visual and Field Indicators of ASS Material

Characteristic		Details and Indicators
Visual Identification	Sediment Characteristics	- Sediments of recent geological age (Holocene). - Marine or estuarine sediments. - Areas identified in geological descriptions or in maps as bearing sulphide minerals, coal deposits or former marine shales/sediments (geological maps and accompanying descriptions may need to be checked). - Deep estuarine sediments greater than 10 metres below ground surface, Holocene or Pleistocene age (only an issue if deep excavation or drainage is proposed).
	Landscape Characteristics	- Waterlogged or scalded areas. - Tidal lakes. - Coastal wetlands or back swamp areas. - Interdune swales or coastal sand dunes (if deep excavation or drainage proposed).
	Vegetation Characteristics	Areas where the dominant vegetation is mangroves, reeds, rushes etc.

3.1.3 Field Indicators

Many of the indicators for AASS and PASS are substantially different, and commonly AASS are found overlaying PASS, and both are often covered by non-ASS topsoil layers. Common indicators of PASS are summarised in **Table 2**.



Table 2: Common Indicators of PASS and AASS Materials

Soil Type	Indicators
PASS	Soil characteristics: • Soil $pH_F > 4$ and commonly neutral. • Soil $pH_{FOX} < 3$, with large unit change from pH_F to pH_{FOX}, together with volcanic reaction to peroxide. • Waterlogged soils - unripe muds (soft, sticky and can be squeezed between fingers, blue grey or dark greenish grey mud with a high-water content, silty sands or sands (mid to dark grey) or bottom sediments (dark grey to black for example mono-sulfidic black oozes) possibly exposed at sides and bottom of drains or cuttings. • Peat or peaty soils. • Coffee rock horizons. • Sulphurous smell, for example hydrogen sulphide or 'rotten egg' gas. Water characteristics: • Waterlogged soils. • Water pH, usually neutral but may be acidic. • Oily looking iron bacterial surface scum (the similar appearances of iron bacterial scum and a hydrocarbon slick can be differentiated by disturbing the surface with a stick - bacterial scum will separate if agitated whereas a hydrocarbon slick will adhere to the stick upon removal). Vegetation characteristics: Dominant vegetation is tolerant of salt, acid and/or waterlogging conditions for example samphire, salt couch, Phragmites (a tall acid-tolerant grass species), swamp-tolerant reeds, rushes, paperbarks and casuarinas.
AASS	Soil characteristics: • Soil $pH_F < 4$ (when soil $pH_F > 4$ but < 5 this may indicate some existing acidity, and other indicators should be used to confirm presence or absence of AASS). • Sulphurous smell for example hydrogen sulfide or 'rotten egg' gas. • Red / jarositic horizons or substantial iron oxide mottling in the surface encrustations or in any material dredged or excavated and left exposed. • Presence of corroded mollusc shells. Water characteristics: • Water of pH < 5.5 (and particularly below 4.5) in surface water bodies, drains or groundwater (this is not a definitive indicator as organic acids may contribute to low pH in some environments such as Melaleuca swamps). • Unusually clear or milky blue-green water flowing from or within the area (aluminium released by ASS materials acts as a flocculating agent). • Extensive iron stains on any drain or pond surfaces. • Iron-stained water and ochre deposits. • Oily looking bacterial surface scum (differentiated from a hydrocarbon slick of similar appearance as described for PASS). Vegetation characteristics: • Dead, dying, stunted vegetation. • Scalded or bare low-lying areas. • Poor vegetation regrowth in previously disturbed areas. Infrastructure: • Corrosion of concrete and/or steel structures (including foundations, fences, masonry/brick walls, pipes). • Waterlogged or scalded areas. • Tidal lakes. • Coastal wetlands or back swamp areas. • Interdune swales or coastal sand dunes (if deep excavation or drainage proposed).



3.2 Construction Activities

Construction activities which have the potential to cause AASS / PASS related impacts include:

- Shallow / deep excavation.
- Stockpiling of impacted material.
- Transportation of impacted material.
- Dewatering.

3.3 Potential Environmental Impacts

Potential ASS impacts from construction activities may include:

- Uncontrolled surface runoff in areas of exposed or stockpiled AASS / PASS, causing the release of acid into the environment.
- Changes to surface run-off patterns promoting the release of acid into the environment.
- Leaching of acid into the environment in the vicinity of the treatment area at the construction site.
- Exposing AASS / PASS at or near new drains or nearby water courses, thus causing the release of acid into the environment in the short- and long-term.
- Exposure of saturated sediments impacted with AASS / PASS to oxygen in excavations causing oxidation and increased release of acid into the environment.



4.0 Project Identification and Setting

Project identification details are provided in **Table 3**.

Table 3: Project Identification

Aspect	Description
Location	81 hectares of pastoral land located between Brymer Road, Rotokauri, and Whatawhata Road, State Highway 23, Hamilton. Refer to Figure 1 .
Project Area	The Project development encompasses three lots: - Lot 1 DP 87291 - Lot 22 DP 79526 - Part Lot 2 DP 18355 / Allotment 365 Pukete PSH The properties encompass a total area of approximately 81 hectares.
Government Authority	Local Authority: Waikato District Council (WDC) Regional Authority: Waikato Regional Council (WRC)
Land Use Zoning	The Project is zoned 'General Rural Zone (GRUZ)' under the Waikato District Plan – Operative in Part. We understand that the Project will be redeveloped for residential land use.

Project setting details are provided in **Table 4**.

Table 4: Project Setting

Setting Type	Details
Elevation and Topography	The topography of the Project area is low-lying peat soils generally found at 20 – 30 m elevation above sea level datum (asld) with rolling hill areas in the northernmost and southernmost portions of the Project area found at 30 – 55 m asld.
Geology	Based on the Geological and Nuclear Sciences (GNS) 1:250,000 geological map, the Project area is underlain by Holocene swamp deposits, described as soft, dark brown to black, organic mud, muddy peat and woody peat.
Hydrology	There are five surface water bodies within 6 kms of the Site: - Horseshoe Lake / Lake Waiwhakareke (1.8 km northeast) - Lake Rotokauri (3.24 km northwest) - Ohote Stream (5.8 km northwest) - Waikato River (4.55 km east) - Waipa River (5.5 km west)
Hydrogeology	A search of the Wells Aotearoa Map, conducted on 13 October 2025, identified four bores within the Project area. The use of the bores is unknown and the depth to groundwater was not recorded: - BH ID 72_11240 (within southwest portion of Project area) 139.50 m bgl depth; depth to groundwater 8.2 m bgl - BH ID 72_12997 (middle of Project area) - BH ID 72_12996 (within northern portion of Project area) - BH ID 72_11239 (within northeast portion of Project area) 113.0 m bgl depth; depth to groundwater 25.53 m bgl
Preliminary Acid Sulphate Soil Risk	The high-level ASS investigation for the Project (refer to Section 5.0) identified a risk of acid-generating potential, particularly the middle portion of the Project area between 0.25 to 2.00 m bgl within peat and clayey silt horizons, based on both regional mapping and site-specific investigations:



Setting Type	Details
	- The WRC 2024 map indicates that most of the middle portion of the Project area lies within zones of high ASS probability, with the northernmost and southernmost portions showing negligible probability (refer to Figure 1). - Field and laboratory analysis identified an overall risk of encountering acid-generating soils as moderate-risk. Further targeted investigation may be required during detailed design or early construction stages to refine the vertical and lateral extent of PASS materials to inform management.



5.0 Works Undertaken

5.1 Hand Auger Investigation

The ASS investigation was undertaken on 18 November 2025 by SLR Consulting, targeting high-risk areas identified from the WRC ASS probability map and utilising elevation and test pit data from the CMW desktop study. A total of three hand auger locations (SS45 – SS47) were advanced across the Project footprint to provide an indicative assessment of ASS risk. The investigation did not provide a comprehensive spatial certainty across the entire Project footprint. Refer to **Figure 1** for the investigation locations.

5.2 Field Assessment

The following preliminary assessment at each hand auger location was undertaken:

- Recording soil stratigraphy at each hand auger (refer to soil logs and profile photographs in Error! Reference source not found.).
- Field screening was undertaken every 0.25 m to determine soil pH (pH_F) and field oxidised pH (pH_{FOX}), providing an initial assessment for the presence of reduced inorganic sulphur.
- Representative soils were placed directly into an ice-filled container for transportation to ALS Global with full chain-of-custody documentation. Sample collection comprised the following:
 - Soil samples were collected at 0.25 m intervals to a maximum depth of 2.00 m bgl at each hand auger location and subsequently placed into laboratory supplied plastic bags for PASS.

5.3 Laboratory Analysis

All laboratory analyses were undertaken by ALS Global. Two samples from each location were scheduled for Chromium reducible sulphur (CRS) analyses at the laboratory, which included:

- pH_{KCl} .
- Titratable actual acidity (TAA).
- Net acid soluble sulfur (SNAS).
- Acid neutralising capacity (ANC), with
- Acid-base accounting (ABA) of net acidity (NA) = CRS + TAA + SNAS – ANC.



6.0 Sulfidic Hazard Classes & Acid Base Accounting

Soil hazard classes for the management of ASS are used to assist with the interpretation of the potential environmental impact of soil acidification as a result of reduced inorganic sulfide (RIS or S) oxidation.

These soil hazard classes refer to procedures in the Acid Sulfate Soils Management Advisory Committee (ASSMAC) guidelines (Stone *et al* 1998) (refer to **Table 5**).

The soil hazard classes are based on the soil sulphur (S) and net acidity (NA) values. Classes normally used are no risk (no-sulphur or non-reactive), moderate risk and high risk. An explanation of these classes is presented in the following subsections. NA is calculated based on the acid-base account (ABA) of the soil being analysed:

- $NA = \text{Total potential acidity (TPA)} + \text{Existing acidity (CRS)} - \text{Acid neutralising capacity (ANC)}$.
- $\text{Existing acidity (CRS)} = \text{Titratable actual acidity (TAA)} + \text{Retained acidity (S}_{NAS}) \times \text{TPA}$.

Hence, the final equation is:

$$NA = CRS + TAA + S_{NAS} - ANC$$

The Sulphide Hazard Class (SHC) in kg sulphuric acid (H_2SO_4) per tonne is expressed by converting the %S threshold values into the equivalent amount of H_2SO_4 produced if all sulphide oxidises. This comes from atomic mass relationship:

$$1\% \text{ S} = 10 \text{ kg S per tonne} \rightarrow \times 3.06 = 30.6 \text{ kg } H_2SO_4$$

- SHC1 / low-no hazard threshold corresponds to:
 - $< 0.03\% \text{ S}$
 - $< 0.918 \text{ kg } H_2SO_4 / \text{tonne}$.
- SHC2 / moderate hazard threshold corresponds to:
 - $0.03 - 0.75\% \text{ S}$
 - $0.918 - 22.95 \text{ kg } H_2SO_4 / \text{tonne}$.
- SHC3 / high hazard threshold corresponds to:
 - $> 0.75\% \text{ S}$
 - $> 22.95 \text{ kg } H_2SO_4 / \text{tonne}$.



Table 5: Sulphide Hazard Class Determination

Soil Texture Group	No Risk (SHC1)				Risk			
	No – Sulphur (SHC1)		Non – reactive (SHC1)		Moderate Risk (SHC2)		High Risk (SHC3)	
	Sulphur	NA	Sulphur	NA	Sulphur	NA	Sulphur	NA
Sands	<1	---	>1	<3	>1	>3	>10	>5
Sandy Silts & Silts	<2	---	>2	<6	>2	>6	>20	>10
Clays	<3	---	>3	<9	>3	>9	>30	>15
Notes: NA Net acidity SHC Sulfide hazard class H ₂ SO ₄ Sulphuric acid With the exception of the 'no sulphur' category, samples require both Sulphur & NA values to define hazard classes. CRS = Actual S x 30.6 (conversion to H ₂ SO ₄ per tonne of soil equivalent) All units are in kg H ₂ SO ₄ / tonne								

6.1 No Risk (No-Sulphur / Non-reactive)

The non-reactive category (SHC1) is based on NA and is defined as having a CRS value greater than the no-sulphur threshold and a NA value below three times that of the no-sulphur value in **Table 5**. These levels are based on SLR's experience with ASS and require calibration using accelerated weathering trials (AWTs) to define the exact value, because soil variation can cause significant deviation from the anticipated value.

6.2 Moderate and High Risk

Moderate (SHC2) and high-risk (SHC3) sulfidic sediment and soil is likely to cause a significant adverse risk to the environment. Essentially, moderate risk will generate a small amount of acid slowly while high risk will either generate acid quickly and/or in large volumes.

If possible, high-risk soil/sediment should not be disturbed. If disturbance cannot be avoided, high risk soil/sediment is recommended to be kept in an anoxic state. Risk categories for soil samples collected from the site, based on the hazard classes is detailed in **Table 5**.

6.3 Action Criteria

The action criteria in **Table 6** that trigger the need to prepare an ASS management plan are based on Net Acidity. As clay content tends to influence a soil's natural buffering capacity, the action criteria are grouped by three broad texture categories – coarse, medium and fine. If the Net Acidity of any individual soil material tested is equal to or greater than the action criterion a detailed ASS management will need to be prepared.

However, it is important to note the acidity hazard of soil materials that are strongly acidic due to processes other than reduced inorganic sulphide (RIS) oxidation, are not considered an ASS acidity hazard. Actual ASS are acid soil materials, but not all acid soil materials are Actual ASS. Naturally occurring acidic soils are not uncommon and are not considered an environmental hazard that require management to change their acidity.

Indeed, these naturally occurring acidic soils are usually part of acidophilic ecosystems whose health depends on maintaining the acidic environment.



Accordingly, the trigger values in **Table 6** apply only to ASS materials and not to other acidic soils. As an example, many soil materials in naturally acidic landscapes, such as acidic peatlands and coastal heaths, often have Net Acidities exceeding the action criteria in **Table 6**. Liming of naturally acidic ecosystems, leading to unnaturally alkaline environments, can result in ecological damage to the acidophilic organisms that relied on the acidic nature of these ecosystems.

The >1,000 tonne disturbance criterion has been applied on a cumulative, project-wide basis reflecting the overall scale of earthworks.

Table 6: Action Criteria

Material Type	Approx Clay Content	Net Acidity #			
		1 – 1,000 Tonnes Material Disturbed		> 1,000 Tonnes Material Disturbed	
Texture Range	(%)	% S-equiv. (oven-dried basis)	mol H+/t (oven-dried basis)	% S-equiv. (oven-dried basis)	mol H+/t (oven-dried basis)
Fine: Light medium to heavy clays	> 40	≥ 0.10	≥ 62	≥ 0.03	≥ 18
Medium: Clayey sand to light clays	5 – 40	≥ 0.06	≥ 36	≥ 0.03	≥ 18
Coarse and Peats: Sands to loamy sands	< 5	≥ 0.03	≥ 18	≥ 0.03	≥ 18
Notes: If bulk density values are not available for the conversion of cubic meters to tonnes of soil, then the default bulk densities based on the soil texture may be used. # Net Acidity can only include a soil material's measured Acid Neutralising Capacity where this measure has been corroborated by other data					

7.0 Results

7.1 Observations

General descriptions and features at each hand auger location are included in **Table 7**. Refer to **Appendix C** for detailed soil logs.

7.2 Field Testing

The complete set of field oxidation results for all sediment cores is included in **Table 7**. Samples were scheduled for laboratory analyses based upon the two largest differences between values for pH_F and pH_{FOX}.



Table 7: Field Oxidation Tests

Sample ID	Depth (m bgl)	pH _F	pH _{FOX}	Reaction	ΔpH	Material
SS45	0.25	5.38	4.57	Minor	-0.81	Clayey SILT
	0.50	5.37	4.74	Minor	-0.63	Silty CLAY
	0.75	5.65	4.81	Minor	-0.84	Silty CLAY
	1.00	5.34	4.57	Minor	-0.77	Sand
	1.25	5.32	4.52	Minor	-0.8	Silty SAND
	1.50	5.43	4.01	Medium	-1.42	Sandy SILT
	1.75	5.61	3.72	Medium	-1.89	SILT
	2.00	6.38	3.32	Medium	-3.06	SILT
SS46	0.25	4.44	3.75	Minor	-0.69	Clayey SILT
	0.50	4.93	3.81	Minor	-1.12	Peat
	0.75	5.4	3.66	Medium	-1.74	Peat
	1.00	5.16	3.46	Medium	-1.7	Peat
	1.25	5.47	3.66	Medium	-1.81	Peat
	1.50	5.49	2.79	Medium	-2.7	Peat
	1.75 – 2.00	5.23	2.54	Medium	-2.69	Peat
	0.25	4.78	3.59	Medium	-1.19	Clayey SILT
SS47	0.50	4.37	3.6	Minor	-0.77	Peat
	0.75	4.87	3.87	Minor	-1	Peat
	1.00	5.4	2.97	Medium	-2.43	SILT and peat
	1.25	5.25	3.9	Medium	-1.35	SILT
	1.50	5.76	4.18	Medium	-1.58	SILT
	1.75 – 2.00	5.92	4.64	Medium	-1.28	SILT

Notes:
Highlight indicates sample selected for CRS analysis

7.3 Results and Suggested Liming Rates

Laboratory CRS testing was completed to quantify reduced inorganic sulphur content and to calculate corresponding acidity, net acidity, and indicative liming rates. Laboratory certificates show original analysis units %S or moles/tonne H⁺. Laboratory results are summarised in **Table 8**, with laboratory certificates included in **Appendix C**.



Table 8: Net Acidity and Suggested Liming Rate

Sample ID	Depth (m bgl)	Material	Sulphur (%S)	Sulphur (kg/H ₂ SO ₄ /T)	Net Acidity (%S)	Net Acidity (mole H ⁺ /t)	Net Acidity (kg/H ₂ SO ₄ /T)	Liming Rate (kg/CaCO ₃ /T)	Risk Category
SS45	1.50	Sandy SILT	0.02	0.612	0.06	38	1.836	3	SHC1: No risk / No sulphur
	2.00	SILT	0.07	2.142	0.10	63	3.060	5	SHC1: No risk / Non-reactive
SS46	0.75	PEAT **	0.14	4.284	0.16	98	4.896	7	SHC1: No risk / Non-reactive
	1.75 - 2.00	PEAT **	0.13	3.978	0.15	96	4.590	7	SHC1: No risk / Non-reactive
SS47	0.25	Clayey SILT	0.17	5.202	0.27	168	8.262	13	SHC2: Moderate Risk
	1.00	SILT and PEAT **	0.05	1.530	0.07	46	2.142	3	SHC1: No risk / Non-reactive
Notes: %S Percentage sulphur Kg/H ₂ SO ₄ /t Kilograms of sulphuric acid per tonne Kg/CaCO ₃ /t Kilograms of calcium carbonate per tonne Mole H ⁺ /t Moles of hydrogen ions per tonne SHC Sulphide hazard classification ** Peat/organic soils are typically classified as silts unless local conventions mandate grouping them strictly as clays									



7.4 Discussion

The hand auger investigation across the Site has provided a preliminary site-specific assessment for ASS occurrence, acidity potential and implications for earthworks management. Key findings and considerations are summarised below:

- **Soil Types and Depth Profiles:** Sandy silt, silt, clayey silt, mixed silt and peat, and peat units were encountered between 0.25 – 2.00 m bgl across the sampled locations (SS45 – SS47, inclusive). These materials include isolated organic-enriched soil horizons (peat and mixed silt and peat) as well as predominantly mineral silts.
- **Field pH Assessment:**
 - Field screening using pH_F and pH_{FOX} indicated variable acidity potential across the sampled horizons.
 - ΔpH values ranged from -0.63 to -3.06, with the strongest reactions observed in SS45 (2.00 m, silt; $\Delta pH = -3.06$) and SS46 (1.75 – 2.00 m, peat; $\Delta pH = -2.69$), with medium reaction observed in both.
 - Most ΔpH values (68% of all field samples at all three locations) exceeded the threshold of $\Delta pH > 1.0$, associated with isolated silty or organic-enriched horizons, where a small portion of ΔpH (32%) was reported between $pH -0.6$ and -1.0 .
 - Positive or negligible ΔpH values (4%) suggest non-acidic soils in shallow soil horizons.
- **Laboratory CRS Results:**
 - CRS analysis confirmed low to moderate sulphur content across all tested samples, reporting $NA > \text{Action Criteria of } 18 \text{ moles } H^+/t / 0.03 \%S$ for management of >1,000 tonnes of disturbed material.
 - Results indicated that:
 - One of the six samples tested met the criteria for AASS or moderate risk of PASS (SS47 clayey silt at 0.25 m) and accordingly categorised as SH2- Moderate Risk, with consideration to sulphur and net acidity content over respective texture grades in accordance with SHC determination (refer to **Table 5**).
 - Remaining samples analysed were categorised as either SHC1 – No sulfur, or SH1 – No risk / Non-reactive.
 - Despite the SHC1 (No Risk) designation, laboratory analysis prescribes positive verification liming rates (ranging from 3 - 13 kg $CaCO_3$ /tonne). This requirement is not driven by a pyritic hazard, but likely from residual background acidity. While these soils will not generate fresh acid via oxidation of pyrites, the existing acid load within the sandy silt, clay, and peat matrices is likely mobile. Excavation and stockpiling will trigger immediate leaching of this legacy acid into local groundwater or surface water systems if left untreated.
 - One exception was sample SS47 (0.25 m bgl) situated within clayey silt which reported a suggested liming rate of 13 kg $CaCO_3$ /t, with acidity driven by sulfidic source.



- Calculated liming rates are consistent with the moderate ΔpH values and CRS content observed.
- **Spatial Distribution of ASS Risk:**
 - Reactive clayey soil horizons were determined to pose a moderate (SS47 at 0.25m).
 - Non-reactive conditions were encountered at all other locations / depths associated with the mineral silts (SS45) and deeper mixed silts / peats (SS46 and SS47).
 - Relatively high NA values reported with SH1 hazard classes over a range of locations / materials were not driven by a pyritic hazard, but likely from residual background acidity.
 - The combination of variable CRS values, ΔpH reactions, and occurrence of reactive materials indicates a potential for acid generation, requiring appropriate management during disturbance.
- **Implications for Earthworks:**
 - Although most soils analysed were characterised as No Sulphur, or No risk / Non-reactive, reported values for NA will still required management, especially where larger soil volumes will be disturbed (>1,000 tonnes).
 - While most soils will not generate fresh acid via oxidation due to pyrite content, there is existing acid load within the sandy silt, clay, and peat matrices that could mobilise. Excavation and stockpiling will trigger immediate leaching of this legacy acid into local groundwater or surface water systems if left untreated.
 - With the overall risk of encountering high-acidity materials being low, the combination of moderate acidity potential, low natural buffering capacity, and the large soil volumes to be disturbed means that management will still be required (WQA, 2018a).
 - Standard ASSMP controls including staged excavation, keeping reactive materials moist, visual/olfactory screening for sulphide odours, and application of lime at calculated rates, are considered sufficient for risk reduction.

8.0 Risk Matrix

Based on the high-level desktop investigation, field investigation and laboratory results completed by SLR, the Project area has a low-to moderate risk of encountering acid-generating soils predominantly within the mid-regions of the Project area between 0.25 m bgl and 2.0 m bgl, with soils in the northernmost regions showing negligible risk.

This verified risk-based classification supports a refined proportionate management approach across the Project footprint. The management approach in **Table 9** tailors sampling, field and lab testing, and treatment strategies based on site-specific conditions. Contingency measures are also included for any unexpected discoveries of PASS or AASS during earthworks.

8.1 Site-Specific ASS Management Matrix

The following matrix provides management requirements for soils encountered during construction, based on verified site conditions and the potential to encounter PASS/AASS.



Table 9: Site-Specific ASS Management Matrix

Aspect	High Risk	Medium Risk	Low Risk	Contingency
Likelihood	Not Expected: CRS > 0.03% and strong ASS indicators	Elevated potential to encounter in mid-regions of the Project area between 0.25 m bgl and 2.0 m bgl: Clayey silts/organic-rich peat layers with notable ΔpH or CRS >0.03%	Isolated deeper soil horizons < 1.0 m bgl: Sands, silts, low organics, minimal ΔpH	Unexpected reactive / sulfidic materials
Typical Soil Description:	Sulfidic clays, peats, grey silts (if present)	Mixed silty clays and sands, minor organics	Sands or silts with little to no organics	Any soil with visual/olfactory signs of oxidation or sulphur
Sampling Intervals:	Every 0.25 m or change in lithology, down to 1 m below excavation depth	Every 0.5–1.0 m or at changes in lithology	Spot checks or 1 sample per location ¹ if disturbance occurs	As required based on visual signs or contractor observation
Field Tests:	pH_F and pH_{FOX} on each sample	pH_F and pH_{FOX} at key depths	pH_F only, unless signs of ASS present	Immediate pH_F / pH_{FOX} and isolate spoil
Laboratory Tests:	CRS on all samples	CRS on selected samples with low field pH	Not required unless indicators are present	CRS if acid-generating potential is suspected
Treatment Options:	Lime dosing as per lab results; stockpile on lined surface with runoff control	Lime dosing if PASS confirmed; isolate stockpiles	No treatment expected; monitor for signs of oxidation	Treat as high risk until results confirms otherwise

8.2 Notes on Implementation

- Elevated-risk horizons are typically associated with middle regions of the Project area (0.25 – 2.00 m bgl), with low-risk generally associated with deeper horizons (>1.0 m bgl). Management requirements therefore apply primarily where such soils are encountered during earthworks.
- Field staff must be trained to recognise visual indicators and implement contingency responses promptly (as/if required).
- This matrix does not replace standard management practices outlined in **Section 9.0** but provides a refinement for operational planning.
- Any materials not clearly falling within “low risk” zones or shows elevated ΔpH , organics or CRS results, shall be treated as “Contingency” until laboratory results confirm otherwise.
- Given the scale of earthworks and the limited spatial coverage of the hand-auger investigation, the presence of localised reactive/sulfidic soils cannot be completely

¹ For the purpose of this matrix, a “location” refers to a specific area of disturbance or excavation (e.g. trench, footing, utility corridor), generally defined by a consistent soil profile within a given work area.



ruled out. The matrix should therefore be applied flexibly, with professional judgement, throughout construction.

9.0 General Treatment Options

The treatment and management of ASS will follow a risk-based approach tailored to the Project's risk zones (refer to **Section 0, Table 9**). Treatment options depend on the soil's classification (High, Moderate, Low, or Contingency) and the outcome of field and laboratory assessments.

Treatment options outlined in **Table 11** will be modified based on risk classification, with contingency protocols applied in areas where unexpected ASS conditions are encountered, as per **Table 9**.

Treatment approaches outlined below are adapted to the verified site-specific conditions, with contingency protocols applied where unexpected ASS/AASS are encountered. Where PASS or AASS are encountered or suspected during earthworks, a precautionary treatment approach must be adopted to prevent oxidation and acid generation.

9.1 Treatment Summary by Risk Category

Table 10 outlines the recommended treatment approach for each risk level identified across the Project footprint, based on field observations, laboratory testing and desktop investigation findings. These management actions are intended to be implemented in tandem with the Erosion and Sediment Control Plan (ESCP) to ensure cohesive site-wide environmental controls, particularly in relation to spoil stockpiling, surface water management, and runoff containment.

Table 10: Summary of Treatment Approaches by ASS Risk Classification

Risk Level	Treatment Approach
High Risk	High-risk acid generation potential is not expected to be encountered during construction earthworks. Measures retained as precautionary reference. Apply lime if encountered: - Stockpile disturbed material on lined surfaces (e.g. geofabric laid on the ground surface) within an earth-bunded area to prevent runoff. - Cover when inactive. - Treat all disturbed material.
Medium Risk	Elevated risk is predominantly associated with the middle region of the Project footprint between 0.25 m bgl to 2.00 m bgl. Lime treatment if PASS is confirmed by field or lab results: - Isolate and monitor stockpiles - Spot field validation.
Low Risk	Low-risk potential is expected throughout the majority of the Project footprint. No treatment expected unless indicators are present: Visual and field monitoring to detect changes.
Contingency	Unexpected reactive/sulfidic materials. Treat as high risk until laboratory results confirm otherwise: - Isolate material - Perform immediate field tests - Schedule lab analysis.



9.2 Treatment Methods

The treatment strategies detailed in **Table 11** are based on established best practices for managing sulphidic soils in the absence of site-specific analytical data.

Table 11: Summary of General Treatment Options

Treatment	Application	Description
Liming (Neutralisation)	The most widely used method for neutralising PASS/AASS is the application of agricultural lime (AgLime: CaCO_3).	- AgLime acts to buffer acidity and prevent the formation of acid leachate during oxidation. - In the absence of lab testing, a conservative liming rate should be applied where sulphide-bearing or waterlogged soils are disturbed. - A general guidance ratio is 1.5 kg of AgLime per 1 tonne of expected sulfuric acid generation (noting this is precautionary and may require adjustment with future testing or validation). - Lime must be thoroughly mixed with affected material in layers not exceeding 300 mm in thickness. - Re-mixing may be required to ensure uniform distribution, especially if the soil is moist or clay-rich.
Minimising Disturbance	Where feasible, the disturbance of suspected ASS should be avoided or limited.	- If excavation is unavoidable: - Limit exposure to air by shortening the time between excavation and treatment. - Return material to anaerobic conditions quickly, especially PASS. - Stockpiles must be covered with impermeable material (e.g. geofabric or plastic sheeting) to reduce oxidation risk. - Avoid working in wet weather or when dewatering is active to minimise leachate risk.
Encapsulation	Where treatment is not practical or desired (e.g. deep PASS layers), materials may be permanently encapsulated to prevent future oxidation.	- Material should be placed in a lined cell or low-permeability pit, ideally below the long-term water table. - Clay liners or HDPE sheeting may be used to isolate the material from oxygen and water. - A guard layer of treated soil or inert fill (minimum 500 mm) must cover the encapsulated material to prevent disturbance.
Water Management	Surface and subsurface water interacting with disturbed PASS/AASS must be carefully managed. Practices will be integrated with the ESCP and implemented in accordance with regional requirements.	- Collected and monitored for pH and electrical conductivity (EC). - Treated with lime or an alkaline agent before discharge, if required. - Water shall be contained using bunds, lined ponds, or settlement basins, particularly during the wet season. - Discharged only when parameters meet environmental criteria, in accordance with an adopted Construction Environmental Management Plan (CEMP) or Soil and Water Management Plan (SWMP). - Implementation of controls will be subject to WRC review and/or approval where applicable.



9.3 Reuse and Disposal

The reuse and disposal management of AASS/PASS will align with consent conditions once provided, which may include:

- Treated ASS may only be reused within fill areas if validation testing confirms that the soil meets neutralisation criteria (typically a pH > 6.0) and shows no visual or olfactory indicators of residual oxidation or sulphur remain.
- Reuse will be prioritised wherever possible to avoid off-site disposal. Treated or untreated PASS/AASS that meets validation criteria may also be safely buried below the long-term groundwater table, provided that:
 - The material is isolated from oxygen ingress (e.g. encapsulated or submerged below water table within approximately 24-hours),
 - The location is geotechnically and environmentally suitable,
 - Burial is supported by appropriate technical assessment and does not compromise the long-term suitability of a particular area.
- As a last resort, soils that do not meet reuse criteria must be disposed of at a Waikato Regional Council-authorised landfill or further treated until suitable for beneficial reuse / clean fill placement.
- Documentation of treatment and validation testing shall be retained and provided as part of environmental compliance reporting.



10.0 Managing Compliance with this ASSMP

This section outlines the procedures, responsibilities, and monitoring requirements necessary to ensure compliance with the ASSMP during construction activities. Consent conditions will be updated and referenced in this section of the ASSMP once consent has been provided. Any substantive updates or revisions to the ASSMP must be submitted to WRC for re-certification.

10.1 Compliance Protocols

Table 12 summarises the key protocols required to maintain compliance with the ASSMP.

Table 12: Compliance Protocols for ASS Management

Aspect	Details
Roles and Responsibilities	Project roles and responsibilities related to ASS management will be defined in any project-specific construction environmental management plan (CEMP) and communicated via Project inductions and toolbox talks. Key responsibilities include: - Identifying potential ASS in field conditions and managing material accordingly. - Ensuring lime is correctly stored and available onsite. - Applying treatment procedures and verifying effectiveness (e.g. pH>6.0 after liming). - Monitoring treatment areas and water quality daily. - Ensuring subcontractors understand and follow this ASSMP. - Documenting treatment and monitoring activities for compliance records. - Advising the environmental representative of any ASS-related incidents or non-conformances. - Coordinating with lab or council (if validation or verification is needed). - A nominated Project environmental representative (or delegated subcontractor) will oversee compliance with this ASSMP.
Training and Awareness	All relevant Project personnel, including subcontractors and consultants, must be trained on their responsibilities under this ASSMP. Training will be covered through: - Project induction programmes, with a focus on environmental awareness. - Toolbox talks, timed to align with stages of earthworks and stockpile management. - Scenario-based training for: - Unexpected discovery of PASS/AASS. - Correct use of lime and protective materials. - Monitoring and reporting procedures. - Training records must be maintained and kept on-site.
Inspections and Monitoring	Daily inspections by the Project environmental representative or their delegate are required only in areas where ASS-related activities are occurring, including: - Excavation, stockpiling, or dewatering of materials identified or suspected to contain PASS/AASS. - Temporary storage or treatment (e.g. lime dosing) of potentially acid-forming materials. - Locations where runoff from treated soil areas may occur. Daily inspections are not required in areas where pre-development investigations confirm the absence of PASS/AASS, unless new indicators (e.g. odour, colour changes, pH changes) emerge during earthworks. These inspections must: - Identify any visible signs of oxidation or leachate (e.g. staining, smell, dying vegetation).



Aspect	Details
	- Check lime mixing quality and coverage of treated materials. - Confirm runoff containment and sediment basin status. - Ensure stockpiles are covered when inactive. Water discharges from treatment or sediment basins must be tested before release to confirm compliance with environmental requirements (e.g. pH>6.5). All findings must be documented in the daily Project environmental log and retained for compliance audits or reporting.
Soil Treatment Procedure	- Where sulfidic material (PASS or AASS) is suspected, soil must be treated promptly to prevent oxidation and acid generation. - Place material on a dedicated treatment pad (e.g. lined with geofabric, within bunded containment). - Spread material in layers no thicker than 300 mm to ensure full contact with lime. - Once material is workable (not saturated), apply agricultural lime (AgLime). - Thoroughly mix lime into the soil, using multiple passes if needed. - Do not leave untreated sulfidic material exposed for more than 2–3 days. - Treated material must remain on the pad until validation pH readings confirm treatment effectiveness. As an alternative to treatment, burial of untreated PASS/AASS below the permanent groundwater table may be considered only where long-term anaerobic conditions can be demonstrated, and with prior approval from WRC. This option must ensure an acceptable risk of oxidation or environmental harm and will be documented accordingly in environmental compliance records.
Liming Specifications	- AgLime (CaCO_3) is the preferred neutralising agent. - Do not use hydrated lime (Ca(OH)_2), as it can lead to pH spikes above acceptable levels (up to ~12.4). - AgLime has a safer neutralising range (max pH ~8.2) and is easier to control in field conditions. - Maintain a stockpile of at least 4 tonnes of AgLime on-site for contingency. - Lime must be free of lumps, evenly graded, and dry at the time of application. - Allow extra lime for: - Treatment of drains - Contingency re-treatment - Guard layers for encapsulation if used.

10.2 Reporting

Table 13 summarises the key reporting requirements associated with ASS management, including daily and weekly obligations, qualitative validation expectations, and procedures for addressing non-conformances in the absence of laboratory testing.



Table 13: Summary of Reporting and Validation Requirements

Aspect	Details
General Reporting	The following records and reports must be maintained in accordance with the CEMP and only where the ASSMP is being implemented, including in designated high-risk areas or where field conditions indicate the presence of PASS/AASS: • Daily Project logs (when applicable) covering lime use, soil movement, pH results, and treatment status. • Weekly and monthly environmental inspections, summarising treatment activities, lime volumes used, and any issues or corrective actions taken. • Dewatering records for any water removed from excavation zones or treatment areas where ASS management is triggered. If no PASS/AASS are encountered, and ASSMP protocols are not activated, routine ASS-specific reporting is not required.
Validation Reporting	In the absence of laboratory testing, validation may be qualitative and based on: • pH field readings (before and after treatment), • Treatment logs. • Visual indicators of neutralisation (e.g. no staining, odour, visible lime coverage). • Photos or checklists used as evidence of compliance. • If lab testing is carried out later in the project, validation reports may be prepared to formally document outcomes.
Non-Conformance	If ASS management procedures are not followed, the following steps must be taken: • Notify the responsible party and Project environmental representative immediately. • Record the non-conformance in the Project log. • Implement corrective action within 48 hours. • Update toolbox talk content and procedures if needed to prevent recurrence.

10.3 Monitoring Requirements

Monitoring will be undertaken to confirm compliance with treatment and containment requirements, to verify that ASS management is effective, and to detect any environmental effects. Monitoring requirements follow the resource consent conditions outlined in **Table 14**.

Table 14: Consent-Driven Monitoring Requirements

Aspect	Details
Pre-Construction Benchmarking	Prior to the commencement of construction works, baseline groundwater and surface water quality monitoring will be undertaken to establish natural background conditions. At a minimum, this shall include: • pH and electrical conductivity (EC) readings • Sampling at agreed groundwater bores or surface water bodies on or near the Project • At least one sampling round prior to disturbance These results will form the baseline against which all subsequent construction-phase water quality monitoring will be compared.
Quarterly Soil Monitoring During Construction	Only during construction and earthworks, quarterly soil sampling shall be conducted in all areas identified as moderate-risk. The monitoring is intended to: • Confirm whether acid sulphate conditions are developing post-disturbance • Assess the adequacy of lime treatment and containment • Provide an early warning of acid generation if present



Aspect	Details
	Samples will be analysed using field pH_F and pH_{FOX} testing, with representative samples submitted for laboratory confirmation where necessary. Sampling is not required once moderate-risk areas are closed out (i.e. earthworks are complete, treatment is validated, and the area is stabilised).
Field Screening and Laboratory Testing	All disturbed soils must undergo field screening using the procedures in Section 5.2. In accordance with consent conditions: - At least 10% of field-screened samples shall be submitted for laboratory testing (e.g. CRS) to validate the accuracy of field observations. - Samples for lab testing will be prioritised from areas where field tests indicate low pH_F, large pH shifts (pH_F to pH_{FOX}), or visible indicators of oxidation.
Monthly Water Quality Monitoring	Monthly groundwater and surface water monitoring will be carried out only in moderate-risk areas where dewatering is occurring. This targeted monitoring will include: - Sampling of pH and EC at selected locations near dewatering zones, consistent with pre-construction benchmarking locations - Visual inspection of water bodies near active excavation or stockpile areas - Adjustment of treatment or runoff controls where adverse trends are observed Monitoring is not required in low-risk areas or where no dewatering is occurring. All water quality monitoring results will be recorded and submitted as part of compliance reporting to WRC, where applicable.

Table 15 outlines the daily monitoring and record-keeping requirements for managing ASS on-site, including procedures for stockpile inspection, runoff monitoring, and documentation to ensure compliance with this ASSMP.

Table 15: Summary of Monitoring and Record-Keeping Requirements

Aspect	Requirement
Stockpile Monitoring	- Where high-risk PASS/AASS material is stockpiled, check soil pH daily using the 1:5 soil:water method (field test kit or probe). - If untreated material has pH < 5.5, prioritise treatment immediately. - If treated material pH < 6.0, return it to the treatment pad for re-liming.
Runoff Monitoring	- Measure runoff pH and EC daily using a calibrated probe at treatment areas and sediment basins. - If pH < 6.5, apply lime to neutralise the water before any discharge. - Collect runoff into lined basins or bunded areas for controlled treatment.
Record Keeping	Keep daily logs of: - Material origin and stockpile location - Soil texture and visual description - pH of stockpiles and runoff - Lime quantities used and amount remaining on-site All records should be integrated into the ESCP documentation and other relevant earthworks reporting. All records should be stored on-site and submitted with weekly environmental compliance reporting when ASS management is active.



11.0 Consent Compliance Summary

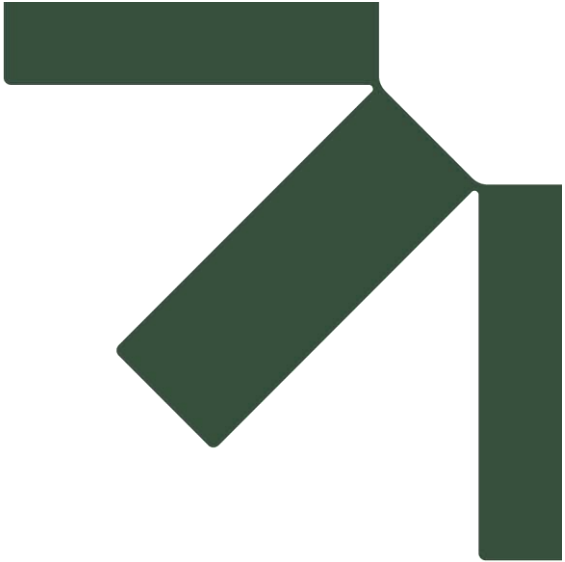
This ASSMP has been prepared to satisfy the ASS management plan requirements outlined in the WRC acid sulphate soil technical guidance (WRC, 2025).

A summary of the relevant consent conditions and where they are addressed in this report will be presented in **Section 1.6**, once provided. This will include requirements for pre-construction Project investigations, monitoring of soil and water during construction, certification procedures, and treatment or disposal protocols.

All works will be undertaken in accordance with this ASSMP and the certification and review process outlined in **Section 10.0** (Managing Compliance with this ASSMP), with monitoring and validation aligned to the framework in **Sections 8.0 to 10.0** (Risk Matrix, General Treatment Options and Managing Compliance with this ASSMP).

Should new ASS risks be identified during construction, contingency measures outlined in **Section 8.1** (Site-Specific ASS Management Matrix) and **Section 9.0** (General Treatment Options) will apply.





Appendix A CMW Desktop Study & Test Pit Logs

Acid Sulphate Soil Management Plan

Brymer Development

CMW Geosciences Ltd

SLR Project No.: 810.031825.00001

12 August 2026

Brymer Farms
Soft Soil Contours
DRAFT 29/10/2025



Legend

- Site Boundary
- CMW Peat TP locations
- CMW elevations

0 250 m 500 m
LINZ CC BY 4.0 © Imagery Basemap contributors



Produced by **Datanest.earth**

Title: Acid Sulfate Soils Probability Map		
Client: CMW Geosciences		Size: A4
Project: Brymer Development DSI	Drawn: LL	Figure No.: 15
Date: 10-11-2025	Checked: NM	
Proj No: 810.031825.00001	Scale: 1:12000	Version: 1.0

TEST PIT LOG - TP25-09

Client: Maven Ltd
Project: Brymer Development
Site Location: 584 Whatawhata Road, Hamilton
Project No.: HAM2025-0084
Date: 02/10/2025



Test Pit Location: Refer to Site Plan Logged by: AN Checked by: MM Scale: 1:25 Sheet 1 of 1

Position: 440025.0mE; 699249.0mN Projection: Mount Eden 2000 Pit Dimensions: 4.2m by 1.5m
Elevation: 24.50m Datum: NZVD2016 Survey Source: Hand-held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/Relative Density	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
	Depth	Type & Results								
			24.5			Pt: Fibrous PEAT: black. Low plasticity. (Piako Subgroup)				
	0.3	Peak = 44kPa Residual = 11kPa								
	0.6	Peak = 27kPa Residual = 5kPa								
	1.0	Peak = 41kPa Residual = 16kPa		1						
	1.5	Peak = 44kPa Residual = 14kPa				... at 1.50m, containing some wood fragments.				
	2.0	Peak = 35kPa Residual = 11kPa		2						
	2.5	Peak = 71kPa Residual = 30kPa		22.2		OL: Organic SILT: with trace wood fragments. Grey mottled brown. Low plasticity. Moderately sensitive to sensitive. (Piako Subgroup)				
	3.0	Peak = 68kPa Residual = 27kPa		3						
						Test pit terminated at 3.50 m				
				4						
				5						

Termination Reason: Refusal due to groundwater.

Shear Vane No: 3434 DCP No: 07

Remarks: Groundwater encountered at 2.7m depth

TEST PIT PHOTOGRAPHS: TP25-09

Client:	Maven Ltd		
Project:	Brymer Development	Location:	584 Whatawhata Road, Dinsdale, Hamilton
Project No:	HAM2025-0084	Date:	03/10/2025
Position:	See test pit logs	Contractor:	Topsoil and sand supplies (Paul)
Logged by:	AN	Checked by:	MM
Dimensions:	4.2m by 1.5m	Termination Depth:	3.5m



CMW Geosciences
Great People | Practical Solutions

Sheet 1 of 2

Survey Source: Hand-held GPS

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 5 - August 2024.

TEST PIT PHOTOGRAPHS: TP25-11

Client:	Maven Ltd		
Project:	Brymer Development	Location:	584 Whatawhata Road, Dinsdale, Hamilton
Project No:	HAM2025-0084	Date:	03/10/2025
Position:	See test pit logs	Contractor:	Topsoil and sand supplies (Paul)
Logged by:	AN	Checked by:	MM
Dimensions:	4.2m by 1.5m	Termination Depth:	3.3m



TEST PIT LOG - TP25-12

Client: Maven Ltd
Project: Brymer Development
Site Location: 584 Whatawhata Road, Hamilton
Project No.: HAM2025-0084
Date: 02/10/2025



Test Pit Location: Refer to Site Plan Logged by: AN Checked by: MM Scale: 1:25 Sheet 1 of 1
Position: 440624.6mE; 699203.2mN Projection: Mount Eden 2000 Pit Dimensions: 4.2m by 1.5m
Elevation: 26.60m Datum: NZVD2016 Survey Source: Hand-held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks		
	Depth	Type & Results										
	0.3	Peak = 27kPa Residual = 11kPa	26.6		OL: Organic SILT: dark brown. Low plasticity. (Topsoil)	M	F		1			
			26.4		Pt: Fibrous PEAT: black. Low plasticity. Moderately sensitive. (Piako Subgroup)				2			
			0.6		Peak = 24kPa Residual = 8kPa							2
												2
												3
												2
	1.0	Peak = 33kPa Residual = 14kPa			1							
					1							
	1.2	Peak = 30kPa Residual = 14kPa			2							
					3							
	1.9	Peak = 98kPa Residual = 46kPa	25.4		OL: Organic SILT: with trace wood. Brown. Low plasticity. (Piako Subgroup)	S		4				
			25.2		SW: Fine to coarse SAND: with some silt. Brown mottled greyish brown. Well graded. (Piako Subgroup)			5				
						6						
						6						
						7						
						7						
						6						
						4						
						4						
			3		24.7		MH: Sandy SILT: light grey. Low plasticity. Moderately sensitive. Sand; fine. (Piako Subgroup)	St			7	
	24.5	SP: Fine SAND: some silt. Light yellowish brown. Poorly graded. (Piako Subgroup)			6							
						8						
						8						
						9						
						8						
						8						
						7						
						10						
					10							
					11							
4							MD to D		11			
					11							
					11							
					10							
					9							
					11							
					13							
					17							
					2							
					0							
5		Test pit terminated at 5.00 m					TP					

Termination Reason: Target depth reached.

Shear Vane No: 3434 DCP No: 07

Remarks: Groundwater encountered at 1.2m depth.

TEST PIT PHOTOGRAPHS: TP25-12

Client:	Maven Ltd		
Project:	Brymer Development	Location:	584 Whatawhata Road, Dinsdale, Hamilton
Project No:	HAM2025-0084	Date:	03/10/2025
Position:	See test pit logs	Contractor:	Topsoil and sand supplies (Paul)
Logged by:	AN	Checked by:	MM
Dimensions:	4.2m by 1.5m	Termination Depth:	5.0m



TEST PIT LOG - TP25-13

Client: Maven Ltd
Project: Brymer Development
Site Location: 584 Whatawhata Road, Hamilton
Project No.: HAM2025-0084
Date: 02/10/2025



Test Pit Location: Refer to Site Plan Logged by: AN Checked by: MM Scale: 1:30 Sheet 1 of 2

Position: 440863.1mE; 699143.5mN Projection: Mount Eden 2000 Pit Dimensions: 4.2m by 1.5m
Elevation: 26.80m Datum: NZVD2016 Survey Source: Hand-held GPS

Groundwater	Samples & Insitu Tests		RL (m)	Depth (m)	Graphic Log	Material Description Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks		
	Depth	Type & Results										
			26.8			OL: Organic SILT: dark brown. Low plasticity. (Topsoil)	M	F to St		1		
	0.3	Peak = 68kPa Residual = 22kPa	26.6			Pt: Fibrous PEAT: black. Low plasticity. Moderately sensitive. (Piako Subgroup)				1		
	0.6	Peak = 44kPa Residual = 16kPa							3			
							1					
	1.0	Peak = 68kPa Residual = 14kPa	25.8	1		OL: Organic SILT: with trace wood fragments. Brown. Low plasticity. Sensitive. (Piako Subgroup)	S	F		1		
									2			
									9			
							4					
	1.5	Peak = 71kPa Residual = 14kPa	25.3			MH: Clayey SILT: with trace fine sand. Light bluish grey. High plasticity. Moderately sensitive to sensitive. (Piako Subgroup)				4		
										6		
										7		
										6		
	2.0	Peak = 82kPa Residual = 22kPa		2						5		
										8		
										9		
									9			
									9			
2.5	Peak = 82kPa Residual = 24kPa								10			
									12			
									12			
									11			
									13			
			23.8	3		SP: Silty fine to medium SAND: Light bluish grey. Poorly graded. (Piako Subgroup)	D			11		
											11	
											9	
			23.4			ML: Sandy SILT: with some clay. Grey. Low plasticity. Insensitive to moderately sensitive. (Piako Subgroup)	W	F to St		11		
3.5	Peak = 84kPa Residual = 19kPa										10	
											11	
									14			
									10			
									9			
4.0	Peak = 33kPa Residual = 24kPa		4						9			
									13			
									8			
									8			
4.5	Peak = UTP								9			
									9			
									12			

Termination Reason: Target depth reached.

Shear Vane No: DCP No: 07

Remarks: Groundwater encountered at 1m depth.

TEST PIT PHOTOGRAPHS: TP25-13

Client:	Maven Ltd		
Project:	Brymer Development	Location:	584 Whatawhata Road, Dinsdale, Hamilton
Project No:	HAM2025-0084	Date:	03/10/2025
Position:	See test pit logs	Contractor:	Topsoil and sand supplies (Paul)
Logged by:	AN	Checked by:	MM
Dimensions:	4.2m by 1.5m	Termination Depth:	6.0m



Client: Maven Ltd
Project: Brymer Development
Site Location: 584 Whatawhata Road, Hamilton
Project No.: HAM2025-0084
Date: 03/10/2025



Position: 439940.4mE; 698943.7mN	Projection: Mount Eden 2000	Pit Dimensions: 4.2m by 1.5m
Elevation: 23.50m	Datum: NZVD2016	Survey Source: Hand-held GPS

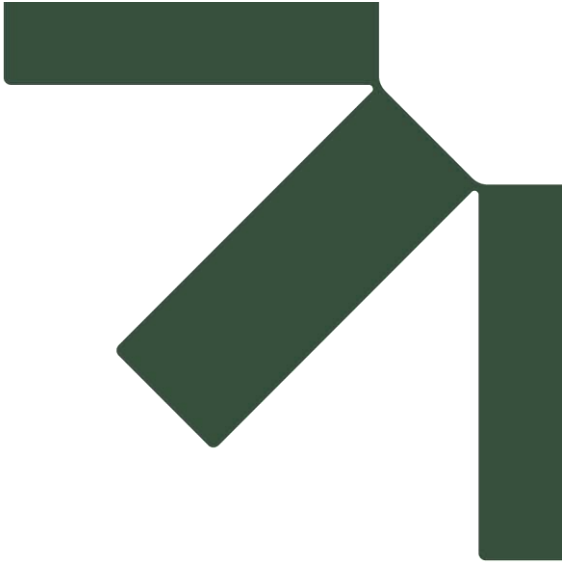
[illegible]

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 5 - August 2024.

TEST PIT PHOTOGRAPHS: TP25-14

Client:	Maven Ltd		
Project:	Brymer Development	Location:	584 Whatawhata Road, Dinsdale, Hamilton
Project No:	HAM2025-0084	Date:	03/10/2025
Position:	See test pit logs	Contractor:	Topsoil and sand supplies (Paul)
Logged by:	AN	Checked by:	MM
Dimensions:	4.2m by 1.5m	Termination Depth:	5.5m





Appendix B Soil Logs and Profile Photographs

Acid Sulphate Soil Management Plan

Brymer Development

CMW Geosciences Ltd

SLR Project No.: 810.031825.00001

12 August 2026

UTM : 60H	Driller Rig :	Job Number : 810.031825.00001
Latitude : -37.77939	Driller Supplier :	Client : CMW Geosciences
Longitude : 175.21518	Logged By : Sandra Hamler	Project : Brymer Development DSI
Elevation : Not Surveyed	Reviewed By : Lindsay Lutes	Location : Brymer Road, Grandview Heights, Hamilton, New Zealand
Total Depth : 2 m	Date : 06/01/2026	Loc Comment :

PID (ppm)	Sample	Moisture	Water Level	Depth (m)	Graphic Log	LITHOLOGICAL DESCRIPTION	COMMENTS / CONTAMINANT INDICATORS	Well Diagram	Elevation (m)
		M		0.1		TOPSOIL Clayey SILT, dark brown, medium plasticity, moist, soft			
		M		0.2		Clayey SILT, brown, medium plasticity, moist, soft			
		M		0.3		Silty CLAY, brown, medium plasticity, moist, firm			
		M		0.4					
		M		0.5					
		M		0.6		SAND, brown, well graded, moist			
		M		0.7					
		M		0.8					
		M		0.9		Sandy SILT, brown, low plasticity, moist, firm			
		M		1.0					
		M		1.1					
		M		1.2		SILT, light brown, low plasticity, wet, firm			
		M		1.3					
		M		1.4					
		W		1.5		Target depth was reached at 2 m.			
				1.6					
				1.7					
				1.8					
				1.9					

UTM : 60H	Driller Rig :	Job Number : 810.031825.00001
Latitude : -37.78666	Driller Supplier :	Client : CMW Geosciences
Longitude : 175.21855	Logged By : Sandra Hamler	Project : Brymer Development DSI
Elevation : Not Surveyed	Reviewed By : Lindsay Lutes	Location : Brymer Road, Grandview Heights, Hamilton, New Zealand
Total Depth : 2 m	Date : 06/01/2026	Loc Comment :

PID (ppm)	Sample	Moisture	Water Level	Depth (m)	Graphic Log	LITHOLOGICAL DESCRIPTION	COMMENTS / CONTAMINANT INDICATORS	Well Diagram	Elevation (m)
		M	1.00 m	0.1		TOPSOIL Clayey SILT, dark brown, medium plasticity, moist, firm			
		0.2			Clayey SILT, brown, low plasticity, moist, firm				
		0.3			PEAT, grey mottled black, moist				
		0.4							
		0.5							
		0.6							
		0.7							
		0.8							
		0.9							
		1.0							
		1.1							
		1.2							
		1.3							
		1.4							
		1.5							
		1.6							
		1.7							
		1.8							
		1.9							

UTM : 60H	Driller Rig :	Job Number : 810.031825.00001
Latitude : -37.78756	Driller Supplier :	Client : CMW Geosciences
Longitude : 175.22788	Logged By : Sandra Hamler	Project : Brymer Development DSI
Elevation : Not Surveyed	Reviewed By : Lindsay Lutes	Location : Brymer Road, Grandview Heights, Hamilton, New Zealand
Total Depth : 2 m	Date : 06/01/2026	Loc Comment :

PID (ppm)	Sample	Moisture	Water Level	Depth (m)	Graphic Log	LITHOLOGICAL DESCRIPTION	COMMENTS / CONTAMINANT INDICATORS	Well Diagram	Elevation (m)
		M		0.1		TOPSOIL Clayey SILT, dark brown, medium plasticity, moist, soft			
		M		0.2		Clayey SILT, brown, medium plasticity, moist, soft			
		M		0.3					
		M		0.4					
		M		0.5		PEAT, grey mottled black, moist			
		M		0.6					
		M		0.7					
		M		0.8					
		M		0.9					
		W	1.00 m	1.0		Organic SILT, brown mottled black, low plasticity, wet, soft			
		W		1.1					
		W		1.2					
		W		1.3		SILT, light brown, low plasticity, wet, soft			
		W		1.4					
		W		1.5					
		W		1.6					
		W		1.7					
		W		1.8					
		W		1.9					
						Target depth was reached at 2 m.			

Photolog

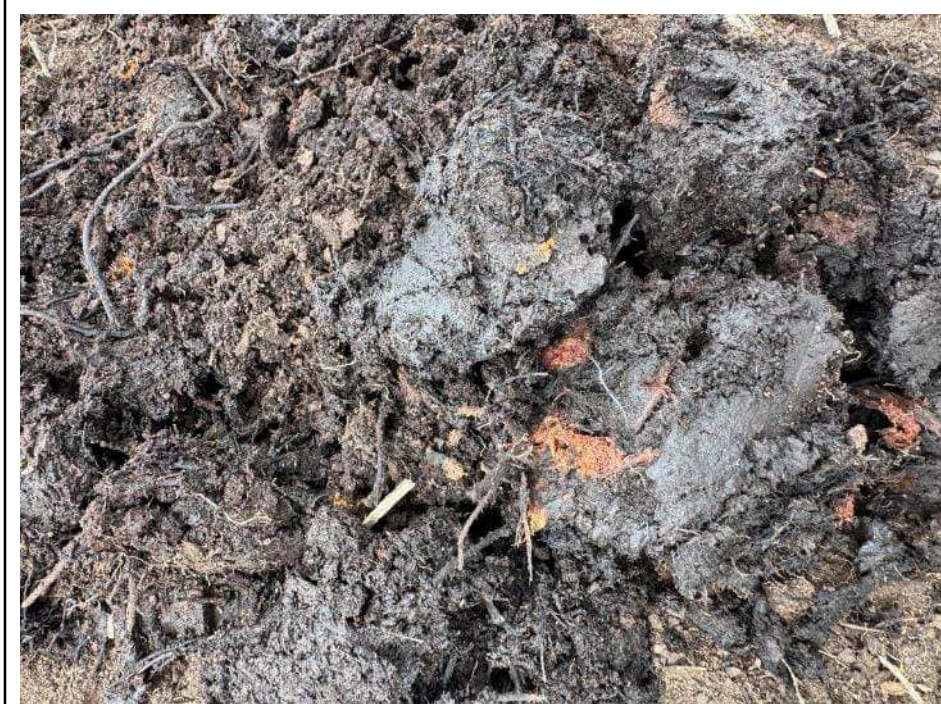
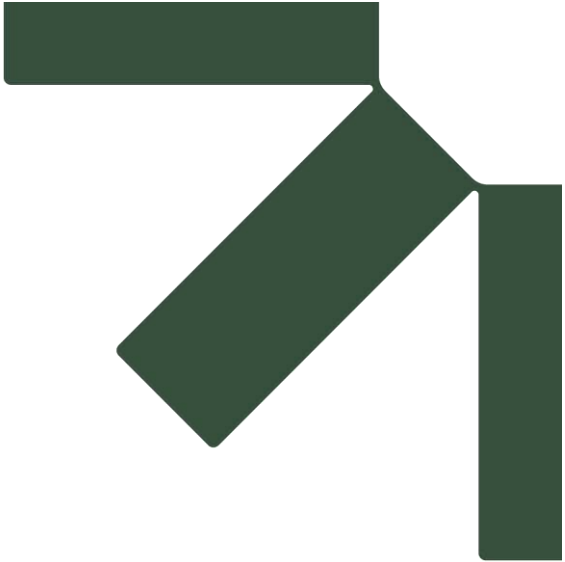
Photo 1: SS45 – Soil profile (18 November 2025). 	Photo 2: SS45 – Soil profile (18 November 2025). 	Photo 3: SS45 – Soil profile (18 November 2025). 
Photo 4: SS45 – Sample location (18 November 2025). 	Photo 5: SS45 – Reaction at depth 0.75 m bgl (18 November 2025). 	Photo 6: SS46 – Soil profile (18 November 2025). 



Photo 7: SS46 – Reaction at depth 0.25 m bgl (18 November 2025).	Photo 8: SS46 – Reaction at depth 0.5 m bgl (18 November 2025).	Photo 9: SS47 – Soil profile (18 November 2025).
		
Photo 10: SS47 – Soil profile (18 November 2025).	Photo 11: SS47 – Soil profile (18 November 2025).	Photo 12: SS47 – Sample location (18 November 2025).
		





Appendix C Laboratory Certificates

Acid Sulphate Soil Management Plan

Brymer Development

CMW Geosciences Ltd

SLR Project No.: 810.031825.00001

12 August 2026



CERTIFICATE OF ANALYSIS

Work Order : NH2502329

Client : **SLR CONSULTING NEW ZEALAND LIMITED**
Contact : Lindsay Lutes
Address : 201 Victoria Street West
Auckland Auckland New Zealand 1010
Telephone : ----
Project : 810.031825
Order number : ----
C-O-C number : ----
Sampler : Sandra Hamler
Site : Brymer
Quote number : EN/111
No. of samples received : 22
No. of samples analysed : 6

Laboratory : Environmental Hamilton
Contact : Prianshu Chawla
Address : Ruakura Research Centre, 10 Bisley Rd
Hamilton WKO New Zealand 3214
Telephone : +64 7 974 4740
Date Samples Received : 19-Nov-2025 07:15
Date Analysis Commenced : 20-Nov-2025
Issue Date : 11-Dec-2025 12:40



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below.

Signatories	Position	Accreditation Category
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD



General Comments

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key: CAS Number: CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR: Limit of Reporting (detection limit).

Unit	Description
-	No Unit
% pyrite S	% pyrite Sulfur
% S	% Sulfur
kg CaCO3/t	kg CaCO3 per tonne
mole H+ / t	H+ / tonne
pH Unit	pH Unit

>: greater than.

<: less than.

ø: ALS is not IANZ accredited for these tests.

^: This result is computed from individual analyte detections at or above the level of reporting.

~: Indicates an estimated value.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Workorder Comments

Samples were collected by yourselves (or your agent) and analysed as received at ALS NZ (or at the subcontracted laboratories, when applicable). Samples were in acceptable condition unless otherwise noted on this report.

ASS: EA033 (CRS Suite): ANC not required because pH KCl less than 6.5



Analytical Results

Sub-Matrix: SOIL

(Matrix: SOIL)

				Client Sample ID	SS45 1.5 ----	SS45 2.0 ----	SS46 0.75 ----	SS46 1.75-2.0 ----	SS47 0.25 ----
				Client Sampling date / time	18-Nov-2025 00:00	18-Nov-2025 00:00	18-Nov-2025 00:00	18-Nov-2025 00:00	18-Nov-2025 00:00
Compound	CAS Number	LOR	Unit		NH2502329-006	NH2502329-008	NH2502329-011	NH2502329-015	NH2502329-016
					Result	Result	Result	Result	Result
EA033-A: Actual Acidity									
pH KCl (23A)	----	0.1	pH Unit		4.4	4.2	3.8	3.9	4.2
Titrateable Actual Acidity (23F)	----	2	mole H+ / t		15	42	87	84	106
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.02	% pyrite S		0.02	0.07	0.14	0.13	0.17
EA033-B: Potential Acidity									
Chromium Reducible Sulfur (22B)	----	0.005	% S		0.037	0.034	0.017	0.019	0.035
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t		23	21	11	12	22
EA033-D: Retained Acidity									
KCl Extractable Sulfur (23Ce)	----	0.02	% S		<0.02	<0.02	<0.02	<0.02	<0.02
HCl Extractable Sulfur (20Be)	----	0.02	% S		<0.02	<0.02	<0.02	<0.02	0.04
Net Acid Soluble Sulfur (20Je)	----	0.02	% S		<0.02	<0.02	<0.02	<0.02	0.09
acidity - Net Acid Soluble Sulfur (a-20J)	----	10	mole H+ / t		<10	<10	<10	<10	41
sulfidic - Net Acid Soluble Sulfur (s-20J)	----	0.02	% pyrite S		<0.02	<0.02	<0.02	<0.02	0.06
EA033-E: Acid Base Accounting									
ANC Fineness Factor	----	0.5	-		1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S		0.06	0.10	0.16	0.15	0.27
Net Acidity (acidity units)	----	10	mole H+ / t		38	63	98	96	168
Liming Rate	----	1	kg CaCO3/t		3	5	7	7	13
Net Acidity excluding ANC (sulfur units)	----	0.02	% S		0.06	0.10	0.16	0.15	0.27
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		38	63	98	96	168
Liming Rate excluding ANC	----	1	kg CaCO3/t		3	5	7	7	13



Analytical Results

Sub-Matrix: SOIL

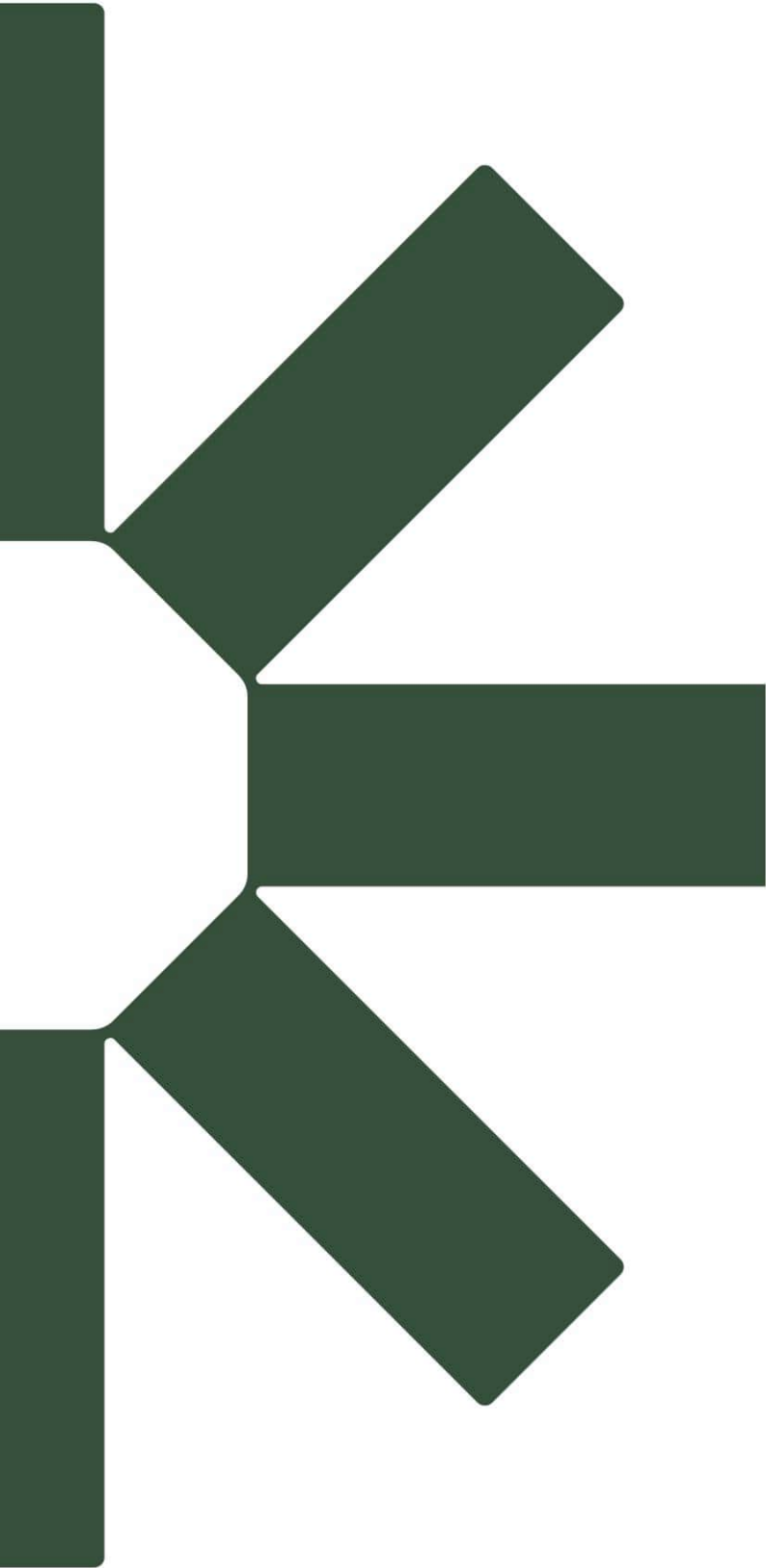
(Matrix: SOIL)

			Client Sample ID	SS47 1.0	----	----	----	----
			Client Sampling date / time	18-Nov-2025 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	NH2502329-019	----	----	----	----
				Result	----	----	----	----
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	4.3	----	----	----	----
Titratable Actual Acidity (23F)	----	2	mole H+ / t	31	----	----	----	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	0.05	----	----	----	----
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.024	----	----	----	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	15	----	----	----	----
EA033-D: Retained Acidity								
KCl Extractable Sulfur (23Ce)	----	0.02	% S	<0.02	----	----	----	----
HCl Extractable Sulfur (20Be)	----	0.02	% S	<0.02	----	----	----	----
Net Acid Soluble Sulfur (20Je)	----	0.02	% S	<0.02	----	----	----	----
acidity - Net Acid Soluble Sulfur (a-20J)	----	10	mole H+ / t	<10	----	----	----	----
sulfidic - Net Acid Soluble Sulfur (s-20J)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	----	----	----	----
Net Acidity (sulfur units)	----	0.02	% S	0.07	----	----	----	----
Net Acidity (acidity units)	----	10	mole H+ / t	46	----	----	----	----
Liming Rate	----	1	kg CaCO3/t	3	----	----	----	----
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.07	----	----	----	----
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	46	----	----	----	----
Liming Rate excluding ANC	----	1	kg CaCO3/t	3	----	----	----	----



Brief Method Summaries

Analytical Methods	Method	Matrix	Method Descriptions
Chromium Suite for Acid Sulphate Soils	EA033	SOIL	In house: Referenced to Ahern et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pHKCl; titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.



Making Sustainability Happen

Process Flowchart – Acid Sulphate Soils

To:Mark McVinnie & Cameron Marshall

From:Lindsay Lutes

Company:CMW Geosciences Ltd

SLR Consulting New Zealand

cc:

Date:12 August 2026

Project No.810.031825.00001

RE:Process Flowchart – Acid Sulphate Soils (ASS)

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This flowchart supplements the Brymer Development ASSMP, dated 12 August, 2026, and covers Potential ASS (PASS) and Actual ASS (AASS) management in accordance with the ASSMP requirements.

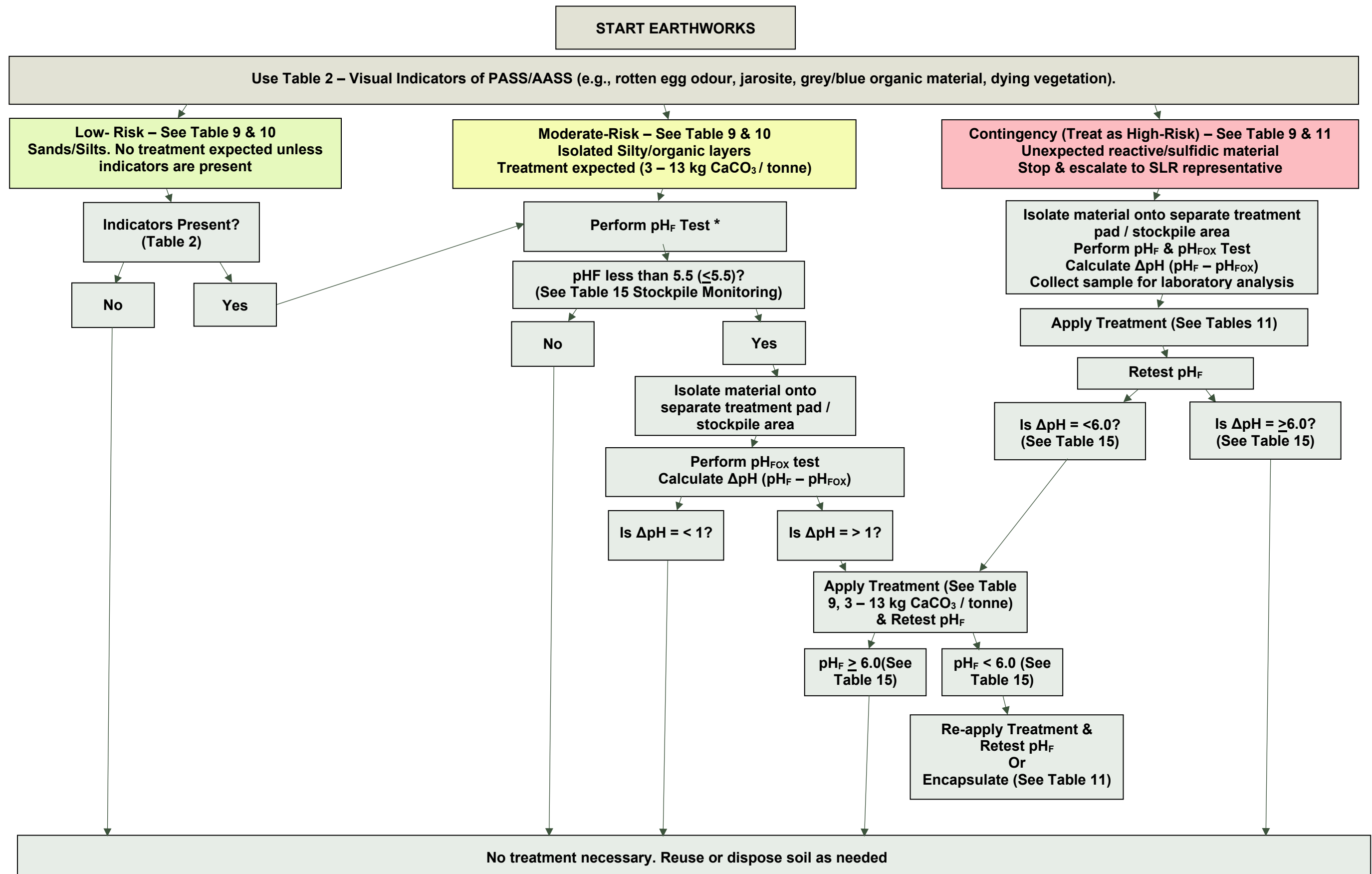
Background and Application

the Project area has a low to moderate risk of encountering acid-generating soils predominantly within the middle region of the Project footprint between 0.25 m and 2.0 m bgl, with soils in the northernmost region exhibiting low to negligible risk. The AASMP risk matrix tables should be applied flexibly with the contractor’s professional judgement throughout construction activities. The Project Location and Layout Plan is shown in **Figure 1** in the ASSMP.

An SLR environmental representative should be notified immediately if a **Contingency/High-Risk** material is indicated. Refer to **Tables 2, 9, 10, 11 and 15** in the ASSMP for more detail.

How to Read This Flowchart

Term / Abbreviation	Description
pHF	Field pH test kit provided by ALS Global laboratory. Used to determine current pH level of soil. Field test kits can be performed by SLR or suitably trained Contractor Environmental Representative.
pHFOX	Field pH test kit provided by ALS Global laboratory. Contains 50mL of 30% peroxide to determine potential acid sulphate risk. Field test kits can be performed by SLR or trained Contractor Environmental Representative.
ΔpH	The difference of pH between pHF and pHFOX field test kit results (pHF – pHFOX = ΔpH)
Low-Risk	Green flow process in flowchart
Moderate-Risk	Yellow flow process in flowchart
Contingency (treated as High-Risk)	Red flow process in flowchart



* One pH test is required for each homogeneous stratigraphic unit unless any of the indicators listed in **Table 2** show a change.

