ACID SULFATE SOILS

BOWEN AREA

Scale 1:25,000

0.5 0.25 0 0.5 1 1.5 2 2.5 kilometres

Projection: Universal Transverse Mercator (MGA Zone 55)
Horizontal Datum: Geocentric Datum of Australia (GDA94)
Note: This map is GDA compliant

GDA

REFERENCE

ACID SULFATE SOILS (ASS)[1] ON RELATIVELY UNDISTURBED LAND

Depth	Depth Code	Depth to Actual Acid Sulfate Soil[2] (pH ≤4.0)	Depth to Strongly Acidic Soil layer[2] (pH >4.0 to ≤5.0)	Depth to Potential Acid Sulfate Soil[3]
0 - 0.5m	0	A0	a0	S0
0.5 - 1m	1	A1	a1	S1
1 - 2m	2	A2	a2	S2
2 - 3m	3	A3	a3	S3
3 - 4m	4	A4	a4	S4
4 - 5m	5	A5	a5	S5
>5m	5+	A5+	a5+	S5+

NOTE:

- The depth codes above imply that a predominance of profiles in the map unit fall within the nominated depth range.
- Actual acid sulfate soil layers (designated with an A code) often overlie potential acid sulfate soil layers (designated with an S code). Where this occurs eg. A0S2 the map unit is coloured according to the depth of the upper surface of the 'actual' layer (A0) and overlayed with yellow dots. An 'a' preceding the soil depth code indicates a strong acid soil layer with field pH ranging from > 4.0 to ≤ 5.0. This may or may not be a result of sulfide oxidation. While 'a' depth code is shown on the map, no colour is assigned to it.
- In areas where there is varying depth to an ASS layer that cannot be separately mapped at the operative scale, two colours are used to designate the dominant depths. This appears as equal width striped colours. e.g., $S1/S2$.
- P as a superscript indicates sediments of Pleistocene age[1], so that $S^{P}5+$ indicates sulfidic sediments (of Pleistocene age) deeper than 5m.
- W as a subscript indicates areas associated with *Melaleuca* sp. wetlands and occasionally *Casuarina glauca* communities. Oxidisable sulfur % in surface layers may be highly variable and often exceeds the 'Action Criteria'. This may include sulfur from organic compounds and modern accretion of sulfides in a wet, organic rich environment. ASS typically occurs at depth. Where this occurs e.g., S_{LAW} or $S2_W$ or $A1_W$ the map is coloured as per the actual or potential depth category and is overlayed with 🌊 pattern.
- N as a subscript indicates areas with oxidisable sulfur values that exceed the action criteria[4] but contain varying amounts of carbonate materials that may compensate for the potential acidity. Commonly the carbonate materials are naturally occurring shell fragments, coral fragments or Foraminifera. Depth codes are as above e.g., a potential acid sulfate soil (rich in carbonate) occuring at 1 to 2m depth is designated $S2_N$. The map unit is coloured as S2 and overlayed with green dots.

S — Land mapped at 1:100 000 scale where ASS occurs within 5m of the surface.

S_{LA} — Limited field assessment but occurs in a landscape position where there is a reasonable probability of ASS occurrence. This is usually land where the present use precludes any disturbance eg. National Parks, Reserves etc., or land where accessibility is severely restricted.

ACID SULFATE ON DISTURBED LAND[5]

S_{DL} — Disturbed land e.g., Canal estate, Marina, Aquaculture, Quarry, Urban, Industrial likely to contain ASS (In some cases partial or full treatment may have been undertaken).

LAND WITH A LOW PROBABILITY OF ACID SULFATE SOIL OCCURRENCE

LP — Land between the 5m AHD contour and the outer limit of Holocene, estuarine ASS (i.e., land below 5m AHD) as mapped at this scale, with low probability of ASS occurrence[6]. Limited field investigation.

LP5 — Land >5m AHD with low or negligible probability of ASS occurrence[6]. Limited field assessment.

LAND NOT ASSESSED

NA — Land not assessed for ASS as part of this survey. It may include non ASS land beyond the boundary established as the limit of Holocene, estuarine, sulfidic sediments[7] but insufficient or no field testing was carried out[6].

5m AHD[8] CONTOUR - NORMAL LIMIT OF FIELD INVESTIGATION

The 5m contour line delineates the normal limit of field investigation of Holocene, estuarine sulfidic sediments[9] which form ASS. However ASS has been found in this study on some lands above 5m, eg. flood plains and sand dunes. In other cases the limit of Holocene ASS[7] is either at or below the 5m contour. In the latter case, the land between the ASS limit and the 5m contour is designated LP explained above.

701 — Borehole locations where profiles were described in detail and samples taken for analysis.

Digital Cadastral Database

W7 — Groundwater monitoring site locations

[1] **Acid sulfate soil** is the generic term used to define soils derived from estuarine sediments containing iron sulfides (pyrite) or containing the acidic products of the oxidation of sulfides. The term includes actual and potential acid sulfate soils. Unless used with the superscript P, the code 'S' implies sulfidic sediments of Holocene age.

[2] An "A" preceding the soil depth code indicates the probable depth to an **Actual Acid Sulfate Soil (AASS)**' layer or horizon which has mobile acidity in the form of ionic hydrogen, aluminium, iron or acid salts. AASS are soils where yellow jarosite mottles occur and/or a field pH of ≤4.0 exists and/or the existing acidity exceeds the "Action Criteria"[4]. Extensive areas with high actual acidity derived from sulfide oxidation may constitute significant environmental hazard. An "a" preceding the depth code indicates the probable depth to a soil layer or horizon with field pH ranging from >4.0 to ≤5.0. This may or may not be a result of sulfide oxidation as some soils with high organic matter may have low pH from organic acids. Further analysis for existing acidity is usually required to determine if the "Action Criteria" is exceeded.

[3] An "S" preceding the soil depth code indicates the probable depth to a **Potential Acid Sulfate Soil (PASS)**' layer or horizon. PASS are soils where the oxidisable sulfur percentage or titratable sulfidic acidity or net acidity exceeds the prescribed "Action Criteria"[4]. Testing for oxidisable sulfur is conducted by the Chromium Reducible Sulfur (S_{Cr}) method, the Suspension Peroxide Oxidation Combined Acidity and Sulfur (SPOCAS) method or the now superseded Total Oxidisable Sulfur method (TOS).

[4] Net acidity or oxidisable sulfur "Action Criteria" that trigger treatment are currently: Sands, 18 mol H^+/t (0.03 %S); Loams to light clays, 36 mol H^+/t (0.06 %S; Medium to heavy clays, 62 mol H^+/t (0.1 %S). When deciding whether treatment is required net acidity should be calculated as defined in the Acid Sulfate Soils Laboratory Methods Guidelines (Ahern et al 2004) and compared to the Action Criteria above. NOTE: for disturbances >1000 tonnes, the action criteria is 18 mol H^+/t (0.03 %S) regardless of soil texture.

[5] Limited or no field checking has been carried out in disturbed lands.

[6] CAUTION: It is not possible to accurately map the distribution of ASS adjacent to rivers and streams at the current mapping scale eg mangrove fringes. ASS may also be buried below alluvium of past and present stream channels some distance upstream of mapped areas.

[7] The outer boundary of Holocene estuarine ASS commonly occurs at the intersection with hard rock or other materials of non estuarine origin. In this area acid sulfate soils can occur up to 8m AHD but generally occur below 5m AHD. This boundary is established using field checking at and above the boundary itself, together with the use of contour lines and geological map boundaries. There is limited field assessment beyond the 5m AHD contour level (10% of boreholes). It should be noted, however, that certain lithologies on land above 5m AHD may contain sulfidic material of non estuarine/Holocene origin. Additionally, much older, estuarine, sulfidic sediments may occur at depth on land >5m AHD, as discussed in footnote 7 below.

[8] The reliability of elevation data is variable across the study area. AHD refers to Australian Height Datum.

[9] The primary focus of ASS investigation in this study are the sulfidic sediments that were deposited in the Holocene epoch, that is, during the last 10 000 years. Experience in coastal stratigraphic mapping shows that similar, but much older sulfidic sediments of Pleistocene age can occur, still in a reduced (anaerobic) state, being buried under either cemented sands or old, consolidated alluvium. They are far less common than the Holocene equivalents, and have been found beneath land whose surface is both above and below 5m AHD. Generally, Pleistocene sediments will be found at greater depths below the surface than equivalent Holocene sediments.

[*] The distinction between AASS and PASS is sometimes not clear and it is not uncommon for a soil layer or horizon to contain both AASS and PASS. Likewise the severity of AASS or PASS can vary in their distribution vertically or spatially. Mapping codes only reflect the dominant category based on this sampling. In most cases detailed sampling and analysis is usually required under the State Planning Policy 2/02 "Planning and Managing Development Involving Acid Sulfate Soils".

NOTE: This map should be used in conjunction with the accompanying report covering this area.

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