Steel Slag For Ameliorating Acid Sulphate Soil

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Project Overview

- The major iron and steel slags include Granulated Blast Furnace Slag (GBFS), Blast Furnace Slag (BFS), Basic Oxygen Slag (BOS), and Electric Arc Furnace Slag (EAFS)(figure 1) and Ladle Furnace Slag (LFS) (figure 2).
- A number of trials have demonstrated the benefits of using slags as a slow setting stabilising binder component in road construction.
- Modern iron and steel slags have been used extensively for road construction and have proved to be very successful, particularly for high speed, heavily trafficked roads and airport pavements.
- Acid Sulphate soils (ASS) are naturally occurring in wet environments such as wetlands and coastal regions. ASS occurrence can also be increased by human activity (Mining). Areas effected by ASS are shown in figure 4 (Government, 2016).
- ASS are formed during the oxidation of Iron pyrite (FeS_2), forming sulfuric acid (H_2SO_4) and iron precipitate ($Fe(OH_3)$) (figure 3) (Government 2016).
- ASS are a major issue for construction of highways in many parts of Australia. Due to the level of oxygen exposure during the road construction period (figure 3).
- One of the major issues with ASS is the solubility and mobility of heavy metal(loid)s including aluminium (Al), arsenic (As), cadmium (Cd), chromium (Cr), manganese (Mn).
- LFS has been shown to be very effective in the neutralization of acidity in ASS, thereby mitigating the mobility and leaching of soil-derived heavy metals, and also improving soil structure (figure 2).

Figure 1: EAFS

Figure 2: LFS

Figure 1&2: Electric-Arc furnace slag and Ladle Furnace Slag produced at the Rooty hill Liberty OneSteel industrial site. Demonstrating slag physical properties (photos supplied by Catherine Skidmore[2]).

Project Aims

The primary aim of this study is to examine the value of LFS in the utilization of ASS in road embankments.
The specific objectives include:

- to compare the ability of various LFS sources in neutralizing acid sulphate soils
- to monitor the solubility and mobility of heavy metals in the co-blended LFS and ASS materials
- to examine the aggregate stability of ASS as impacted

LFS neutralisation

- to quantify the bioavailability and ecotoxicity of heavy metal(loid)s in co-blended LFS and ASS materials

Research Methods

(i) Incubation experiment: to examine the effect of various liming materials including LFS on the neutralization of acid sulphate soil as measured by pH and other soil characteristics
(ii) Leaching experiment: to examine the mobility of heavy metals in ASS as impacted by liming material
(iii) Plant growth experiment: to examine the pytoavailability of heavy metals in ASS as impacted by liming materials

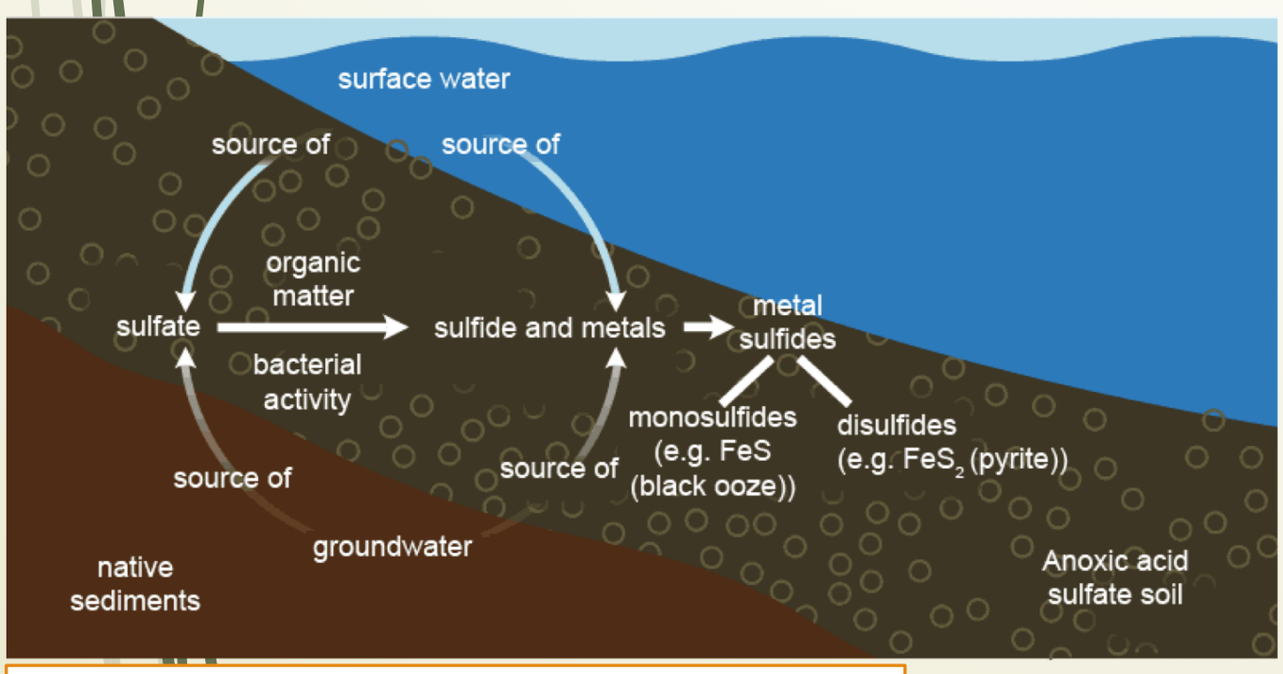

Figure 3: ASS formation process. (Government, 2016)

Expected Outcomes

The outcomes from research will provide science-based evidence for:
(i) beneficial utilization of slags as an alternative soil amendment
(ii) the extent of mobilization of heavy metals
(iii) slag-induced stabilization of acid sulphate soil for road construction
(iv) slag-induced mitigation of ecotoxicity of acid sulphate soils

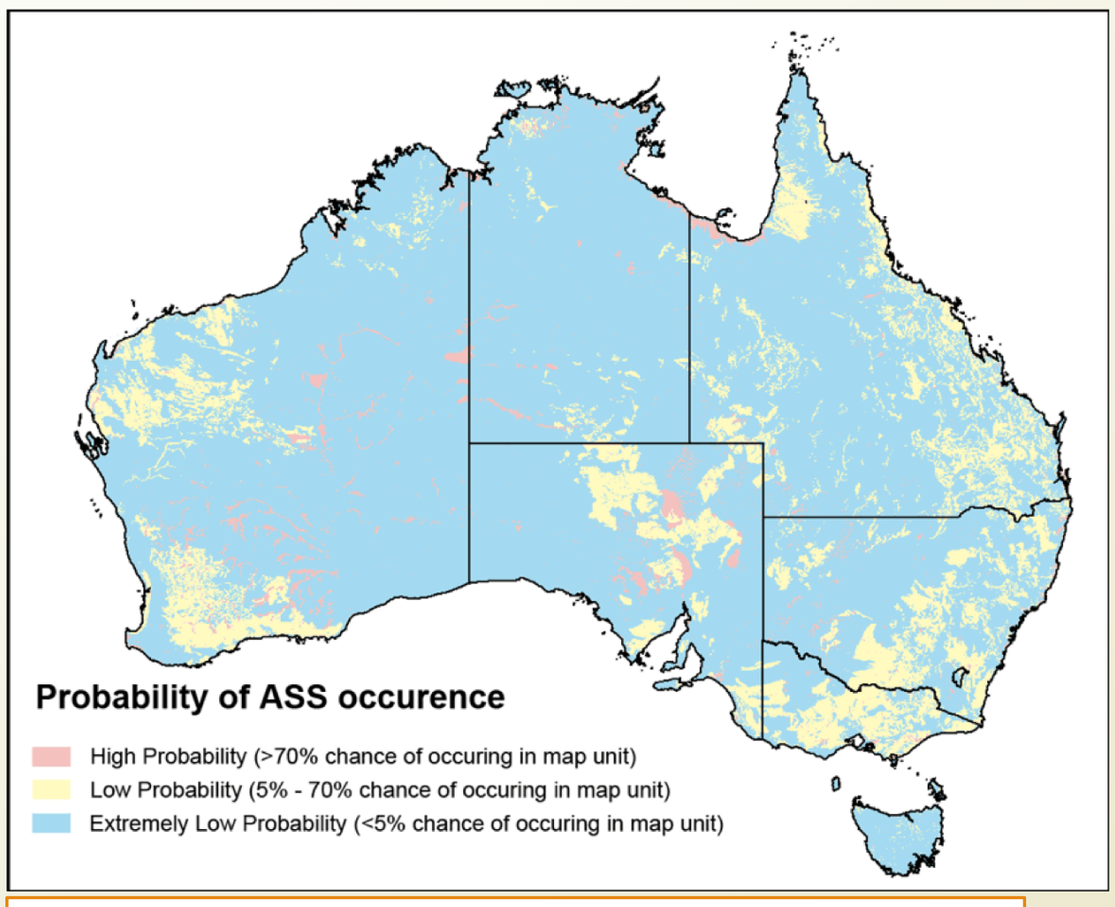

Figure 4: Probability of ASS occurrence within Australia, predominantly coastal regions and inland (Government, 2016).

References

GOVERNMENT, A. 2016. *About Acid Sulfate Soils* [Online]. Available: http://www.agriculture.gov.au/water/quality/acid-sulfate-soils/about-acid-sulfate-soils [Accessed 26/02 2018].