



# ASSAY

A NEWSLETTER ABOUT ACID SULFATE SOILS

No. 43 Sept 2007

## Australian Standards for acid sulfate soils

After a lengthy gestation period and a long and painful labour, the Australian Standard for the analysis of acid sulfate soil has finally, almost, been delivered!

The process of giving birth to an Australian Standard is a convoluted process. Once the sub-committee charged with writing a particular Standard is happy with their draft, it is sent out for public comment, usually for a period of 2 months. Public comments are collated then evaluated by the sub-committee and the draft Standard revised accordingly. At this point, the document is sent to the parent committee for postal ballot to adopt or reject the Standard. Once passed by the postal ballot process and after final checking by the sub-committee and Standards Australia editor, the Standard is then released.

The Standard dealing with the analysis of dried acid sulfate soil is AS4969. It is comprised of Parts 0 to 14. Part 0 is an introductory document; Part 1 deals with soil/sample preparation, Parts 2–13 deal with chemical methods and/or calculated results coming out of these methods, while Part 14 details Acid Base Accounting (ABA) procedures. Public comment closed on 9<sup>th</sup> August 2006 for Parts 0–4 and 7, and on 6<sup>th</sup> October 2006 for Parts 4–6 and 8. Parts 9–11, which are essentially calculations leading on from earlier parts, closed on 2<sup>nd</sup> April 2007. Part 12 (the complete SPOCAS procedure) closed on 29<sup>th</sup> June 2007, while Part 13 (a method for measuring acid neutralising capacity) closed on 10<sup>th</sup> April 2007. Part 14 (on ABA) is at the public comment stage and closes on 26<sup>th</sup> October.

Parts 0–11 and Part 13 were reviewed by the sub-committee after public comment and were sent to postal ballot (closed 27<sup>th</sup> April 2007). All that remains now is for Part 12 to complete postal ballot (closed 9<sup>th</sup> September), and to complete the public comment, revision and postal ballot stages for Part 14. It is expected that the complete Standard will be released by the end of the year.

For further information contact Angus McElnea from the Qld Department of Natural Resources and Water on (07) 3896 9331 or [angus.mcelnea@nrw.qld.gov.au](mailto:angus.mcelnea@nrw.qld.gov.au)

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## From the editor

Welcome to edition number 43.

In this edition we cover the emerging issue of acid sulfate soils in the Murray Darling Basin. This is an issue we will hear more about as the drought continues and water restrictions tighten. Also in this edition are a number of examples of what can be achieved by remediating acid sulfate soils; check out the articles about Rocky Mouth Creek and Kerklins Levee.

As always, we are happy to receive contributions from our readers.

Happy reading  
Chrisy

## Acid sulfate soils at the Great Oaks housing development in Virginia, USA

*Del Fanning, W. Lee Daniels, Zenah Orndorff*

Construction of the Great Oaks subdivision in Fredericksburg, Virginia began in 2001.

Researchers at Virginia Tech were contacted in August 2005 by a concerned resident who could not establish a lawn. A reclamation prescription was developed which included heavy liming (25 tons per acre), phosphorus fertilisation (300 lbs per acre), and if possible an organic amendment such as compost – all to be incorporated to a depth of 6 inches. This work was

completed in the fall of 2005, and a grass cover was established by the following spring. As of June 2007 the grass has persisted with few patchy areas.



Iron (hydr)oxide coatings on sidewalk.

Several lots in Great Oaks are affected by acid sulfate soils, and sidewalks have been degraded by acid runoff. The developer applied reclamation measures similar to those described above and plans to pressure-wash the iron sidewalk coatings. Residents should still be concerned about possible corrosion on concrete and metal materials, and continued detrimental effects on water quality.



Yard afflicted by acid sulfate soils in the midst of reclamation work (left) and the following spring (right).

Acknowledging the benefits of prevention over reclamation the City of Fredericksburg passed an ordinance in March 2007 to reduce exposure of sulfidic materials from new construction.

The policy is available at [www.cses.vt.edu/revegetation/remediation.html](http://www.cses.vt.edu/revegetation/remediation.html). This is the first such ordinance in Virginia, and will hopefully set a new standard for other localities in the USA.

For further information contact Del Fanning at [DelvinDel@aol.com](mailto:DelvinDel@aol.com) or [dsf@umd.edu](mailto:dsf@umd.edu), W. Lee Daniels at [wdaniels@vt.edu](mailto:wdaniels@vt.edu), or Zenah Orndorff at [zorndorf@vt.edu](mailto:zorndorf@vt.edu).

A more detailed version of this article is available at: [www.sawgal.umd.edu/mapss/Pedologue/PEDOLOGUESummer07.pdf](http://www.sawgal.umd.edu/mapss/Pedologue/PEDOLOGUESummer07.pdf)

### New acid sulfate soil project for Tasmania

Natural Resource Management (NRM) Strategic Reserve funding has been secured to develop a project to further understand and better manage acid sulfate soil in Tasmania. All three NRM regions in Tasmania have supported this process and the Land Conservation Branch of the Department of Primary Industries and Water will deliver the project.

Part one of the project will deliver a set of guidelines for the management of acid sulfate soils as well as produce a recommendation's report that will reflect the information needs of land managers in Tasmania. Depending on identified information needs, additional funding may be made available in 2008 to action report recommendations with particular emphasis on development of information products. Project Officer Amy Jansen, who began working on the project in early September, will engage with interested stakeholders including agriculture, forestry, aquaculture and recreational industries, private landholders and local government.

If you would like to be involved in this process or you require more information regarding this project please contact Declan McDonald on (03) 6233 6212 or Declan.McDonald@dpiw.tas.gov.au or Amy Jansen on (03) 6297 8565 or ajansen@csu.edu.au

### Fears of pollution in lakes

Acid metal pollution and a rotten egg smell could result from drying of the Lower Lakes, Alexandrina and Albert, which are at their lowest level for more than a decade. CSIRO scientists, however, say this scenario near the mouth of the Murray could be minimised or avoided if work is done now to locate problem soils and sediments.

CSIRO's Dr Rob Fitzpatrick said the acid could cause fish kills, heavy metal pollution and a nasty rotten-egg smell. "When the level in the lakes starts to really drop, the soils and sediments that are normally under water will be exposed to the air," he said. "As they dry out, salts will form on the surface and, if there are sulfidic materials present, they will react with the oxygen in the air to form sulfuric acid and a bad smell. The acid could mobilise heavy metals, which can be toxic. It might take decades to flush it out. It could well be irreversible." Dr Fitzpatrick said problem soils had been found in the lakes and surrounding wetland and marsh areas. Their extent is not known. "We can plan for the impacts, use lime, maybe let some water in so that we don't dry it completely," Dr Fitzpatrick said.

A Department for Environment and Heritage spokeswoman said they were looking into the issue as part of the Government's response to the drought. "We have had discussions with CSIRO to undertake this project and they are gearing up to undertake soil sampling and analysis," she said.

The latest Murray-Darling Basin Commission weekly report shows the level of Lake Alexandrina is at 0.11m above sea level, less than one-third of its full supply of 0.75m.

Without further rain, the level is expected to fall gradually. The department spokeswoman said: "We have had shoreline exposure over the last couple of years and the acid sulfate soils haven't been a problem. Now, due to the drought, more soil will be exposed therefore we need to undertake further investigations to assess the risks.

*As appeared in the Adelaide Advertiser 30/05/07, written by Clare Peddie*

### Professional training in acid sulfate soil management

The Centre for Acid Sulfate Soil Research is seeking expressions of interest in an accredited acid sulfate soil management course to be run in 2008. The course is aimed at professionals working with acid sulfate soil materials in particular people involved in the preparation, assessment, implementation and monitoring of acid sulfate soil management plans. The course runs for four days and will include lectures, laboratory work and field excursions.

Day 1 will cover introductory topics such as definitions, formation and distribution of acid sulfate soils, an introduction to relevant legislation and desk top identification. Day 2 will examine the assessment of acid sulfate soils including laboratory and field methods and understanding and interpreting results. Day 3 covers the management of acid sulfate soils including a review of Local Environment Plan, understanding management options, and monitoring acid sulfate soil management plans. Day 4 is dedicated to bringing everything together as participants are given a case study for which they must develop an acid sulfate soil management plan. This management plan forms the main assessment item for the course.

Courses will initially be run in Lismore, however they may be run in other areas if sufficient interest is generated. Courses can also be tailored to meet the specific needs of individual organisations if required.

For further information email the Centre for Acid Sulfate Soil Research at [cassr@scu.edu.au](mailto:cassr@scu.edu.au)

### From scald to soya

It can be done. This is a rehabilitated acid scald on Robert Quirk's farm at McLeod's Creek, northern NSW.

The picture shows a healthy paddock of soya beans direct seeded in cane residue, one week after harvesting the cane.

The area was previously considered marginal; at 0.5m AHD with high salt, iron, aluminium and acidity levels. All of the peat burned from the surface in the 1930's, and the area was floodgated in the mid 1960's.

Initially Robert struggled to grow any viable sugar cane crops on the area until he laser levelled the fields and started a program of green cane trash retention and mound planting in the mid 1990's.

The transformation has been incredible. Sugar cane production has gone from a low 50 tonnes per hectare to an average of 90-100 tonnes per hectare.



A former acid sulfate scald now supports productive agriculture.

### Reducing acid outflows from Rocky Mouth Creek - stage 1

A \$95,000, three year project funded by the NSW Environmental Trust to reduce acid sulfate soil impacts, has been completed in the Richmond catchment of NSW at Rocky Mouth Creek.

Rocky Mouth Creek is located to the south-west of Woodburn in northern New South Wales. The drained former wetland complex is underlain by acid sulfate soils and has been the source of poor water quality and extensive fish kill events for many years. The main land-use is sugar cane cultivation (north of the creek) and beef grazing (south and west of the creek).

Over three years ago, the sugar cane farmers were approached to develop a project that would assist in reducing the generation and export of acid. A group of six landholders were involved and were instrumental in identifying and selecting techniques to better manage their acid sulfate soils. The role of farmers in choosing their preferred options has been extremely effective in developing their sense of project ownership.



Reshaping drains so they are wider and shallower.

Over 80 hectares have now been laser levelled and limed to enhance drainage of surface waters following flood events. Levelling also removes the need for a high density of field drains which can otherwise lead to undesirable drainage of groundwater.

Over 1.5 kilometres of drains have been reshaped to be wider and shallower and hence further reduce groundwater drainage, while maintaining or enhancing the removal of excess surface water. The exposed earthworks were limed at industry recommended rates to minimise any impacts arising from the construction phase.

Landholders also aimed to increase biodiversity values by retaining 19 hectares of mature paperbark forest. Corridor plantings of 700 trees were undertaken to value-add to the retained areas. Contractors were required to do the initial plantings and then deliver regular weed maintenance for a period of two years. Site monitoring of water quality changes was sub-contracted to Geoff Kerr, a post-graduate of Southern Cross University. Photo-points assisted in showing on-ground works changes over time.

These works were complemented by a further \$50,000 from the Northern Rivers Catchment Management Authority, which enabled the shallowing of an additional 2.5 kilometers of drains plus the installation of a sluice to allow for the active management of a floodgated drainage system.

The key success of this project has been the increased willingness of the agricultural sector to become involved in works which benefit the wider community through improved water quality and biodiversity outcomes, in tandem with better on-farm profits. Neighbouring landholders have now approached NSW Department of Primary Industries with a view to undertaking similar programs of environmental repair on their properties.

For further information contact Simon Walsh from Department of Primary Industries on (02) 6626 1256 or [simon.walsh@dpi.nsw.gov.au](mailto:simon.walsh@dpi.nsw.gov.au)

### **Kerkin's Levee relocation a success for marine habitat**

Kerkin's Levee was built in the 1980's to protect sugar cane land from flooding from the Pimpama River in south east Queensland. As a result of the levee construction, tidal lands were physically separated from the river, which was declared a Fish Habitat Area in 1983.

Reduced tidal flushing behind the levee resulted in a plant diversity shift from a mangrove dominated to a saltcouch dominated community. The levee and tidally excluded areas contained potential acid sulfate soils that acidified following construction. More than 700 tonnes of sulfuric acid was present to 0.4m deep on the 20 ha of tidally excluded land, while the levee represented 215 tonnes of potential and stored sulfuric acid.

Queensland Department of Primary Industries and Fisheries (DPI&F), Gold Coast City Council and Department of Natural Resources and Water collaborated to relocate the levee, in accordance with a restoration plan to prevent acid runoff impacting adjacent environmental values. The levee relocation restored the tidal inundation pattern some 16 years after the levee was constructed, while still achieving flood mitigation. Habitat was also created for the false water-rat, a species listed vulnerable under Commonwealth legislation, on 'islands' created from lime-treated material from the original levee.

A recent inspection of the site in May 2007 revealed successful recruitment of grey mangroves, particularly close to the former levee and replacing saltcouch, while saltcouch is colonising the areas further from the levee that were previously dominated by weeds. Several juvenile mud crabs were seen on site, indicating a huge improvement in habitat quality. The site is also being used to showcase remediation of a barrier to aquatic fauna movement, as part of DPI&F's biopassage project.

For more information contact Rebecca Batton of DPI&F on (07) 3239 0675 or [rebecca.batton@dpi.qld.gov.au](mailto:rebecca.batton@dpi.qld.gov.au).

### **ASS mapping and management plans in Great Barrier Reef catchments**

The Queensland Department of Natural Resources and Water (NRW) was recently successful in winning a national Natural Heritage Trust contract for a project to undertake acid sulfate soils mapping and planning in North Queensland.

Over two years, the project aims to map acid sulfate soils and establish management strategies for avoiding their disturbance and mitigating disturbed acid sulfate soils in priority regions adjacent to the Great Barrier Reef. The priority will be to avoid further acid sulfate soil disturbance, thereby preventing further acidic leachates/contaminants, followed by setting management measures, timelines and estimating budgets for their implementation to achieve acid sulfate soil management goals and objectives.

The high priority regions for the purpose of this project are the Far North Queensland (Terrain) and Mackay-Whitsunday NRM regions. Objectives for each region are as follows:

1. Mackay-Whitsunday – building on existing mapping and analysis to date compile an acid sulfate soil management plan; and
2. Far North Queensland – undertake mapping of key priority areas and prepare an acid sulfate soil management plan.

This project will build on the existing Reef Coastal Catchments Initiative program by developing regional acid sulfate soil plans for incorporation into priority current/proposed Water Quality Improvement Plans, using a comparable but tailored planning process.

Local project steering committees have been established in each region and mapping has commenced around the Cairns district.

For further information contact Bernie Powell from NRW on (07) 3896 9398 or Jim McClurg from NRW on (07) 4967 0881

### Mapping Caboolture Shire, south east Queensland

In 2006 a jointly funded project between the Caboolture Shire Council and the Department of Natural Resources and Water (NRW) commenced mapping (1:50,000) the distribution of acid sulfate soils in low lying areas of Caboolture Shire i.e. below 5 m Australian Height Datum. The aim of the medium intensity mapping was to build upon previous broad scale (1:100 000) mapping undertaken by NRW and identify the presence, depth and net acidity of acid sulfate soils within three key areas: Beachmere, the southern end of Bribie Island and Toorbul–Donnybrook.

To date mapping has been completed in the 367 ha of land in the Beachmere area. The investigation included 70 boreholes undertaken to a maximum depth of 7.6 m. Of the 367 ha investigated, 15 ha were found to contain actual acid sulfate soils with existing acidity up to 0.17 %S (106 moles H<sup>+</sup>/tonne) at shallow depth primarily within the top 1.0 m of soil. Of the remaining 352 ha, potential acid sulfate soils with up to 2.7 %S (1684 moles H<sup>+</sup>/tonne) were found to occur at various depths ranging from less than 0.5 m to 4 m below the surface.

Acid sulfate soil mapping on the southern end of Bribie Island covering 1656 ha of land is continuing with 82 boreholes complete and potential acid sulfate soil identified at depths from less than 0.5 m to 9 m.

For further information contact Don Malcolm from the Department of Natural Resources and Water on (07) 3896 9888 or don.malcolm@nrw.qld.gov.au

### Acid sulfate soil management important in the booming Qld building industry

A booming Queensland economy has led to increased activity within the building industry, to a level not seen in many decades. As a result, environmental management of building sites has become an important aspect in ensuring sustainable growth and development.

Keep Australia Beautiful Queensland (KABQ) has led the way in promoting environmental initiatives in the Queensland building industry. The Clean Site program is an initiative of KABQ, which is the states longest standing community based environmental organisation.

KABQ along with the Queensland government, and various media and private organisations, has participated in several Clean Site demonstration days. These days provide information on improving management of building sites to local participants in the building industry.

The Queensland Acid Sulfate Soil Investigation Team from the Department of Natural Resources and Water has displayed at several of these demonstration days, with the aim of creating industry and community awareness about the dangers of disturbing acid sulfate soils. The acid and metals from oxidisation of acid sulfate soils, can damage the environment and also the foundations of infrastructure based on concrete or metals.

For further information contact Carl Cross from the Department of Natural Resources and Water on (07) 389 69226 or carl.cross@nrw.qld.gov.au



Carl Cross (left) from NRW and Glen Millar (right) from Caboolture Shire Council at a Clean Site Demonstration day.

## Groundwater from acid sulfate soil shown to promote harmful algae

The toxic marine blue-green alga *Lyngbya majuscula* has always been in Moreton Bay, but in recent years its blooms have become larger and more persistent. The Moreton Bay region is one of the fastest growing areas in Australia and it experiences some of the largest blooms reported anywhere in the world.

The blooms affect tourism, recreation and fishing. Greg Savige and his brothers have been commercial fishers in Moreton Bay for 35 years, and they blame *Lyngbya* for catch reductions of up to 66% during bloom times.

The Department of Natural Resources and Water (NRW) is working with the University of Queensland (UQ) on a project to address the *Lyngbya* problem with funding assistance from Natural Heritage Trust through the SEQ Healthy Waterways Partnership.

Various researchers have shown that temperature, light, salinity and nutrients affect the size and duration of the blooms. Using bioassays and field experiments, UQ PhD student Kathleen Ahern has shown significant responses of *Lyngbya* to iron, phosphorus, nitrogen and organic matter. Groundwater from acid sulfate soils also showed significant *Lyngbya* responses in bioassays and was correlated with iron and phosphorus levels.

Shane Pointon from NRW has led the Queensland Acid Sulfate Soil Investigation Team in sampling groundwater and investigation land sources of these nutrients through soil and water sampling, analyses and mapping. A model and map of areas that are likely to export nutrients into Moreton Bay has been developed to support the *Algal Bloom Policy 2.4.7* in the South-East Queensland Regional Coastal Management Plan 2006.



*Lyngbya* looks like dark, matted hair when removed from the water. Only sea hare and rabbit fish can tolerate its toxins. If touched directly it can cause skin, eye and throat irritation.

During hot, calm periods *Lyngbya* blooms and forms surface rafts that wash onto beaches and mangroves where they rot. The decay smells, is unsightly and causes beach closures and large clean-up bills. The inhalation of dried *Lyngbya* that has washed up on beaches can bring on asthma-like symptoms

Caboolture Shire Council removed approximately 6000 tonnes of *Lyngbya* from foreshores in the summer of 2006/07 at a cost exceeding \$345,000. Bribie Island was one of the shire's worst affected areas.

For further information contact Shane Pointon from NRW on (07) 389 69352 or [shane.pointon@nrw.qld.gov.au](mailto:shane.pointon@nrw.qld.gov.au)

Acidified groundwater has been linked with *Lyngbya* outbreaks.

### Scientists study acid remediation at East Trinity

Just 2 km from Cairns across Trinity Inlet, scientists from Queensland's Department of Natural Resources and Water (NRW) have been remediating a highly degraded wetland. The scientists have been working at East Trinity since 2001 and have succeeded in substantially reducing acid and metal discharges that were causing environmental problems.

Now researchers from the CRC for Contamination Assessment and Remediation of the Environment (CRC CARE) and NRW are teaming up to study the soil and water changes that occur during remediation of acid sulfate soils at East Trinity.

The team is led by Dr Richard Bush from Southern Cross University's Centre for Acid Sulfate Soil Research and will develop new risk-based methods to control the release of acid from the highly degraded former cane farm.

They will establish a \$2.75 million national demonstration site to test new acid management techniques that can be used wherever the problem occurs in Australia, says the Managing Director of the CRC CARE, Professor Ravi Naidu.

"East Trinity is also likely to become a site of international significance in developing new ways to curb the acid sulfate soils menace," adds CRC's Professor Leigh Sullivan. "Acid sulfate soil problems occur elsewhere in the world and we need to develop satisfactory solutions. Australia is pioneering these."

The new risk assessment and remediation tools developed by the team will convert low-value acid-affected sites with high environmental risk to high value development sites that have a low environmental risk. East Trinity's proximity to the Great Barrier Reef World Heritage Area makes it a site of particular local and international concern. When remediation is finished the East Trinity site could become a valuable eco tourism destination, Professor Sullivan predicts.

Professor Naidu says that CRC CARE's national contaminated sites demonstration program allows researchers to test and demonstrate to industry, government and the community the latest and best methods for handling contamination problems. "They are a proving ground for new technologies which our dynamic clean-up industry can then export around the world," he says.

Professor Naidu says the CRC will use the new Cleanup Industry Cluster, launched in Adelaide in July this year, to keep industry and environmental managers up to speed on the latest findings and methods for cleansing and protecting the Australian environment from all kinds of contaminants, including acid sulfate soils.

For further information contact Professor Ravi Naidu from CRC CARE on (08) 8302 5041, Professor Leigh Sullivan from CRC CARE on (02) 6620 3742, Bernie Powell from NRW on (07) 3896 9398 or Col Ahern from NRW (07) 3896 9510.

Further information is also available at [www.crccare.com](http://www.crccare.com)



Iron stained creek at East Trinity.

### 6<sup>th</sup> International ASS Conference

The 6<sup>th</sup> International Acid Sulfate Soil Conference will be held next year in China. The conference, which will be run in conjunction with the Acid Rock Drainage Symposium, provides researchers and industry with an opportunity to highlight new developments and identify directions for future research on acid sulfate soil related issues.

The conference is being jointly organised by the South China Agricultural University and the Acid Sulfate Soil Working Group of International Union of Soil Sciences. Conference Chair is Professor Chuxia Lin.

Abstracts of no more than 500 words are invited and should be submitted on-line by 30<sup>th</sup> October 2007. Papers concerning the characteristics, processes, distribution, classification and management/remediation of sulfidic soils in coastal, mining and mined, and other inland environments are welcomed. Papers also dealing with biogeochemical processes, eco-toxicological assessment and remediation of acid drainage from coastal and mine site acid sulfate soils are requested. In addition, papers concerning characteristics, processes and environmental impacts of sulfidic materials and acid sulfate materials such as acid rain-affected soils, mangrove and salt marsh soils, sulfidic dredge spoils, sulfidic and jarositic industrial wastes are also invited.

The conference will be held in Guangzhou, China from the 16<sup>th</sup> to 20<sup>th</sup> September, 2008.

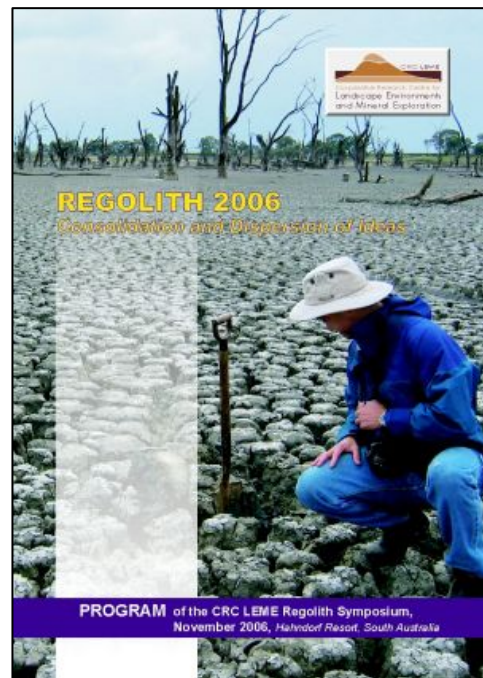
For further information visit [www.6assard.org](http://www.6assard.org)

### Proceedings for Regolith Symposium available

Proceedings from the CRC for Landscape Environments and Mineral Exploration's (CRC LEME) Regolith Symposium are now available.

The proceedings contain 93 papers, covering topics such as inland and coastal acid sulfate soils. Proceedings can be purchased or each paper can be individually downloaded from the internet.

For further information visit <http://crcleme.org.au/Pubs/Monographs/Regolith2006.html>



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 information and awareness