

Connecting soil policies with plans to improve water quality – an example with acid sulfate soils from two north Queensland regions

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Abstract

In recent years, Australian Government investment in preparing catchment-based water quality improvement plans has been substantial. At the same time the overall level of investment in the understanding, planning and management of the soils in these catchments has not been to the same level, despite their critical place in the likely success of such plans. A recently completed exception was the Queensland Government (with funding support from the Australian Government), completing acid sulfate soil water quality improvement plans (ASS WQIPs) for two regions comprising a number of catchments draining into the Great Barrier Reef. These plans were based on the principles and processes of the Australian Government's Framework for Marine and Estuarine Water Quality Protection. Approximately 666 000 ha of coastal acid sulfate soils (ASS) are estimated to occur within the Great Barrier Reef catchments. The disturbance of coastal ASS, in both disturbed and undisturbed condition, represents a significant threat to coastal and marine reef ecosystems. It is critically important to prevent further disturbance and to identify and establish timelines for measures to address existing disturbed ASS. ASS WQIPs were prepared for the Far North Queensland and Mackay-Whitsunday regions. These plans addressed actual and potential ASS in existing urban, regional and agricultural contexts and the need to specifically manage these soils for a water quality outcome.

Key Words

Water quality, acid sulfate soil, Great Barrier Reef.

Introduction

To protect the Great Barrier Reef from risks of pollution and eutrophication, considerable effort is being undertaken to reduce pollutant delivery from catchments. The National Water Quality Management Strategy (NWQMS 2008) and the Queensland Environmental Protection Policy (Water) 1997 promote the sustainable management of water resources by determining environmental values of waterways and corresponding water quality objectives for different water quality indicators as a basis of management actions to protect these values (Environmental Protection Agency 2005). The Australian Government's Coastal Catchment Initiative supports the development and implementation of water quality improvement plans (WQIPs) in accordance with the Australian Government Framework for Marine and Estuarine Water Quality Protection. The development of WQIPs provides an approach consistent with the National Water Quality Management Strategy to set water quality objectives and targets for reducing pollution. WQIPs are targeted toward the high risk catchments identified in the Reef Water Quality Protection Plan (The State of Queensland and Commonwealth of Australia 2003). The WQIPs (and hence their water quality objectives) were mainly focused on impacts of sediments, nutrients and pesticides on Great Barrier Reef waterways.

Disturbance of coastal acid sulfate soils, if not managed appropriately, also poses a threat to the environment (including water quality and coastal values) of the Great Barrier Reef and to its economic and social base. The annual cost of acid sulfate soil disturbance and management in Queensland was estimated to be more than \$180 million in 2000 (Sutherland & Powell 2000). The ASS WQIPs for the Far North Queensland (wet tropics) region (McClurg *et al.* 2009a) and the Mackay-Whitsunday region (McClurg *et al.* 2009b) address these threats in urban, rural and agricultural contexts and complement the existing water quality improvement plans for these regions. Approximately 666 000 ha of acid sulfate soils (ASS) are estimated to occur within the Great Barrier Reef catchments (Powell & Martens 2005). This represents about 30% of the estimated total area of 2.3 million hectares of ASS in Queensland (Powell, Smith & Ahern 1996). There is an increasing body of evidence of existing and historical environmental harm in reef catchments that may be due to acid sulfate soil disturbances. The intent of these plans is to ensure that acid sulfate soils are identified within the regions and that further disturbance does not contribute to degradation of soil, water and biological resources. This will help achieve ecologically sustainable production and development while maintaining the water quality objectives specified in the plans.

Methods

For these plans, the following acid sulfate soil related water quality objectives were adopted, based mainly on the water quality objectives for aquatic ecosystems environmental values specified for Trinity Inlet mid-estuary conditions (Environmental Protection Agency 2007): pH: 6.5–8.4, dissolved oxygen should not be reduced by more than 10% below natural minimal diurnal concentration, alkalinity: >2 meq/L, aluminium: <55 µg/L (pH > 6.5) (sourced from ANZECC & ARMCANZ 2000a), arsenic: <36 µg/L, iron: <1000 µg/L, hydrogen sulfide: <1 µg/L (un-ionised H₂S measured as [S]). It is important to note that these water quality objectives are long term targets. In the shorter term they are guideline trigger values that if not met, identify the need for a management response. The appropriate management responses are described in the plans. It is also important to understand that these trigger values apply to ambient water quality, not to freshwater flows during peak runoff events. As runoff recedes and acidic groundwater comes to increasingly contribute to waterway flows, the trigger values apply. They also assess ASS areas and disturbance risk of the catchments or subcatchments within the regions. This allows consistency and easy integration where appropriate between this Plan and other WQIPs produced. Impacts that may arise if these water quality objectives are not met are also outlined

By adopting the WQIP process, the following issues were addressed: climate impacts on acid sulfate soil, acid sulfate soil disturbances from historical land uses, acid discharges, consultation processes, threats of ASS disturbance, effect of economic growth, effect of climate change, existing programs addressing ASS such as Commonwealth legislation, Queensland legislation, non-statutory plans and strategies, industry codes of practice, existing mapping and identification of priority areas for future mapping. Having articulated the main drivers and pressures that have led to the present situation, the ASS WQIPs articulated proposed management measures and control actions for each region based on the goals of the National strategy for the management of ASS (ANZECC & ARMCANZ 2000b):

Goal 1 - Avoid or minimise future disturbance of ASS

Goal 2 - Promote sustainable management of ASS disturbed by development

Goal 3 - Undertake rehabilitation of previously disturbed ASS to minimise damaging Effects

The plan concludes with recommendations that support implementation such as monitoring and adaptive management systems, institutional and organisational reforms, reforms to the Queensland statutory planning framework, amendments to Queensland environment protection legislation, changes to local government within Queensland, changes to Commonwealth and state government natural resource management investment programs, priority additional research and development activities, a review and reporting framework, statutory capacity to implement this Plan, and programs and funding for the implementation of the Plans

Results

In the Mackay- Whitsunday ASS WQIP 63 400ha of ASS are estimated to be present. Four catchments are identified as high priority for further attention: Lethe Brook, Thompson Creek, Mackay City and Bakers Creek. There are an estimated 155 000ha of ASS in the Far North Queensland Region. A threat analysis concluded three WQIP areas are high priority and in need of urgent attention: the Barron - Trinity Inlet, Tully and Herbert areas (representing about 100 000ha of ASS). Little detailed ASS mapping is available to support planning and development processes for these areas. Mapping associated with the plan helped alleviate this gap for the Barron- Trinity Inlet area and a small percentage of the vast Herbert River delta area. Expansion of sugar cane onto the coastal wetlands and swamps, particularly in the 1970s to 1980s led to drainage and disturbance of ASS. Since the 1990s urban development and port expansion have also significantly encroached low-lying coastal areas involving ASS. There is compelling evidence that ASS disturbance is implicated in the fish kills that occur periodically in the Barron, Mulgrave, Russell, Johnstone and Herbert.

While many ASS problems are locally expressed and need region specific responses, the principles of ASS distribution, impacts and management and planning responses are common for all reef regions. Consequently many aspects of any ASS WQIP would be the same or similar for all catchments adjacent to the Great Barrier Reef. To support these plans, common responses could be most efficiently shared across a number of reef regions. Major recommendations arising from the planning exercise include filling extensive gaps in ASS risk mapping, upgrading best management practices and management guidelines, provision of awareness and training, coordinated and targeted water quality monitoring and feasibility assessment of potential remediation sites.

Conclusion

The plans will make a lasting contribution to an improved understanding of ASS occurrence, severity and management planning requirements in the two regions. The involvement of stakeholders from a wide variety of areas has led to improved protection from ASS disturbance in the Far North Queensland Regional Plan 2008- 2031. While many ASS problems relating to water quality need region-specific responses, good quality ASS mapping, and planning/management responses are common for all reef regions. Consequently to support the ASS WQIPs, common recommended responses could be efficiently shared across a number of Reef regions. Major activities involving soil disturbance and drainage should follow the requirements of the *State Planning Policy 2/02; the Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland* (Ahern *et al.* 1998) and the *Soil Management Guidelines* (Dear *et al.* 2002). The ASS WQIPs make a strong case for the connection between water quality in reef waterways and acid sulfate soil disturbance, but successful water quality outcomes depend on additional resource allocations. The current Commonwealth Reef Rescue program and Queensland Reef Regulations address sediments, nutrients and pesticide impacts on water quality but need to go further and also address ASS. This would allow the plan recommendations to be substantially progressed.

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References

- Ahern CR, Ahern MR, Powell B (1998) 'Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils in Queensland'. (QASSIT: Department of Natural Resources, Indooroopilly, Queensland).
- ANZECC, ARMCANZ (Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand) (2000a) 'Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy'. (Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand: Canberra).
- ANZECC and ARMCANZ (Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand) (2000b) 'National strategy for the Management of Coastal Acid Sulfate Soils'. (Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand: Canberra).
- Dear SE, Moore NG, Dobos SK, Watling KM, Ahern CR (2002) 'Soil Management Guidelines, in Queensland Acid Sulfate Soil Technical Manual'. (Department of Natural Resources and Mines: Indooroopilly).
- Environmental Protection Agency (2005) 'Establishing Draft Environmental Values and Water Quality Objectives: Guideline Resource Assessment'. (Environmental Protection Agency: Brisbane).
- Environmental Protection Agency (2007) 'Trinity Inlet Environmental Values and Water Quality Objectives'. Basin 111 (part), Environment Protection (Water) Policy 1997. (Environmental Protection Agency: Brisbane).
- McClurg JI, Powell B, Norman P, Morrison D, Hampson RJ (2009a) 'Acid Sulfate Soil Water Quality Improvement Plan Far North Queensland Region'. (Queensland Department of Environment and Resource Management).
- McClurg JI, Powell B, Norman P, Hampson RJ (2009b) 'Acid Sulfate Soil Water Quality Improvement Plan Mackay Whitsunday Region'. (Queensland Department of Environment and Resource Management).
- NWQMS (2008) 'National Water Quality Management Strategy'.
www.environment.gov.au/water/quality/nwqms/index.html
- Powell B, Ahern CR (1999) 'QASSMAC Acid Sulfate Soil Management Strategy for Queensland'. (QASSMAC and Queensland Department of Natural Resources: Indooroopilly, Queensland).
- Powell B, Smith CD, Ahern CR (1996) Mapping acid sulfate soils in Queensland. In 'Proceedings 2nd national conference on acid sulfate soils, Coffs Harbour, 5–6 September'. (Eds RJ Smith *et al.*)

(ASSMAC: Australia).

Sutherland NM, Powell B (2000) Overview of the Queensland Acid Sulfate Soils Management Advisory Committee. In 'Acid sulfate soils: Environmental issues, assessment and management'. Technical Papers, 20–22 June 2000, Brisbane. (Eds CR Ahern, KM Hey, KM Watling, VJ Eldershaw) pp. 1–4. (Department of Natural Resources: Indooroopilly).

The State of Queensland and Commonwealth of Australia (2003) 'Reef Water Quality Protection Plan for catchments adjacent to the Great Barrier Reef World Heritage Area, Queensland'. (Department of Premier and Cabinet: Brisbane).