A dangerous legacy

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On November 15 last year (1994), the Federal Environment Minister, Senator John Faulkner, took action to control the controversial Port Hinchinbrook resort development near Cardwell in far north Queensland.

The development is near the World Heritage-listed Great Barrier Reef, which the Minister is responsible to protect. Senator Faulkner said he had information that turbidity created by mangrove clearing might risk the seabed grasses that are grazed by dugong and turtles in the Hinchinbrook Channel.

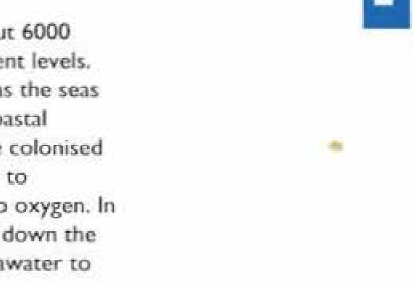
In an effort to resolve this situation, Senator Faulkner convened a group of scientists, including representatives from CSIRO, chaired by the Government's chief scientist, Professor Michael Pitman.

The CSIRO scientists raised another environmental aspect of the project: the existence of potential acid sulfate soil in the mangroves area which, if disturbed by a major excavation, could release sulfuric acid lethal to fish and other water organisms. The group agreed that an investigation into acid sulfate soils was needed and CSIRO successfully tendered for this work.

The CSIRO team involved in the study – in collaboration with the University of New South Wales, the Australian Centre for International Agricultural Research, and the NSW Department of Agriculture and Fisheries – liaises with land and water users to develop tools for assessing the hazards posed by acid sulfate soils, and for managing the soils to minimise the environmental impact of acid drain water.

As part of CSIRO's Coastal Zone Program, the team is mapping the possible distribution of acid sulfate soils along the Australian coast. It is also trying to gain a better understanding of the hydrology and the chemical, mineralogical and biological transformation occurring in such soils.

Acid sulfate soils were formed from about 6000 years ago when sea levels rose to their present levels. Global warming had melted ice sheets, and, as the seas rose, coastal sediments were deposited in coastal estuaries. The newly formed sediments were colonised by mangroves, which allowed organic matter to accumulate in conditions where there was no oxygen. In such anaerobic conditions, bacteria breaking down the organic material reduced the sulfate from seawater to iron sulfide, commonly known as iron pyrite, in concentrations of up to 15% in the top metre of the sediment.



While under water, this pyrite layer is a harmless 'potential acid sulfate soil.' But once exposed to air, – through drainage, excavation or the drought-flood cycle – iron pyrite is transformed into sulfuric acid and the layer becomes actual acid sulfate soil.

Agricultural, tourism and urban developments along Australia's coastal zone have led to the drainage of these soils, thus releasing acid water. The environmental and economic effects are just beginning to be understood, but scientists have so far established that acid drain water is highly toxic to gilled organisms. It has been suggested that drainage of estuarine lands has been a major contributor to the

Acid drain water is highly toxic to gilled organisms. It is thought to cause red spot disease which can wipe out whole catches. Drainage of estuarine lands is suspected to have contributed to the decline of fish catches off northern NSW in the past 40 years. Scientists are investigating potential acid sulfate soils at a proposed development site near Hinchinbrook Channel in Queensland, an area grazed by dugong and turtles.

decline in fish catches in northern NSW in the past 40 years. In addition, acid drain waters are suspected to cause epizootic ulcerative syndrome, or red spot disease in fish, known to have destroyed whole catches.

Acid groundwater also decreases plant production in dairy pastures, sugar cane and other crops. The acid is also corrosive to engineering structures and has caused millions of dollars worth of damage to water pipes.

Dr Greg Bowman of CSIRO's Division of Soils says appropriate techniques for managing acid sulfate soils depend on specific soil characteristics, the sensitivity of the local environment and the type of the proposed development. Available techniques include leaving the soil undisturbed, leaching of the acidity, neutralisation of the acidity usually using lime, removal of the pyrite using hydrocyclones, and burial of the soil beneath clean fill.

'Crucial to selecting a soil management tool is the systematic collection of appropriate and adequate information for specific sites so that informed decisions can be made,' Bowman says.

Scientists from CSIRO and the University of NSW have helped the NSW Road and Traffic Authority to form policies and strategies for treating acid sulfate soils in road projects. Some of the areas where the authority may build future coastal roads are low-lying and may be sources of acidity.

In addition to working on the ground with land and water users, the CSIRO team also advises state and local governments on policy issues. Dr Ian White of CSIRO's Centre for Environmental Mechanics is a member of the NSW Minister for Agriculture and Fisheries Acid Sulfate Soils Management Advisory Committee. This committee is developing policy and techniques for the equitable management of these problem soils.

White says NSW and Queensland state governments now acknowledge the potentially severe environmental and economic impacts of acid sulfate soils.

'The evolving guidelines, particularly in NSW, will help to manage the conflicting demands of the agricultural sector and other land users (who produce soil acidity) and the fishing industry whose products are affected by acid drain water,' White says.