

Victorian

Coastal Acid Sulfate Soils

Strategy



Natural Heritage Trust
Helping Communities Helping Australia

A Victorian
Government
initiative



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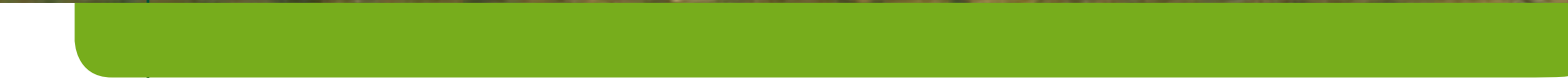
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Foreword

The *Victorian Coastal Acid Sulfate Soils Strategy* aims to protect the environment, humans and infrastructure from the potentially harmful effects of disturbing coastal acid sulfate soils.

It explains why acid sulfate soils in Victoria's coastal and estuarine areas present planning and management issues. The strategy aims to raise understanding and awareness of the risks and impacts associated with disturbing them.

A series of ongoing actions are proposed to help land managers and other authorities address these issues. Avoiding disturbing acid sulfate soils in our coastal and estuarine areas is a major focus of this strategy.

While the existence of coastal acid sulfate soils and their associated risks have been recognised for some time, it is only recently that the harmful effects of disturbing them have been documented.

The science of identifying risk areas continues to evolve. Mapping land with the potential for containing acid sulfate soils requires a good understanding of current and past landform processes and detailed on-ground investigation. It involves specialised soil sample extraction, transport, storage, testing and interpretation procedures. To help with these site investigations, the Victorian Best Practice Guidelines for Assessing and Managing Coastal Acid Sulfate Soils are being developed and will be published in 2009.

This Victorian Coastal Acid Sulfate Soils Strategy was prepared by the Coastal Acid Sulfate Soils Steering Committee.

The steering committee reflects the cross-government nature of issues associated with coastal acid sulfate soils. Membership of the steering committee includes:

- Mr John Ginivan (Chair) – Department of Planning and Community Development (formerly Department of Sustainability and Environment)
- Ms Rebecca Price – Department of Sustainability and Environment
- Ms Cluny Ferguson – Department of Sustainability and Environment (formerly Department of Planning and Community Development).
- Ms Maggie Baron – Victorian Coastal Council
- Mr Austin Brown – Department of Primary Industries
- Mr Doug Crawford – Department of Primary Industries
- Mr Chris McAuley – Environment Protection Authority
- Ms Denise Turner – Environment Protection Authority
- Mr Chris Barry – Gippsland Coastal Board.

The steering committee acknowledges the invaluable assistance of Ms Lyndel McLennan, Ms Virginia Brook and Mr Dominic Passaportis from the Department of Sustainability and Environment in developing this strategy.

Funding for developing this strategy was received under the Victorian Government's \$200 million Our Environment, Our Future - Sustainability Action Statement 2006, as well as from the Natural Heritage Trust and the Gippsland Coastal Catchment Initiative.

▼ FLOODED VEGETATION



▲ BACK LAGOON OF NICHOLSON RIVER

List of acronyms

AASS	Actual acid sulfate soil
AHD	Australia Height Datum
ASRIS	Australian Soil Resource Information System
ASS	acid sulfate soil
CAMBA	China – Australia Migratory Bird Agreement
CASS	coastal acid sulfate soil
CASSIC	Coastal Acid Sulfate Soil Strategy Implementation Committee
CASSKC	Victorian CASS Knowledge Centre
DPCD	Department of Planning and Community Development
DPI	Department of Primary Industries
DSE	Department of Sustainability and Environment
EPA	Environment Protection Authority
EPBC	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
IASS	inland acid sulfate soil
IWMP	Industrial Waste Management Policy
JAMBA	Japan-Australia Migratory Bird Agreement
MBO	monosulfidic black ooze, see glossary
NRMMC	National Resource Management Ministerial Council
OH&S	occupational health and safety
PASS	potential acid sulfate soil
SEPP	State Environment Protection Policies
SPPF	State Planning Policy Framework
VCS	<i>Victorian Coastal Strategy 2008</i>
WASS	waste acid sulfate soil

▼ IN THE FIELD AT LAKE WELLINGTON



▲ GYPSUM CRYSTALS



▲ INTACT CORES FOR DESCRIBING SOILS



▲ SOIL BLEACHED BY ACID AT HEART MORASS

Terminology and definitions used in conjunction with acid sulfate soils

Acid Sulfate Soil (ASS) is any soil that contains sulfidic or sulfuric material.

Actual Acid Sulfate Soil (AASS) is any soil (coastal or inland) that contains sulfuric material.

CASS risk area refers areas at risk of containing CASS being:

1. Areas mapped as having potential for CASS (Maps 1–6). These maps are also found on (www.dpi.vic.gov.au/dpi/vro/vrosite.nsf/pages/soil_acid_sulfate_soils).
2. Areas mapped as having potential for CASS in the Atlas of Australian Coastal Acid Sulfate Soils 2006 on the Australian Soil Resource Information System (ASRIS) website at (www.asris.csiro.au/index_ie.html).
3. Areas < 10 m AHD where soil landscape mapping indicates high water tables, swamp or estuarine environments or where vegetation is coastal or estuarine in nature (such as mangrove and *Melaleuca* spp. *Casuarina* spp. or salt tolerant species). Maps are available at (www.dpi.vic.gov.au/dpi/vro/vrosite.nsf/pages/soil_acid_sulfate_soils).

Coastal Acid Sulfate Soil (CASS) is an acid sulfate soil (ASS) that has formed as a result of sea influence (excluding cyclic salt).

Dewatering is the process of removing water from soil.

Disturbance refers to any activity which may cause CASS to be oxidised, including excavation and transport of CASS, dewatering (temporary or permanent) of a site containing CASS or bathing (temporary or permanent) of in-situ CASS with oxygenated water.

High risk activities refers to activities identified as presenting a high risk of disturbing CASS. Such activities include:

- excavating soil;
- filling land;
- moving soil from a pre-activity location (horizontally or vertically);
- temporarily or permanently dewatering soil; and
- causing CASS to be temporarily or permanently bathed in oxidised water (as opposed to the low oxygen content water in which it is normally submersed).

H₂S. Hydrogen sulfide gas. A highly toxic gas produced by the breakdown of sulfites in an anaerobic environment.

Holocene Period is the geological epoch which began approximately 10,000 years ago and continues to the present.

Inland Acid Sulfate Soil (IASS) is an ASS that has formed from processes unrelated to the sea (apart from cyclic salt).

Land with potential for containing CASS is low lying coastal land which may have coastal acid sulfate soils as suggested by its geomorphology.

Monosulfidic Black Ooze (MBO) is a high organic sludge material that occurs under water on the bed of swamps, lakes, drains or channels. MBO is enriched with iron monosulfide (FeS) which has the potential to produce sulfuric acid.

▼ FIELD SAMPLING ON THE FLOODPLAIN OF THE LATROBE RIVER



▼ IRON STAINING AT LAKE TYERS



▲ TYPICAL LOW-LYING LANDS ALONG WATERWAY

Potential Acid Sulfate Soil (PASS) is any soil (coastal or inland) that contains sulfidic material but not sulfuric material.

Prospective land refers to land whose geomorphology indicates that there is a potential or prospect of encountering sulfidic material or sulfuric material.

Ramsar Site is a wetland listed on the Ramsar list of wetlands of International importance. The Ramsar convention is an international treaty for the conservation and sustainable utilisation of wetlands.

Sulfidic material is any soil, sediment or peat layer (horizon) that contains metal sulfides (generally pyrite or iron sulfide; FeS_2). This material only exists under oxygen free or anoxic, waterlogged conditions.

Sulfuric material is any soil, sediment or peat layer (horizon) that contains sulfuric acid (H_2SO_4). Sulfuric acid is produced by oxidation of sulfidic material.

Waste: means waste as defined in Section 4 of the *Environment Protection Act 1970*.

- (a) any matter whether solid, liquid, gaseous or radio-active which is discharged, emitted or deposited in the environment in such volume, constituency or manner as to cause an alteration in the environment
- (b) any discarded, rejected, unwanted, surplus or abandoned matter
- (c) any otherwise discarded, rejected, abandoned, unwanted or surplus matter intended for
 - (i) recycling, reprocessing, recovery or purification by a separate operation from that which produced the matter, or
 - (ii) sale and
- (d) any matter prescribed to be waste.

▼ FLOODING ALONG THE COAST



▲ SCALDING FROM DISTURBED CASS



▲ FLOODPLAIN OF THE AGNES RIVER

1. Victorian Coastal Acid Sulfate Soils Strategy

The Victorian Coastal Acid Sulfate Soils Strategy aims to help protect the environment, humans and our infrastructure from the harmful effects which can occur when coastal acid sulfate soils (CASS) are disturbed.

Acid sulfate soils occur naturally in both coastal and inland settings. These soils contain metal sulfide minerals. Left undisturbed these soils are harmless, but if drained, excavated or exposed to air the metal sulfides react with oxygen and form sulfuric acid. This acid can trigger the release of other toxic elements (such as heavy metals and other contaminants) and when combined with acid kills plants and animals and can contaminate drinking water and food (such as oysters) as well as corrode concrete and steel.

It is important that land use planners and managers can identify areas where development is best avoided due to acid sulfate soils. Already, there are many examples of costly mistakes in Australia involving considerable damage to land, buildings and waterways as a result of disturbing CASS.

The strategy explains why CASS are a management issue in Victoria and outlines actions to address issues identified.

To date, the extent of CASS and the risks associated with their disturbance have not been well documented nor integrated in land resource assessment and management processes. As a first step in addressing this, mapping has been conducted to identify land that potentially contains CASS (see Maps 1–6).

Mapping areas with potential for CASS is time-consuming and at this stage it remains at a broad-scale rather than detailed. However, given the complexities of chemical change caused by disturbing CASS and the exponential increase in areas of impact if disturbed, a precautionary approach has been adopted in this strategy.

In this sense the strategy should be considered as the first stage of a work in progress (see Scope below).

It is envisaged that as mapping of CASS progresses and the need to avoid disturbing CASS is better understood, maps identifying land with potential for containing CASS will be updated to provide more detail. The objective to avoid disturbing CASS will be promoted by adopting the Victorian Best Practice Management Guidelines for Assessing and Managing CASS (to be published in 2009) in land resource assessment and management processes.

▼ IRON STAINING IN THE HEART MORASS



▲ IRON STAINING IN THE DOWD MORASS



▲ COASTAL PLAIN VEGETATION

Purpose of this strategy

The Victorian Coastal Acid Sulfate Soils Strategy aims to protect the environment, humans and infrastructure from the harmful effects of disturbing CASS. It aims to build the capacity of land owners and land and water managers to plan and manage activities in CASS risk areas. It identifies principles and promotes a risk management approach to guide decision-making. The emphasis of the strategy is on avoiding disturbing CASS.

Scope

This strategy applies to all coastal and estuarine lowlands in Victoria at or less than 10 m AHD (Australian Height Datum) where there is intention to undertake 'high risk activities'. The strategy also applies to land between 10–20 m AHD which has been mapped and identified as potentially containing CASS or where the land immediately adjacent has been mapped and potential identified for containing CASS (see Maps 1–6).

The focus of this strategy is on acid sulfate soils in coastal areas, as the greatest risks to the Victorian environment are currently seen to be from potential mismanagement of soils along our coastline. This strategy does not apply to areas known to have inland acid sulfate soils (IASS). IASS may be included in a second phase of this strategy once further soil mapping has identified areas with the potential of containing IASS across Victoria.

The strategy and its associated mapping does not apply to CASS under permanent water bodies (such as lakes) and waterways (rivers or creeks) or areas below the high tide mark (ocean bays, estuaries or inlets).

The strategy applies to the potential development of new sites and not to the rehabilitation of existing sites, although it is recognised that aspects of the strategy could help in assessing and rehabilitating already disturbed sites.

Consultation

The *Draft Strategy for Coastal Acid Sulfate Soils in Victoria* was released for consultation in July 2008 and 25 submissions were received.

From August to September 2008, members of the steering committee conducted five workshops with key stakeholders from a range of organisations, groups and agencies, including from the Victorian and local governments.

▼ ESTUARINE VEGETATION



▲ GEO-PROBE SOIL SAMPLER



▲ IRON STAINING IN WATER – DOWDS MORASS, GIPPSLAND

2. Why we need a coordinated strategy for CASS

Victoria has little documented history of CASS causing environmental degradation. However, anecdotal evidence is emerging that past acid discharge events may have occurred but the environmental impacts were attributed to other causes. While knowledge and evidence of the immediate and long-term impacts of disturbing sulfidic materials in CASS builds, it is appropriate for Victoria to take a preventative approach to ensure adverse impacts experienced in other areas of Australia are not repeated here.

A number of factors indicate the need for a coordinated strategy to manage CASS in Victoria:

- **increased pressure to develop low-lying coastal areas**, which increases the risk of disturbing CASS and the potential to trigger acid and other toxic releases into fragile coastal and estuarine ecosystems
- **increased evidence** that CASS issues should be addressed at the planning stage before approving any development
- **the need to educate decision-makers** on the risks (environmental, social and economic) associated with disturbing CASS
- **increased need to improve sustainable land management** with a focus on the capability of the land to support proposed activities now and in future
- **the current commitment to manage CASS** in both the National Cooperative Approach to Integrated Coastal Zone Management: framework and implementation plan 2006 and the *Victorian Coastal Strategy 2008*
- **Victoria's current commitment** as a signatory to the National Strategy for Coastal Acid Sulfate Soils Management 2000
- **the need to coordinate CASS investigations**, studies and training conducted at a local and / or regional level
- **the need to better coordinate and strengthen** existing policy and statutory instruments relating to CASS.

▼ BLEACHED AND IRON-STAINED SOILS



▲ ANGLESEA RIVER ESTUARY



▲ FLOCCULATE IN DRAIN, PORT ALBERT

3. The national and state policy context

There is a strong national and state policy context for CASS (see Figure 1).

National policy context

The *National Strategy for Coastal Acid Sulfate Soil Management 2000* has four key objectives:

- **IDENTIFY** and define CASS
- **AVOID** disturbance of CASS
- **MITIGATE IMPACTS** when CASS disturbance is unavoidable
- **REHABILITATE** disturbed CASS and acid drainage.

The National Cooperative Approach to Integrated Coastal Zone Management 2006 identified the need to manage the impact of coastal development in areas with acid sulfate soils.

Victorian policy context

The *Victorian Coastal Acid Sulfate Soils Strategy* builds on several policy and legislative initiatives:

1. The *Industrial Waste Management Policy (IWMP): Waste acid sulfate soils (WASS)* was developed in reference to the *Environment Protection Act 1970*. This policy was developed in response to increasing development pressure in the Lower Yarra Basin, an area renowned for its Coode Island Silts, which contain high levels of CASS. The limitation of this policy is its focus on dealing with CASS after it has been disturbed, rather than assessing the risks of CASS disturbance at the planning stages.
2. The state *Planning Policy framework (SPPF)* 15.08-2 (gazetted December 2008) which states that planning for coastal areas should:
 - Avoid development in identified coastal hazard areas susceptible to CASS
 - Ensure that development conserves, protects and seeks to enhance biological diversity and ecological values by avoiding the disturbance of CASS.
3. The *Environment Effects Act 1978* Guidelines made in terms of the *Environment Effects Act 1978* which highlight the need to consider CASS in assessing proposed developments.
4. The *Coastal Spaces Recommendations 2006* which provides recommendations that seek to improve and clarify strategic planning policies, provisions and tools for managing sustainable coastal development in non-metropolitan coastal areas. A key recommendation is that the government “establish clear planning policy that discourages disturbance of coastal acid sulfate soils” (Recommendation 6).
5. The first principle of the *Victorian Coastal Strategy 2008 (VCS)* is “to protect significant environment and cultural values, based upon a sound understanding of coastal features, vulnerability and risks”. The VCS contains as a policy the need to “avoid disturbing coastal acid sulfate soils and ensure any development proposed near or on CASS demonstrates that it will avoid any disturbance”. The VCS further commits the Victorian Government to developing a strategy and planning tools for managing CASS.
6. Preliminary strategy work and risk assessment methodology for CASS undertaken by Fitzsimons and Brown (2003).
7. Other Victorian Government policy documents that recognise the risks posed by disturbing CASS and which require it acts to mitigate these risks.

▼ FIELD SAMPLING AT THE LATROBE RIVER FLOODPLAIN

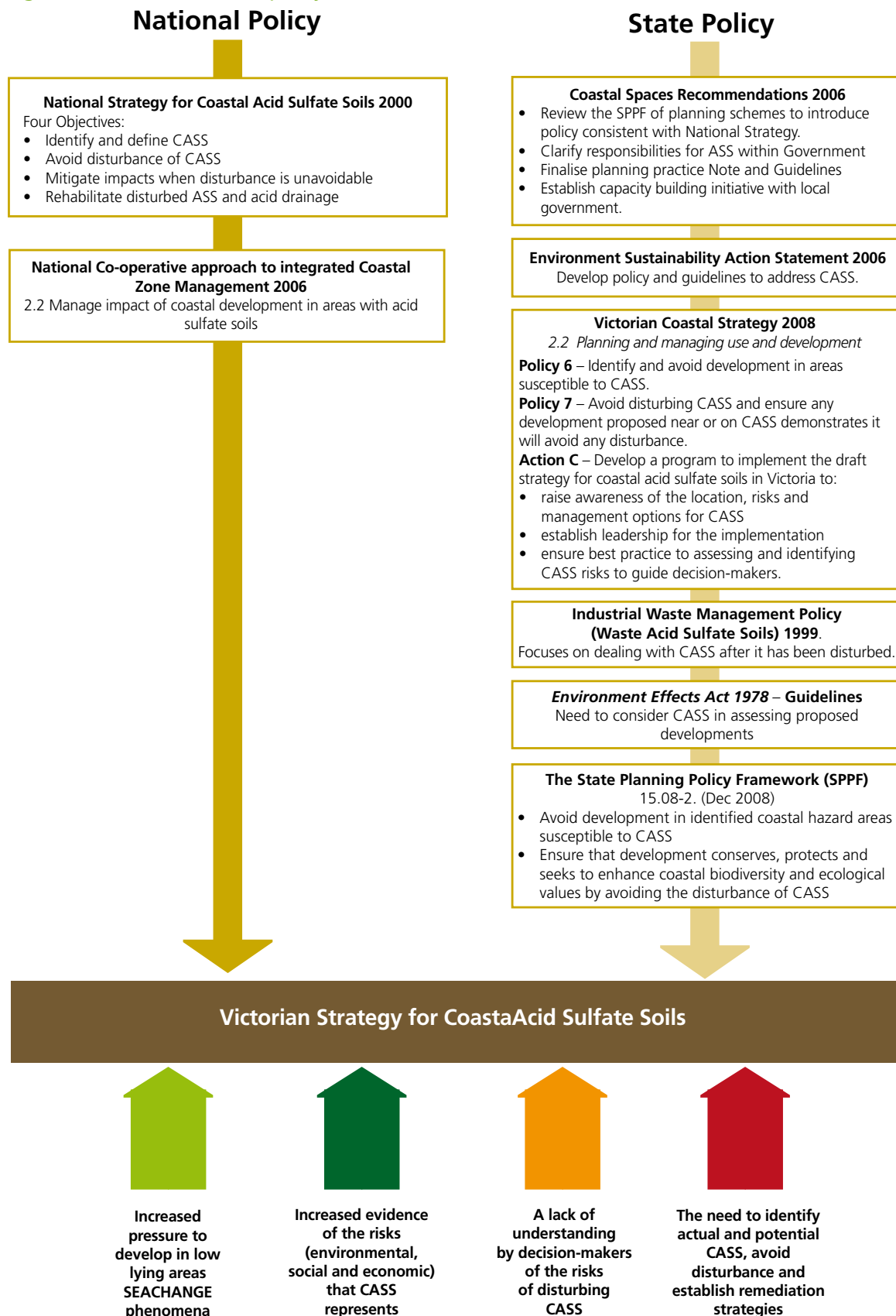


▲ GEO-PROBE SOIL SAMPLER



▲ PEAT SCALDING ON THE NICHOLSON RIVER

Figure1. National and state policy context for CASS



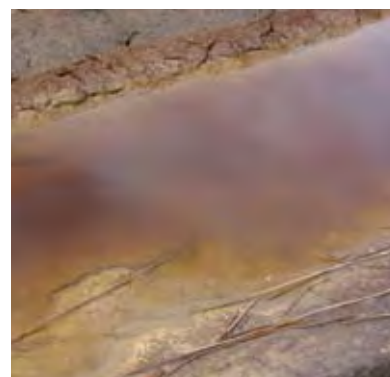
4. How are coastal acid sulfate soils formed?

Coastal acid sulfate soils (CASS) contain sulfuric acid or have the potential to form sulfuric acid when exposed to oxygen.

CASS forms naturally when sulfate rich water (such as sea water, sewerage waters or mine waters) mixes with soils containing iron and organic matter (see Figure 2). Most CASS found in Victoria was formed within the last 10,000 years after the last major sea level rise, when levels were about 1.5 m higher than today. When sea water flooded the land, the sulfate it contained mixed with land sediments containing iron oxides and organic matter. Under these waterlogged, anaerobic (oxygen-free) conditions, bacteria assist in converting sulfates into sulfides. These sulfides react with metals to form metal sulfides, typically pyrite.

If left undisturbed and covered in water, sulfidic materials (or potential acid sulfate soil – PASS) pose little or no threat. However, when exposed to oxygen through drying under drought conditions or from excavating or dredging, chemical reactions may lead to the formation of sulfuric materials ($\text{pH} < 4$) (or actual acid sulfate soil – AASS) and the generation of sulfuric acid (see Figure 3). When sulfuric materials are exposed to water again, there is a risk that significant amounts of sulfuric acid are released which can cause the acidification of wetlands and estuaries. Other heavy metals and metalloids (such as arsenic) can also be mobilised.

▼ FLOODPLAIN AT THE HEART MORASS



▲ IRON STAINING AT THE HEART MORASS

Figure 2. Natural setting: PASS insulated from exposure to oxygen by watertable. Waterway well flushed, mitigating impact from incidental acid discharge events.

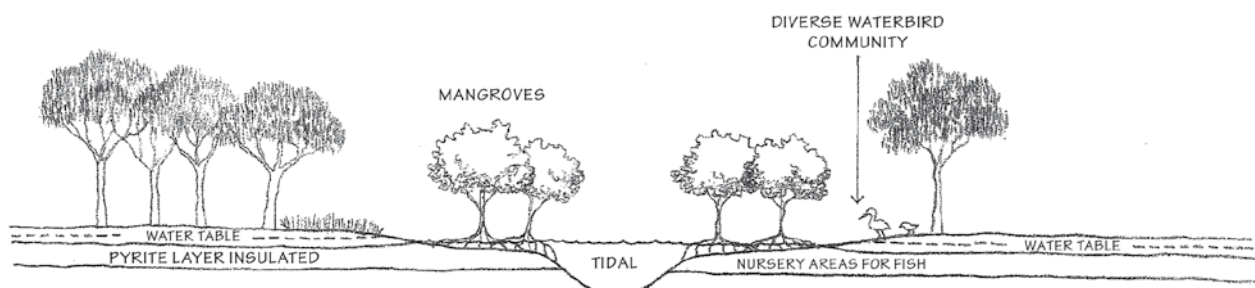
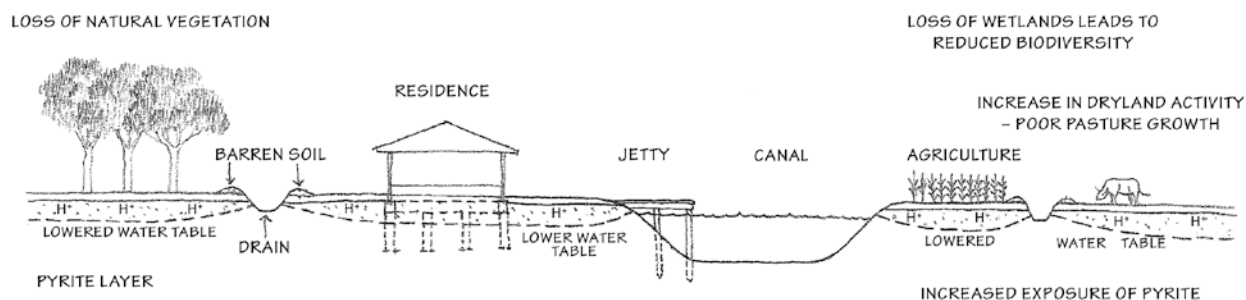


Figure 3. Post drainage: Lowered watertable exposes PASS soils to oxygen. Increased drainage density and volume leads to increased acid export.

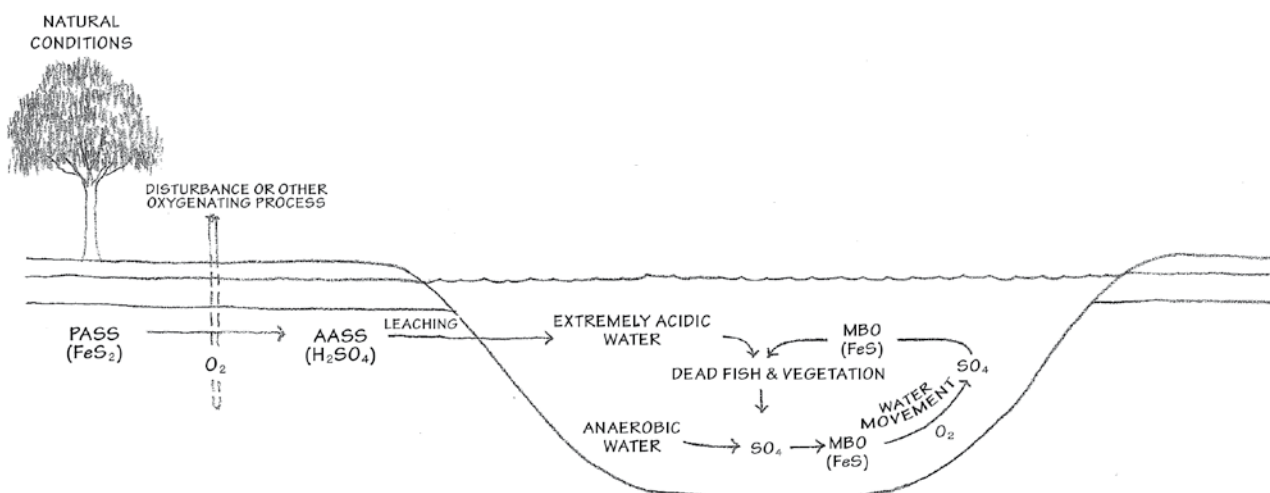


Monosulfidic black ooze (MBO) forms in water bodies and still waterways, where sulfate and iron from surrounding ASS combine with abundant organic matter (see Figure 4). Such environments provide excellent conditions for sulfate reduction, leading to iron monosulfide precipitation. The production of swamp gas (hydrogen sulphide; H_2S) is a common occurrence in these environments. When water containing MBO is oxygenated through swirling or stirring (such as flood events), the MBO in a finely suspended state can completely consume the dissolved oxygen and cause massive fatalities for fish and other aquatic life, within minutes.



▲ GAS BUBBLING FROM PEAT SWAMP ON NICHOLSON RIVER

Figure 4. The Formation of Monosulfidic Black Ooze (MBO)



5. Why are CASS a problem?

When sulfidic material in CASS is disturbed and exposed to air, an oxidation process occurs and sulfuric acid is produced. Sulfuric acid has the potential to mobilise heavy metals such as arsenic and aluminium which may be dissolved in the soil. These metals can become soluble in toxic quantities. The combination of sulfuric acid and heavy metals can have severely detrimental effects on land and water, including:

- **Acidification** of waterways, wetlands, and estuaries which leads to massive fish kills. In turn, deoxygenation of the water can lead to toxic algal blooms. Acid has also been linked to chronic effects on aquatic systems that include disease, reduced hatching survival and growth rates for a wide range of species.
- **Degradation** of the ecology of wetlands, shallow freshwater and brackish aquifer systems through loss of water quality, degradation of habitat and decline in dependent ecosystems. Apart from the direct affect of acid production which causes fish kills and the decline in number and diversity of invertebrate populations, acidification and heavy metal toxicity can have a negative impact on macrophytes and other aquatic vegetation that aquatic animals depend on for food, shelter and reproduction. Loss of aquatic animal life can, in turn, have serious consequences for other species along the food chain, such as birds. Sulfuric materials in CASS can potentially affect important breeding and feeding habitat for various waterbirds, including migratory species listed under international agreements such as JAMBA and CAMBA.
- **Adverse impacts** on commercial and recreational fisheries and rural productivity. In New South Wales, it is estimated the annual cost to the commercial fishing industry from fish kills and disease is \$2 million dollars. In 2001, the Richmond River was closed to fishing for six months following a major fish kill. In 1995, over \$1 million of sea mullet was discarded by New South Wales commercial fishers because of Epizootic Ulcerative Syndrome (red spot). Losses in production of Sydney rock oysters from CASS impacts were estimated at \$7 million from 1994 to 2000.
- **Corrosion** of concrete and steel infrastructure, such as foundations and footings, culverts, pipes (including drinking water conduits), bridges and floodgates, reducing their functional life span. The costs associated with damage to public and private infrastructure is significant. Local governments have spent millions of dollars in New South Wales replacing iron water pipes corroded by acid groundwater in areas that contain CASS. Concrete corrosion of road and rail bridges and other structures has been identified from the Shoalhaven area in southern New South Wales to Cairns in northern Queensland. Anecdotal evidence from Victorian water authorities suggests that areas exposed to a high risk of CASS require more frequent infrastructure replacements.

▼ YARRA RIVER ESTUARY, DOCKLANDS



▲ BEACH EROSION AT 90-MILE BEACH

- **Immediate detrimental human health effects** such as skin and eye irritations and burns. The long-term impacts of exposure to heavy metals on human health are not well understood but are thought to include increased risks of cancers (skin and lung) and skin lesions. Water polluted by toxic quantities of soluble heavy metals has led to human and animal ill health. Corrosion of pipes can also lead to contamination of drinking water supplies and increased sewerage spills.
- **Occupational health and safety (OH&S)** risks associated with disturbing CASS such as the inhalation of H_2S associated with working in confined spaces. Health risks associated with handling contaminated wastes and exposure to acid dust also exist.
- **Loss of high recreational and environmental value.** Disturbing CASS and the acidification of waters could result in areas being unsuitable for recreation and tourism due to unsightly environmental impacts, potential disagreeable odours and human health issues.
- **Irreversible change to landforms and soils.** It is now recognised that certain environmental effects of the oxidation of acid sulfate soils can last for hundreds and thousands of years. Acid discharge can lead to changes in the soil fabric, leading to irreversible shrinking and lowering of ground surfaces.

All these impacts generally occur off-site, so managing CASS must consider a wider area than a particular site under development. One on-site activity which can have off-site impacts is the dewatering of areas surrounding a development site.

The CSIRO estimates the cost of mitigating the impact of CASS around Australia from coastal development is around \$10 billion (Fitzpatrick et al 1999 "Risks seen from Acid Sulfate Soils") The high cost of treating and rehabilitating acid-affected areas has led to many developments being stalled or abandoned. To reduce this problem and to better manage coastal resources, there is a need for greater recognition of the occurrence, severity, risk and avoidance of CASS in Victoria.

In addition to the ecological costs and loss of amenity associated with disturbing CASS, ongoing liability issues include:

- infrastructure damage and maintenance costs
- human health costs
- occupational health and safety costs
- dredging and spoil management costs
- environmental management costs
- opportunity costs associated with tourism.

Avoiding disturbing CASS is more cost effective than managing, mitigating and / or remedying adverse results once it is disturbed.

▼ CORRODED CONCRETE IN THE HEART MORASS



▼ BEACH EROSION AT 90-MILE BEACH



▲ EXPOSED LAGOON PEATS AT 90-MILE BEACH

6. Where are CASS found in Victoria?

CASS are generally found in low lying areas within coastal plains and along the edges of water bodies. This includes flood plains and lower slopes, abandoned river meanders and oxbow lakes, swamps (including back-swamps, peat swamps and reclaimed swamps), morasses, beaches, coastal dunes and swales and tidal flats. Tidal influence can also extend many kilometres inland up incised valleys.

The mapping of land with the potential for CASS utilised a geomorphological approach by identifying sea levels during the mid-Holocene geological period of Earth (about 10,000 years ago) and the knowledge that associated sediments often contain appreciable contents of pyrite. It should be noted that at the scale of investigation conducted, the boundaries defining areas with potential for containing CASS should be regarded as a guide only.

On-ground investigation was concentrated on priority areas where pressure for land development is high and where CASS issues are known to have occurred. The results of these investigations are shown in Maps 1–6.

Areas mapped as having potential for CASS covers approximately 250,000 ha of land. The majority of land with potential for CASS was found surrounding Port Phillip Bay and east to the Gippsland Lakes. However, environmentally sensitive areas are scattered along the entire coastline of Victoria, which may be affected from relatively small point sources of acid production.

In addition to the boundaries for land with potential for containing CASS, mapping also included a precautionary boundary at the 10 m AHD contour, which is the area between the two boundaries where CASS may still be present.

The maps indicating land with potential for CASS are attached to the strategy and also available at www.dpi.vic.gov.au/dpi/vro/vrosite.nsf/pages/soil_acid_sulfate_soils

This strategy defines areas at risk of containing CASS as:

1. areas mapped as having potential for CASS (Maps 1-6). These maps are also found at (www.dpi.vic.gov.au/dpi/vro/vrosite.nsf/pages/soil_acid_sulfate_soils).
2. areas mapped as having potential for CASS in the Atlas of Australian Coastal Acid Sulfate Soils 2006) on the Australian Soil Resource Information System (ASRIS) website at (www.asris.csiro.au/index_ie.html).
3. areas <10m AHD where soil landscape mapping indicates high water tables, swamp or estuarine environments (that is soils with a marine origin and potential to contain iron sulfur in anoxic condition). Vegetation is coastal or estuarine in nature, such as mangrove, *Melaleuca* spp., *Casuarina* spp. or salt tolerant species. Maps are available at (www.dpi.vic.gov.au/dpi/vro/vrosite.nsf/pages/soil_acid_sulfate_soils).

▼ COASTAL FOOTSLOPES



▲ FLOODPLAIN OF THE NICHOLSON RIVER
(UPPERMOST LIMIT OF CASS 24 KILOMETRES INLAND)

7. Activities that can disturb CASS

The emphasis of this strategy is on avoiding the disturbance of CASS.

Disturbance refers to any activity that disturbs or alters the sulfidic materials in CASS and causes oxidation. Types of activities that have a high risk of disturbing CASS are:

- excavating soil;
- filling land;
- moving soil from its pre-activity location (horizontally or vertically);
- temporarily or permanently dewatering soil; and
- causing CASS to be temporarily or permanently bathed in oxidised water (as opposed to the low oxygen content water in which it is normally submersed).

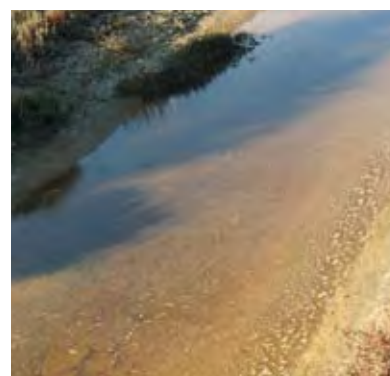
Examples of these activities include:

- **agricultural activities** that involve land drainage, particularly deep drainage (such as works to prevent flood and tidal inundation or lowering of the water table)
- **dredging** in low land areas and low land waterways and drains which deposits acid sulfate soil that acidifies if disposed of on-shore without dewatering and requires expensive neutralisation treatment
- **drilling** for bores
- **drought** (such as drying of soil profiles to depth)
- **extractive** industries (sand and gravel extraction from rivers or flood plains)
- **infrastructure works** (flood management, drainage works, installation of utilities such as railways, roads, and water and sewerage pipelines)
- **land use change** (including decommissioning of irrigation or land or vegetation management practices that alter water tables. For example, Blue Gum plantations in Western Australia have been recorded to have significantly lowered the water table, thus exposing CASS to oxygen)
- **urban and tourism development** (such as for housing, resorts or marinas)
- **water extraction**.

The risks and impacts of disturbing CASS may vary between sites and affect the environment well beyond a disturbed site. The onus is on the potential disturber of a site to prove that CASS are not present or will not be activated. This will require detailed site investigations.

This strategy proposes the completion of the *Victorian Best Practice Guidelines for Assessing and Managing Coastal Acid Sulfate Soils* (draft released June 2008). The Guidelines propose a decision making tree to assist in identifying risks from CASS. Is a high risk activity proposed in an area with potential to contain CASS? The guidelines will also outline site investigation requirements. The investigations are necessary to identify risks and impacts. Once risks and impacts are identified, avoidance or a low risk solution can be planned.

▼ FLOCCULATE IN DRAIN, PORT ALBERT



▲ COASTAL FLOODPLAIN, HEART MORASS

8. CASS in a time of climate change

The risks and impact of climate change and related sea level rises are acknowledged at all levels of government in Australia. The *Victorian Coastal Strategy 2008* identifies climate change as one of three significant issues likely to impact on Victoria's coastline over the medium to long term. Potential climate change impacts on the Victorian coastline include sea level rises and increased frequency and severity of storm events which are likely to lead to inundation and erosion. Potential environmental effects of climate change that could expose CASS include erosion of ocean foreshores and inlets, including cliffs, dune systems, sandbars and tidal mud flats as well as estuary river beds and banks. Salinisation through sea water flooding into aquifers is also a potential threat.

Climate change has the potential to increase CASS exposure which highlights the importance of this CASS strategy to act as a significant tool to help manage high risk activities along Victoria's coast.



▲ LAGOON PEAT EXPOSED BY BEACH EROSION AT 90-MILE BEACH



▲ BEACH EROSION AT APOLLO BAY



▲ EROSION OF THE NORTH SHORE OF LAKE WELLINGTON



9. Decision-making principles for managing CASS

1. **Avoid** disturbing CASS.
2. **Ensure** any use and / or development proposed near, or on potential CASS can demonstrate it will avoid any disturbance (*Victorian Coastal Strategy 2008*).
3. **Take a precautionary (risk management) approach*** when planning and managing high risk activities in areas with potential to contain CASS (CASS risk areas).
4. **Discourage** the intensification of use and / or development in areas with potential to contain CASS.
5. **Assess** impacts and risks of CASS on any land, waterway and water body with a connection to a CASS risk area. **Consider** the cumulative effect of any use and / or development proposal in areas with potential to contain CASS.
6. **Assess** risks and impacts on the basis of the *Victorian Coastal Acid Sulfate Soils Strategy* and any subsequent *Victorian Best Practice Guidelines for Assessing and Managing Coastal Acid Sulfate Soils*.
7. **Consider** the potential risks and impacts to the environment, humans and infrastructure from disturbing CASS.
8. **Remediate** detrimental effects arising from the past and current disturbance of CASS.

* The precautionary principle of sustainability advocates taking action now despite a level of uncertainty to minimise future risks. The principle may lead to a decision not to take action or not to proceed with a proposal because of a high level of uncertainty about beneficial outcomes.



▲ FERRUGINISED BAXTER FORMATION AT HASTINGS



▲ BEACH EROSION AT LAKE WELLINGTON

10. Objectives and actions

The objectives of this strategy are to:

Establish **LEADERSHIP** for implementing the *Victorian Coastal Acid Sulfate Soils Strategy*.

Raise **AWARENESS** of the location, risks and impacts of CASS in Victoria. To identify existing CASS risk areas, avoid disturbance in high risk areas and ensure appropriate management or remediation actions in moderate or low risk areas.

Ensure **BEST PRACTICE** in assessing and identifying CASS risks and impacts.

Implementing these actions is subject to funding availability (see Objective 1, Action 2 below – *Develop a five-year funding strategy*).

Objective 1 Establish LEADERSHIP		Responsibility	Timeframe
Action 1	Finalise and release the <i>Victorian Best Practice Guidelines for Assessing and Managing Coastal Acid Sulfate Soils</i> .	DSE	YR1
Action 2	Establish an interdepartmental CASS Implementation Committee (CASSIC) to lead implementation of this CASS strategy across Victoria. The role of the implementation committee will be to: <ul style="list-style-type: none"> lead the collection and coordination of knowledge, information and research into CASS obtain resources for CASS planning and management develop a five-year funding strategy for implementing the CASS strategy develop a CASS strategy implementation program across government strengthen the institutional arrangements that give affect to the strategy, such as clearly defining roles and responsibilities and associated resources. 	DSE	YR1
		CASSIC	YR1–5
Action 3	Establish a Victorian CASS Knowledge Centre VIC (CASSKC). <ul style="list-style-type: none"> maintain a level of expertise in and an ability to assess (review) case studies / sampling undertaken by land owners and managers. 	CASSIC	YR1
			Ongoing
Action 4	Establish and maintain a CASS investigations database: <ul style="list-style-type: none"> investigate legal and / or other mechanisms to ensure that CASS risk assessment reports are routinely added to the database, allowing sharing of assessment knowledge for sites, avoiding the need to repeat previous assessment undertaken and building greater certainty into the CASS risks maps investigate data sharing agreements to ensure CASS soil risk information is distributed as widely as possible. 	DPI lead	YR2
		CASSIC	
Action 5	Continue site investigations to increase the accuracy and quality of CASS soil information (DPI role).	DPI	YR1
			Ongoing
Action 6	Continuously update CASS risk mapping for Victoria and publish on the Department of Primary Industries website at http://www.dpi.vic.gov.au/dpi/vro/vrosite.nsf/pages/soil_acid_sulfate_soils	DPI	Ongoing

Objective 2 – Raising AWARENESS		Responsibility	Timeframe
Action 7	Develop an ongoing communication strategy targeting key stakeholders such as decision-makers, land and water managers and utility providers. This strategy should include: <ul style="list-style-type: none"> regularly promoting CASS issues in newsletters, publications, conferences and other communication tools developing fact sheets and advisory notes and planning practice notes developing information kits for farmers, council workers and construction workers. 	CASSIC	YR1–5 Ongoing
Action 8	Develop and implement a Victorian CASS education strategy which includes: <ul style="list-style-type: none"> training programs for decision-makers in CASS policy and practice, particularly relating to any changes in land use planning policy and / or legal requirements. 	VIC CASSKC	YR1–5
Objective 3 – Ensuring BEST PRACTICE		Responsibility	Timeframe
Action 9	Work with land and water managers and utility providers to: <ul style="list-style-type: none"> modify internal procedures and approvals to adopt best practice CASS assessment and management. develop a code of practice for utilities providers that incorporates a CASS risk identification process. develop a simple CASS guide handbook for construction supervisors, planners, environmental engineers and others. 	CASSIC Land and water managers and utility providers	YR2–5
Action 10	Develop a planning advisory/practice note explaining best practice CASS assessment and management.	DPCD	YR1–2
Action 11	Review the State Planning Policy Framework (SPPF) in the Victoria Planning Provisions (VPP) to include clear and comprehensive policy statements reflecting the principles and guidelines of the CASS strategy.	DPCD	YR1
Action 12	Determine the most appropriate mechanisms for CASS risk management in the Victorian planning system. Facilitate implementation across the state.	DPCD	YR1–5
Action 13	Ensure local government planners and land managers are aware and have knowledge of the CASS strategy and risk maps when considering planning permit applications and undertaking strategic planning processes and planning scheme amendments.	DPCD Local Government	Immediate
Action 14	Contribute to the review of national and state Building Codes to reduce the likelihood of adverse impacts from CASS on structures and materials and to further protect the environment during construction processes.	CASSIC	As required
Action 15	Ensure risks from CASS are identified in any guidelines for granting consent under the <i>Coastal Management Act 1995</i> .	DSE	Immediate YR1
Action 16	Ensure that guidelines for developing regional catchment strategies reflect requirements to address risks from CASS as outlined in this strategy.	DSE	YR1 Immediate
Action 17	Ensure that catchment management authorities with coastal land within their boundaries include CASS management issues (awareness, leadership and best practice) when developing regional catchment strategies.	DSE	Ongoing
Action 18	Review EPA Publication 655 to ensure it aligns with this CASS strategy and any subsequent <i>Victorian Best Practice Guidelines for Assessing and Managing CASS</i> .	EPA	YR1–2



Objective 4 – MONITORING and REVIEW		Responsibility	Timeframe
Action 19	Monitor and review implementation of this CASS strategy and report to the Minister for Environment and Climate Change.	CASSIC	Five years
Action 20	Ensure continuous learning as science, technology and understanding of CASS issues change.	CASSIC	Continuous
Action 21	Monitor implementation of the <i>Victorian Best Practice Guidelines for Managing CASS</i> .	CASSIC	Continuous
Action 22	Review these guidelines in light of monitoring results and as advances in best practice emerge.	CASSIC – DSE lead	Five years



▲ IRON STAINING AT LAKE TYERS

11. Legislation with direct relevance to managing CASS in Victoria

Current legislation and approvals processes

Legislation listed and described below has most direct relevance to CASS issues in Victoria.

1. The *Catchment and Land Protection Act 1994*

Section 20 of the *Catchment and Land Protection Act 1994* clearly outlines the duty of land owners to take all reasonable steps to avoid causing or contributing to land degradation which causes or may cause damage to the land of another land owner, as well as to conserve soil and protect water resources.

2. The *Coastal Management Act 1995*

Section 37 of the *Coastal Management Act 1995* requires the written consent of the Minister for proposals for use and development on coastal Crown land (Crown land 200 m from high tide). There is opportunity for a CASS risk identification process to be triggered under these consent provisions.

3. The *Crown Land (Reserves) Act 1978*

The *Crown Land (Reserves) Act 1978* provides for the reservation of Crown lands for public purposes including: watersheds and gathering grounds for water supply purposes; the supply and distribution of water and works including reservoirs, aqueducts, pipe-lines channels and waterways; the protection of the beds or channels and the banks of waterways; and drainage and sewerage works.

Section 13 of the Act provides for regulating Crown lands for: its “care, protection and management”; “the carrying out of works or improvements”; “the safety of persons on the land”; and for “issuing permits and licences and entering into agreements in relation to the land”. Section 14 of the Act provides for the appointment of Committees of Management. While the *Crown Land (Reserves) Act* does not make specific reference to CASS, there is scope under these provisions for any CASS risk identification process to be triggered or for regulations to be made.

4. The *Environment Effects Act 1978*

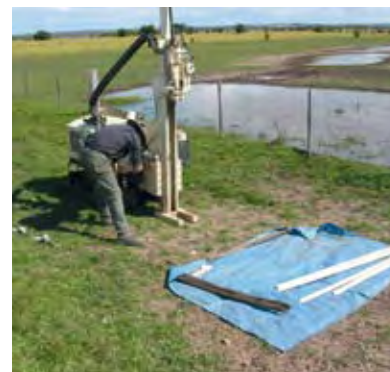
The *Environment Effects Act 1978* establishes a mechanism for assessing projects with potentially significant environmental effects. The consideration of CASS is included in best practice guidelines for developing environmental effects statements under the Act.

5. The *Environment Protection Act 1970*

The *Environment Protection Act 1970* was established to regulate pollution. It also establishes the ability to develop State environment protection policies (SEPP) and industrial waste management policies within specific sectors of the environment.

Policy has been established in Victoria to prevent and regulate pollution from acid sulfate soils. These include the *State Environment Protection Policy (Prevention and management of contamination of land)* S95, 4 June 2002 and the *Industrial Waste Management Policy (Waste acid sulfate soils 1999)*.

▼ SAMPLING AT THE LOWEST POINT



▲ SOIL SCALDING AT HEART MORASS



For acid sulfate soils, Clause 18 of the SEPP is intended to point to the *Industrial Waste Management Policy (IWMP)* for waste acid sulfate soils. Off-site impacts refer to the off-site reuse or disposal of acid sulfate soils. In this context, the SEPP states that “occupiers of land which, due to its physical or chemical properties (including naturally elevated levels of indicators or acid sulfate characteristics) has the potential to adversely impact on protected beneficial uses, must manage the land in a manner that ensures that adverse impacts on the beneficial uses of the sites are avoided by taking into account the properties of the land when disturbing, developing or using the site; or that the risks of adversely affecting any beneficial use of any element of the environment off-site is reduced to a level acceptable to the EPA; and that the disposal or reuse of any material off-site is undertaken in accordance with any legislative requirements and procedures approved by the EPA”.

The *Industrial Waste Management Policy (Waste acid sulfate soil)* sets out the management regime for the off-site disposal and reuse of waste acid sulfate soils and specifies the responsibilities of those involved. This policy states that the off-site disposal and reuse of waste acid sulfate soils cannot occur except where the occupier of the premises has an appropriate EPA licence or has submitted for approval by the EPA an environmental management plan for the off-site disposal or reuse of waste acid sulfate soils.

The EPA’s *Best Practice Management Guidelines for Dredging (BPEMG)* provide broad policy principles for what needs to be considered and a framework for assessing applications for dredging. Page 18 of the guidelines specifically refers to CASS, consistent with the provisions of Clause 18 of the SEPP and the IWMP. The BPEM Guidelines generally encourage the disposal of spoil to land, where practical and environmentally beneficial. However, the EPA will consider disposal to water if this disposal method can be justified as more environmentally beneficial.

6. The Environment Protection and Biodiversity Conservation Act 1997 (Australian Government)

The *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* protects the environment, particularly in areas of national environmental significance (protected matters). It streamlines the national environmental assessment and approvals process, protects Australian biodiversity and integrates management of important natural and cultural places. CASS in Victoria is located in or near many listed wetlands areas of national environmental significance (such as Ramsar sites in Port Phillip Bay at Edithvale and Seaford, at Corner Inlet and in the Gippsland lakes). Potential exposure of CASS near an area of national environmental significance may need approval under the EPBC Act.

▼ VEGETATION LOSS FROM CASS, OVERGRAZING, DROUGHT AND SALINITY AT HEART MORASS



▲ FLOCCULATE IN DRAIN, PORT ALBERT

7. The Flora & Fauna Guarantee Act 1988

The *Flora & Fauna Guarantee Act 1988* was developed to conserve Victoria's communities of flora and fauna, to manage potentially threatening processes and to ensure the genetic diversity of flora and fauna is maintained. The Act provides for a Flora & Fauna Guarantee Strategy which makes provision for "guaranteeing the survival, abundance and evolutionary development in the wild of all taxa and communities of flora and fauna" and "ensuring the proper management of potentially threatening processes".

Part 5 of the Act (Conservation and Control Measures) provides for "the conservation protection or management of flora, fauna, land or water" and for "the prohibition or regulation of any "detrimental activity" or process which takes place on the land or in relation to the water or the use, management or development of the land or water".

8. The Occupational Health & Safety Act 2004 (OH&S) Act

Disturbing acid sulfate soils can potentially impact on the health of workers. In particular, issues associated with working in confined spaces (inhalation of hydrogen sulfide H_2S and acid dust) and the disposal of contaminated waste materials are relevant.

Section 3.4.7 of the *Occupational Health & Safety Act 2007* regulations provide that "An employer must ensure that any risk associated with work in a confined space is eliminated" and WorkSafe Victoria's Industry Standard Contamination and Construction Sites June 2005 provides best practice guidelines for the removal and / or re-use of contaminated waste soils.

9. The Planning and Environment Act 1987

The planning system is the primary means for regulating land use and approving development and is an important mechanism for triggering the consideration of CASS.

- The *Planning and Environment Act 1987* requires that when preparing a planning scheme or a planning scheme amendment a planning authority should "take into account any significant effects which it considers the scheme or amendment might have on the environment or which it considers the environment might have on the use and development envisaged in the scheme or amendment" (section 12).
- The Act also requires that before deciding on a planning permit application, a responsible authority must consider "any significant effects which the responsible authority considers the use or development may have on the environment or which the responsible authority considers the environment may have on the use or development" (Section 60).

The *State Planning Policy Framework (SPPF)*, clause 15.08, stresses the need to avoid disturbing acid sulfate soils. The planning system provides further opportunity at the local level to include more accurate and confident mapping of CASS risk areas directly into planning schemes and to identify a

▼ LOSS OF DIVERSITY IN WATERWAYS IN DOWD MORASS



▲ SOIL SCALDING AT HEART MORASS

planning trigger for implementing a CASS risk identification process when considering development proposals.

10. The *Water Act 1989*

Groundwater and surface water extraction is controlled under provisions of the *Water Act 1989*. A licence is required for constructing a bore and for extracting and using water from an aquifer (other than for domestic and stock use). In issuing a licence under the *Water Act*, consideration must be given to any adverse effect that issuing the licence may have on “water quality”, the “need to protect the environment” and “the proper management of the aquifer”.

CASS is not mentioned directly in the *Water Act*. However, the process of issuing licences does give some opportunity for implementing a CASS risk identification process as an important consideration in regard to water quality and the need to protect the environment.

The intent of licensing groundwater extraction is generally about protecting aquifers. CASS sediments are seldom deep enough to be considered for water supply.

11. The *Water Industry Act 1994*

The objectives of the *Water Industry Act 1984* are to ensure that regulatory decision-making has regard to the health, safety, environmental sustainability and social obligations of regulated entities. Regulations under this Act may be made for managing and protecting land, waterways and works, for using environmental and recreational areas and for sanitary drainage.

CASS is not mentioned directly in the *Water Industry Act*. However, the process of issuing water, sewerage, drainage and sewage treatment licences does give some opportunity for implementing a CASS risk identification process as an important consideration in regard to “water quality standards”, “the planning, construction, operation or maintenance of works”, “technical performance standards” and “the discharge of trade waste”.

▼ IRON SLUDGE ON SHORES OF LAKE WELLINGTON



▲ POWLETT RIVER, NEAR KILCUNDA



▲ POWLETT RIVER, NEAR KILCUNDA

12. Roles and responsibilities

Ministerial interests (in alphabetical order)

Ministerial Portfolio interest	Legislative & policy framework	Relevant agencies	Role in CASS management
Agriculture Fisheries	<i>Extractive Industries Development Act 1990</i> <i>Fisheries Act 1995</i> <i>Mineral Resources Development Act 1990</i> <i>Pipeline Act 1967</i>	DPI	<ul style="list-style-type: none"> • Research and extension, knowledge and capacity, expertise in science and technology, information and advice: <ul style="list-style-type: none"> – house soils science expertise and research for Victoria – storage of databases and intellectual knowledge for Victoria. • Policy direction for agriculture, fisheries and minerals and extractive industries.
Environment (Minister to lead whole-of-government approach)	<i>Catchment and Land Protection Act 1994</i> <i>Coastal Management Act 1995</i> <i>Crown Land (Reserves) Act 1978</i> <i>Flora and Fauna Guarantee Act 1988 Policy</i> <i>Victoria's Native Vegetation Management: a framework for action 2002</i> <i>Environment Protection Act 1970 Policy</i> <i>Industrial Waste Management Policy (Waste Acid Sulfate Soils) 2000</i>	DSE EPA	<ul style="list-style-type: none"> • Policy direction for CASS coastal, land and catchment management. • Embraces a strategic long-term view of environmental protection, and the concepts of public good. • Decision-making for consent for use and development of coastal Crown land under the <i>Coastal Management Act</i>. • Decision-making for consent for use and development of Crown land under the <i>Crown Land (Reserves) Act</i>. • Decision-making and regulation through administration of the <i>Flora & Fauna Guarantee and Victoria's Native Vegetation Management Framework</i>. • Regulation through environmental controls (EPA), State environment protection policies and industrial waste management policies. • Pollution control. • Development and enforcement of State environment protection policies.
Planning	<i>Planning and Environment Act 1987</i> <i>Environment Effects Act 1978</i>	DPCD	<ul style="list-style-type: none"> • Policy direction for planning and development. • Implementation in statutory and strategic planning building and environmental assessment procedures. • Lead implementation of the Environmental Effects Assessment for Victoria.
Water	<i>Water Act 1989</i> <i>Water Industry Act 1994</i>	DSE DSE, Rural and regional water authorities	<ul style="list-style-type: none"> • Policy direction for CASS in water and groundwater management. • Decision-making for issuing licences under the <i>Water Act</i>. • Regulation through licensing and inspections of water, sewerage, drainage and sewage treatment licences under the <i>Water Industry Act</i>.

CASS roles and responsibilities (in alphabetical order)

Who	Role	Responsibility	Responsibility in relation to CASS
Australian Government	Coordination of matters of national environmental significance and cooperative policy development. Provision of resources.	<ul style="list-style-type: none"> Facilitate implementation of and set the national agenda for managing CASS. 	<ul style="list-style-type: none"> Provide benchmarks for the CASS strategy. Provide the National Atlas and CASS Knowledge Initiative.
Catchment Management Authorities		<ul style="list-style-type: none"> Caretakers of river / estuary health. Management of wetland health. Recognise the impact of catchment activities on river and estuary health. Recognise that drainage and flood management activities / works may disturb CASS if present. Understand detrimental consequences of CASS disturbance. 	<ul style="list-style-type: none"> Raise awareness of need to avoid disturbing CASS and consequences. Identify regional hotspots and priorities for managing CASS through regional catchment strategies. Ensure awareness and relevant triggers for CASS identification process are contained within internal procedures, particularly where approvals for high risk activities are given.
Construction industry/ Developer	Develop land for housing, tourism, industry, etc.	<ul style="list-style-type: none"> To develop the land to ensure no detrimental impacts to the use and enjoyment of neighbours and future users and generations. Note: legislative requirements are the same as for land owner / manager. 	<ul style="list-style-type: none"> Responsible for implementing a CASS risk identification process if property is in a CASS risk area and proposing a high risk activity. Seek expert advice if planning activities that may disturb CASS (high risk activities). Plan development to avoid risk of CASS disturbance. Be aware that work is taking place in a CASS risk area. Ensure all workers are aware of CASS risks and associated health and safety issues. Ensure any CASS management plan is followed. Ensure attendance at any CASS identification training opportunities.
Department of Planning and Community Development	Develop policy direction for planning and development. Lead the implementation of Environmental Effects Assessment for Victoria	<ul style="list-style-type: none"> Development of the state planning policy framework to reflect agreed state policy for CASS. Implementation in statutory and strategic planning, building and environmental assessment procedures. 	<ul style="list-style-type: none"> Determine the most appropriate mechanism for CASS risk management in the Victorian planning system. Ensure CASS risks are adequately addressed in accordance with best practice CASS management in any Environmental Effects Assessment. Coordinate and assist local government in incorporating CASS risk areas identified by the DPI mapping project into planning schemes appropriately as a trigger for considering and managing CASS through the planning system. Introduce suitable policies into the SPPF. Lead the introduction of state-wide planning scheme amendment for any necessary changes to overlays or other controls determined as appropriate.

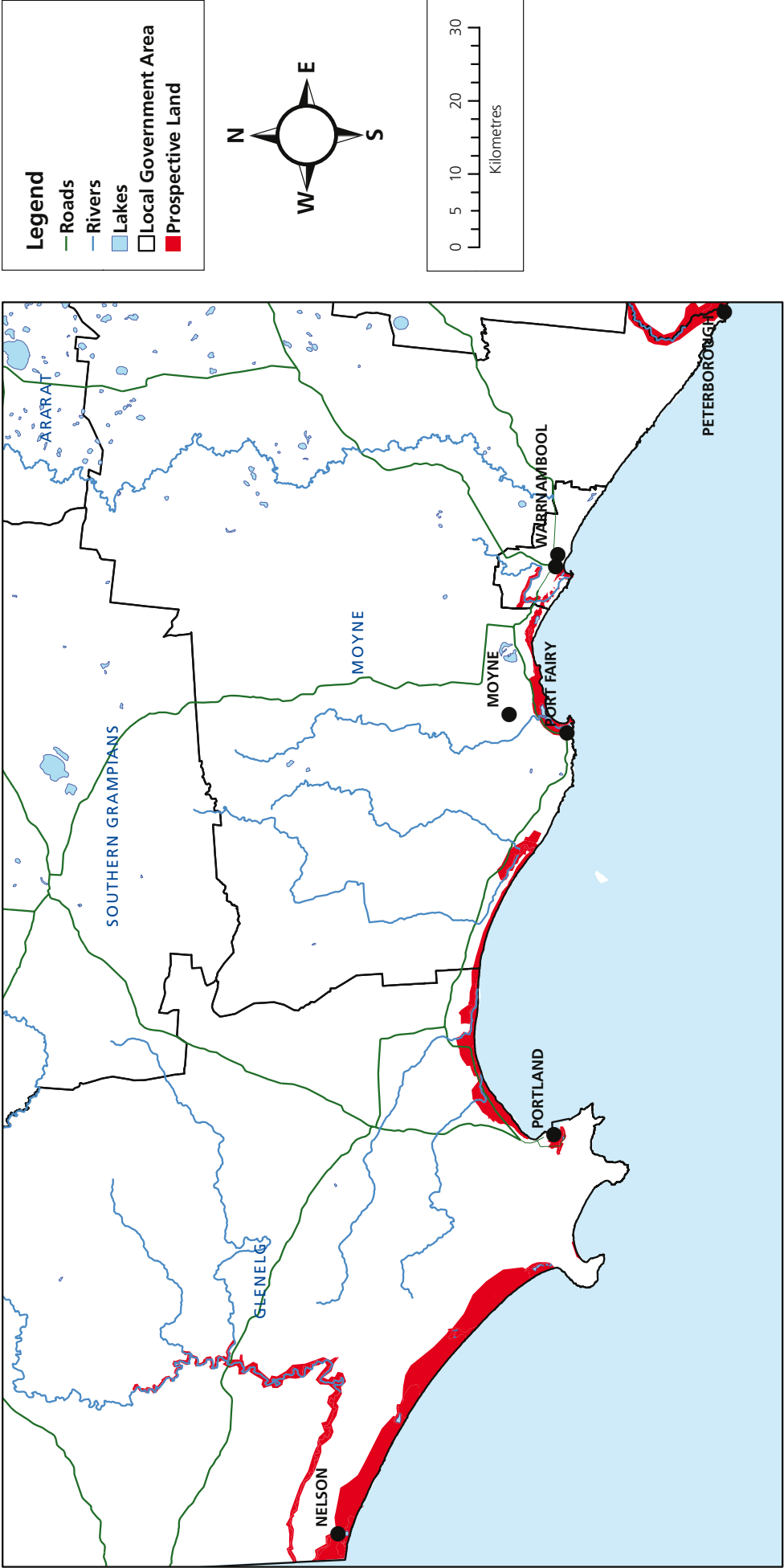
Who	Role	Responsibility	Responsibility in relation to CASS
Department of Primary Industries	House soil science expertise and research for Victoria. Storage of data bases, intellectual knowledge / property.	<ul style="list-style-type: none"> • Develop policy direction for Fisheries. • Develop policy direction for Agriculture. • Influence the development of agricultural policy to ensure that disturbance of CASS is avoided. • Influence the development of fisheries policy in respect to CASS and consequences to fisheries if CASS are disturbed. 	<ul style="list-style-type: none"> • Develop and maintain a database of CASS soil survey data. • Manage the interface of this database with the community. • Meet requirements to complete and provide Victorian component to the National Atlas of CASS. • Provide expertise in CASS science and technology to provide information and advice on the use and management of resources. • Advise the administration of assessment guidelines and standards. • Encourage sampling to be undertaken to meet Australian best practice standards. • Maintain a level of internal expertise and an ability to assess CASS studies / sampling undertaken by land owners / managers and advice on best practice standards.
Department of Sustainability and Environment	Develop policy direction for coastal management. Develop policy direction for land, water and catchment management. Administer approvals for the use and/or development of coastal, Crown land. Administer approvals for the use and/or development of Crown land reserves. Administer the <i>Flora & Fauna Guarantee and Victoria's Native Vegetation: a framework for management</i> .	<ul style="list-style-type: none"> • Obligation to meet commitments of the NRMMC – National strategy for management coastal acid sulfate soils. • Commitment to <i>Integrated Coastal Zone Management</i>. • Development of the <i>Victorian Coastal Acid Sulfate Soils Strategy</i>. • Development of the state wetlands strategy. • Protect Victoria's native vegetation against decline caused by soil disturbance (changes to ph and water table). 	<ul style="list-style-type: none"> • Lead development of state-wide policy relating to CASS management in coastal, land, catchment and water management areas. • Facilitate implementation of the Victorian CASS Strategy across government. • Monitor implementation of the strategy across government. • Develop programs to raise awareness of detrimental consequences of disturbing CASS and management strategies to avoid it. • Ensure CASS risk identification process is observed in consent process under the <i>Coastal Management Act 1995</i>. • Ensure CASS risk identification process is observed in administering approvals under the <i>Crown Land (Reserves) Act 1978</i>. • Manage the CASS implementation committee (CASSIC) and provide guidance to decision-makers, in particular relating to achieving avoidance. • Advise on issues relating to CASS management and decision-making under the CASS risk management process and in relation to the <i>Victorian Best Practice Management Guidelines for Assessing and Managing CASS</i>.

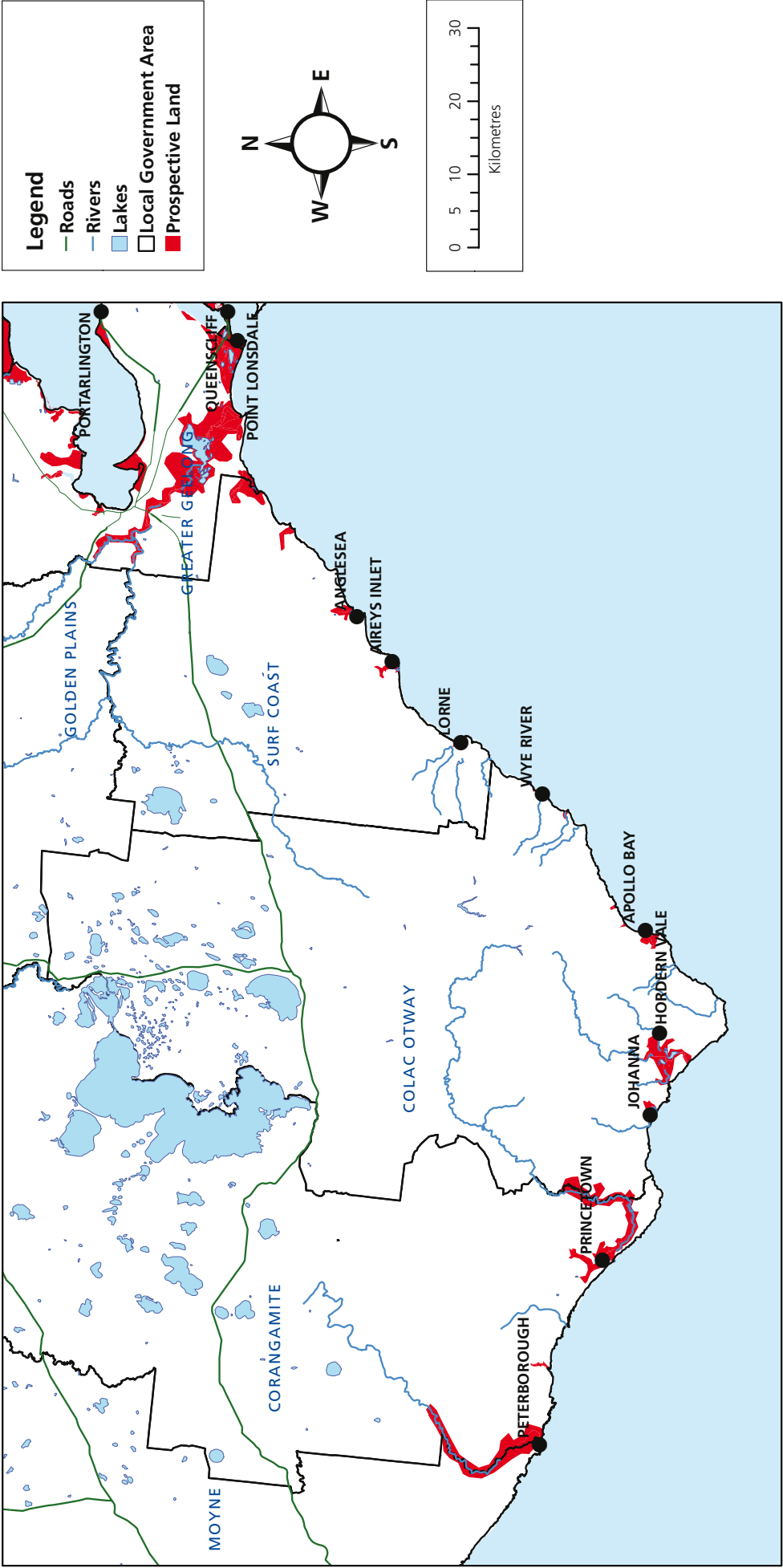
Who	Role	Responsibility	Responsibility in relation to CASS
Drainage / water management agencies	Drainage, river and flood management.	<ul style="list-style-type: none"> • Manage water quality. • Caretakers of river health. • Recognise the impact of catchment activities on river health. • Recognise that drainage and flood management activities / works may disturb CASS if they are present. • Understand the detrimental consequences of disturbing CASS. 	<ul style="list-style-type: none"> • Be aware of the need to implement a CASS risk identification process if works are proposed in a CASS risk area. • Plan works to ensure that CASS is not disturbed. • Ensure awareness and relevant triggers for a CASS risk identification process are contained within internal procedures.
Environment Protection Authority	<p>Pollution control</p> <p>Development and enforcement of State environment protection policies</p> <p>Ensure that requirements of the <i>Environment Protection Act 1970</i> are achieved.</p>	<ul style="list-style-type: none"> • Ensure compliance with <i>Industrial Waste Management Policy</i> (Waste Acid Sulfate Soils). • Review management plans developed from implementing this industrial waste management policy. 	<ul style="list-style-type: none"> • Regulation and pollution control for incidences of pollution caused by CASS. • Approve licences for sites to receive waste acid sulfate soils and approve environmental management plans for disposal and reuse of waste acid sulfate soils under the <i>Industrial Waste Management Policy</i>.
Land owner / manager	Use of land for agricultural or other production, housing, living, wildlife, industry, etc.	<ul style="list-style-type: none"> • To use and manage that land to ensure no detrimental impacts to the use and enjoyment of neighbours and future generations. • Note: <i>Catchment and Land Protection Act 1994</i> Section 20(1) (Part 3) requires that : <ul style="list-style-type: none"> – "... a land owner must take reasonable steps to a) avoid causing or contributing to land degradation which causes or may cause damage to land of another land owner: and b) conserve soil" – "... a land owner must take reasonable steps to a) avoid causing or contributing to land degradation which causes or may cause damage to land of another land owner: and b) conserve soil". • The <i>Environment Protection Act 1970</i> Section 45.1 states: "A person shall not pollute land so that the condition of the land is so changed as to make or be reasonably expected to make the land or the produce of the land: <ol style="list-style-type: none"> a. noxious or poisonous b. harmful or potentially harmful to the health or welfare of human beings c. poisonous, harmful or potentially harmful to animals, birds or wildlife; d. poisonous harmful or potentially harmful to plants or vegetation; e. detrimental to any beneficial use made of the land". 	<ul style="list-style-type: none"> • Be aware of the need to implement the CASS risk identification process if property is in a CASS risk area. • Seek expert advice if planning to undertake activities that may disturb CASS (high risk activities). • Plan works in such a way that CASS is not disturbed.

Who	Role	Responsibility	Responsibility in relation to CASS
Land management agencies	Manage land for the public good, for environmental, forestry and protection of natural resources.	<ul style="list-style-type: none"> • Recognise the impact of catchment activities on river health. • Recognise that some land management activities, earth moving, drainage, mining etc may disturb CASS if present. • Understand detrimental consequences of CASS disturbance. 	<ul style="list-style-type: none"> • Be aware of the need to implement the CASS risk identification process if works are proposed in a CASS risk area. • Plan works in such a way that CASS is not disturbed. • Ensure awareness and relevant triggers for CASS risk management process are contained within internal procedures.
Local government	<p>Local government acting as planning and responsible authorities.</p> <p>Local councils undertake strategic planning, develop strategies and identify appropriate planning scheme controls to regulate the use and development of the land, administer the planning scheme for their municipality and make decisions on individual applications for development proposals.</p> <p>Planning and responsible authorities must consider "any significant effects which the authority considers the use or development may have on the environment or which the authority considers the environment may have on the use or development".</p> <p>Local governments also have a role as the land managers for public land. In many locations they are Committee of Management for Crown land.</p>	<ul style="list-style-type: none"> • When considering a request for a planning scheme amendment or planning permit application the authority must consider the impact the proposal may have on the environment, including how the proposal will avoid disturbing CASS. • At the local level identify high risk areas and develop land use and development strategies which are implemented through planning appropriate scheme response to avoid disturbing CASS. • Promote understanding in the community of the detrimental consequences of disturbing CASS. 	<ul style="list-style-type: none"> • Identify land use changes in CASS risk areas. • Recognise high risk activities that may be proposed in a municipal area. • Ensure CASS responsibilities of land owner / developer (implementation of the CASS risk management process) is undertaken before any planning approvals are given. • Raise awareness in the general community of CASS and the CASS risk management process. • Administer any requirements to fulfil this obligation under the <i>Planning and Environment Act 1987</i>. • Ensure decision-making is consistent with the decision-making principles for CASS management in the Victorian Best Practice Management Guidelines for Assessing and Managing CASS and the planning scheme. • Enforce any breach of CASS management requirements required by the planning scheme and overlay or a permit.
Regional Coastal Boards	Coastal planning advisory bodies.	<ul style="list-style-type: none"> • Implement objectives and actions identified in the Victorian Coastal Strategy 2008 (VCS). 	<ul style="list-style-type: none"> • Assist in communicating CASS issues to the wider community. • Facilitate response to problems that occur due to exposure of CASS.
Regional Water Authorities Victoria		<ul style="list-style-type: none"> • Issuing of ground water licences across • Administering drainage works. 	<p>Note areas where CASS risks are identified and consider these risks to water quality in a groundwater licence application process.</p> <p>Plan infrastructure works with the objective of avoiding disturbing CASS.</p>
Victorian Coastal Council		Implement objectives and actions identified in the Victorian Coastal Strategy 2008 (VCS).	Ensure any development proposed near or on coastal acid sulfate soils will avoid any disturbance.

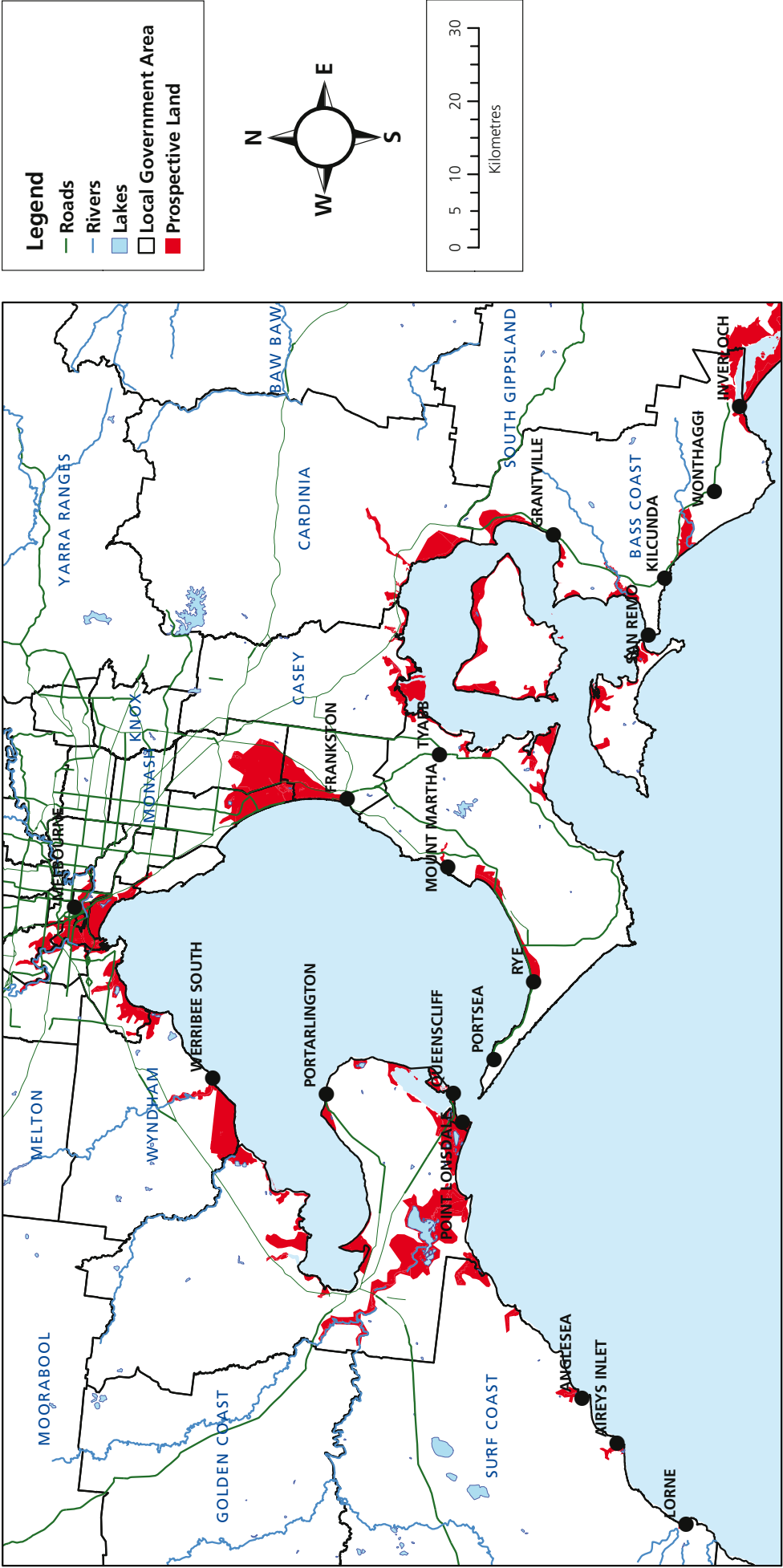


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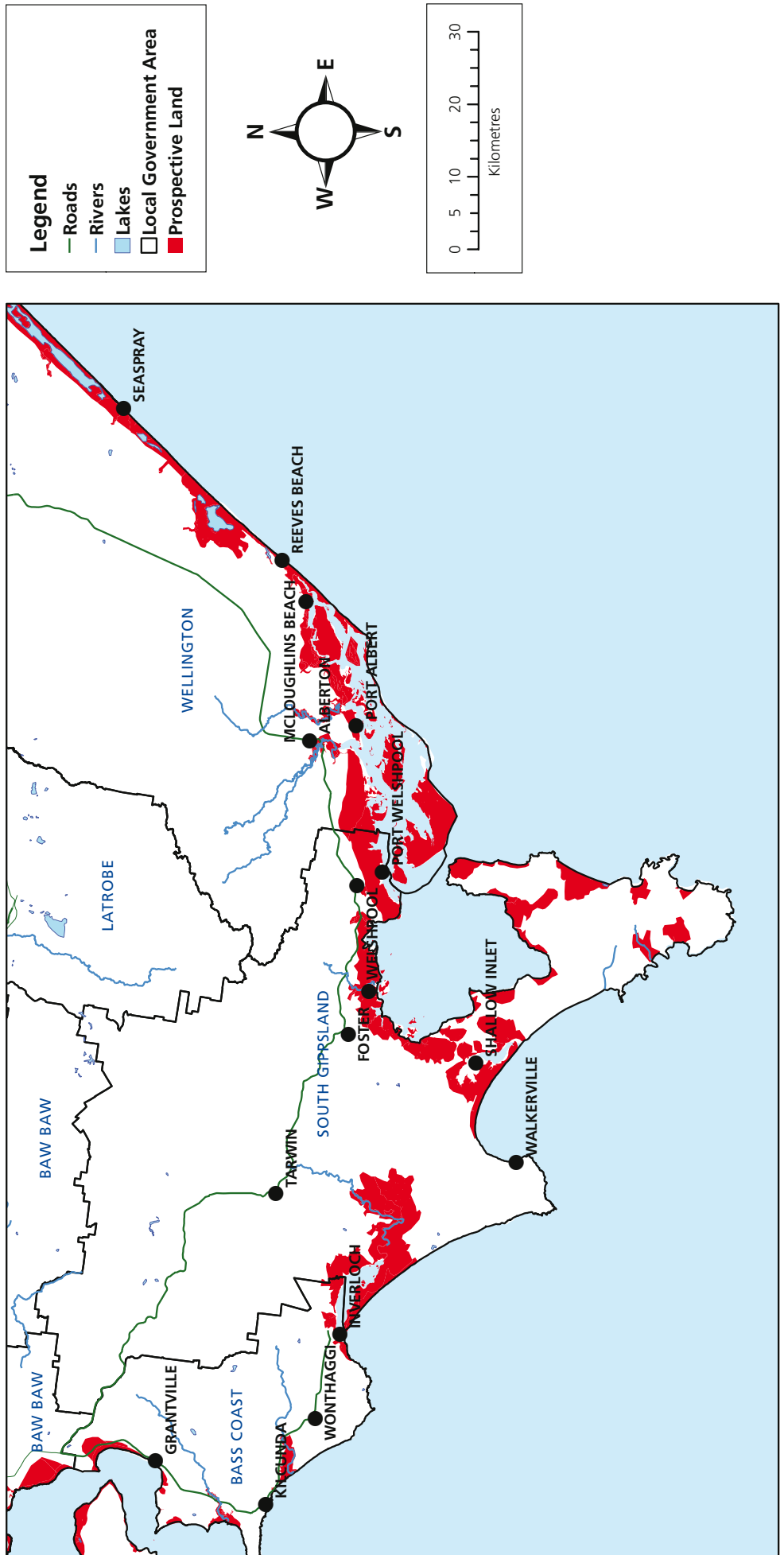


Map 3 Central Coast

Prospective Land: land that has the potential to contain Coastal Acid Sulfate Soils

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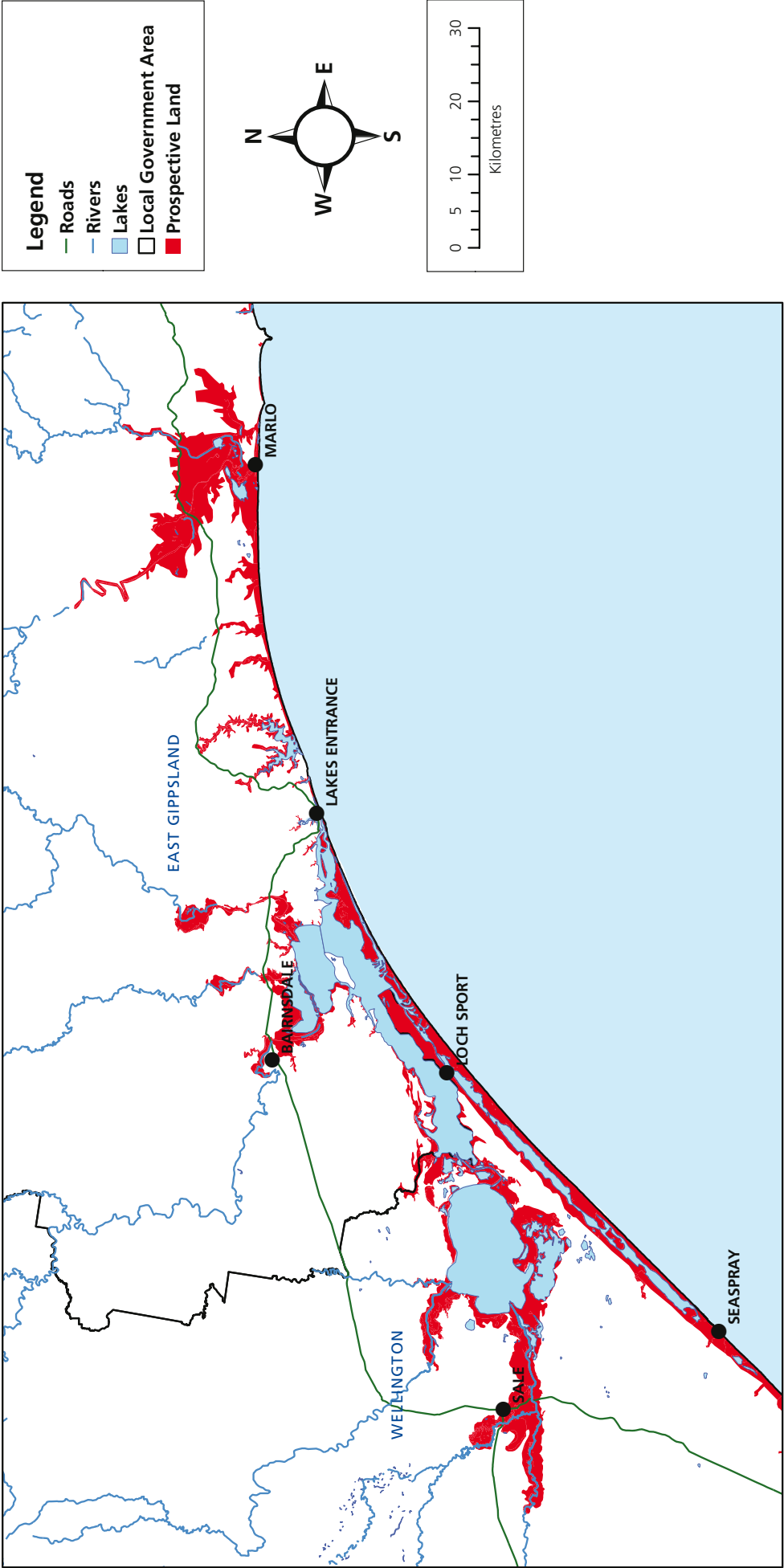
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Map 4 South Coast

Prospective Land: land that has the potential to contain Coastal Acid Sulfate Soils

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Map 5 Gippsland Lakes

Prospective Land: land that has the potential to contain Coastal Acid Sulfate Soils

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