Executive Summary

Decades of scientific research and evaluation have clearly and unequivocally established that land use activities in the catchments adjacent to the Great Barrier Reef are directly contributing to a decline in water quality. A range of pollutants are measurable in river outflows and these are degrading the inshore ecosystems of the Reef. Similar patterns of pollutant-related decline have lead to the collapse of coral reef systems in other parts of the world.

Increases in pollutants discharged to the Reef since c1850 are as follows –

- Sediment loads – up between 300 and 900%
- Phosphorus – up between 300 and 1,500%
- Nitrogen – up between 200 and 400%
- Pesticide residues – now detectable in coastal sediments

Even more worrying is the fact that almost all pollutant loads are increasing annually and showing no sign of abatement. Of particular concern is the rapid increase in fertilizer delivered inorganic nitrogen (nitrate and ammonia) that is the most dangerous to marine ecosystems and herbicide residues that damage seagrass (and potentially coral) communities.

The pollutant contributions of individual Great Barrier Reef catchments (26 in all) vary significantly. This is due to the size of the catchment, the volume of runoff from these catchments, and the nature of the land use producing the pollutant. Virtually all of the developed Great Barrier Reef catchments show serious concentrations of water borne pollutants. These pollutants have been demonstrated to seriously impact on the health and reproductive capacity of the corals, seagrass and fauna of inshore reefal areas.

In response to the directive of the 8 June 2001 Great Barrier Reef Ministerial Council, a scientific working group was established to review the available data on pollutant runoff and existing national water quality guidelines, to prioritise catchments according to the ecological risk present to the Reef, and to recommend the minimum targets for pollutant loads that would halt the decline in water quality entering the Reef.

This is the first phase in a staged approach which aims to stop the decline of water quality and eventually allowing for the recovery of inshore reefal ecosystems.

Data and guidelines included in the scientific review were drawn from –

- National Land and Water Resources Audit
- Australian Institute of Marine Science (river monitoring studies and long term monitoring studies)
- Co-operative Research Centre for the Great Barrier Reef
- Great Barrier Reef Marine Park Authority (chlorophyll monitoring studies and pesticide residue studies)

- Australia and New Zealand Environment and Conservation Council (pesticide, sediment and water quality guidelines)

The working group has defined 10-year targets (2011) for the entire Great Barrier Reef catchment (individual catchment targets are detailed in the text). These targets are:

- Sediment – a 38 % reduction from 11,700,000 tonnes per year to 7,300,000 tonnes per year
- Nitrogen – a 39% reduction from 39,300 tonnes per year to 24,000 tonnes per year
- Phosphorus – a 47% reduction from 7,400 tonnes per year to 3,900 tonnes per year
- Chlorophyll – a 30 to 60% reduction below present levels in coastal waters.
- Heavy metals and pesticides –reductions in detectable levels.

The targets are presented in a way that allows for the natural variability in runoff to the Great Barrier Reef, and permits meaningful comparison between years.

This Action Plan suggests specific actions that need to be taken to improve the quality of water entering the Great Barrier Reef World Heritage Area.

The Queensland government has day-to-day responsibility for natural resource management in the catchments adjacent to the Great Barrier Reef. Commonwealth involvement is focussed at the strategic level, through initiatives such as the National Action Plan for Salinity and Water Quality (NAP) and the Natural Heritage Trust.

The water quality targets set out in this report should be specifically incorporated into relevant plans under the NAP (in the Burdekin, Fitzroy and Burnett River Catchments). For the catchments not covered by the NAP, the Queensland Government should prepare, and submit to the Great Barrier Reef Ministerial Council, integrated catchment management plans that set out the actions required to meet the water quality targets.

In this way, the water quality targets for the Great Barrier Reef will be delivered within a framework that ensures strategic Commonwealth input but with the responsibility for on-ground implementation devolved to the appropriate level.

It is important to ensure consultation with stakeholders in the implementation of these water quality targets. However, the degree of consultation needs to be balanced against the urgent need for substantive action.

5. suggest for the actions identified in objective 4, a timetable for implementation; and
6. detail arrangements for:
   - monitoring, including independent monitoring, of water quality;
   - reporting the results of that monitoring, including results which address the specific water quality targets referred to in objective 3; and
   - reporting of all information to the community.

The catchments considered in the Action Plan are shown in Figure 1.

2. Catchment-Based Threats to the Great Barrier Reef

The Great Barrier Reef World Heritage Area (the Reef) contains the largest system of coral reefs in the world. This diverse ecosystem contains more than just coral reefs, it also includes extensive seagrass beds, mangrove forests, sponge and soft coral gardens, soft bottom habitats and island communities. Of the 2,900 individual reefs in the Reef ecosystem, 989 are fringing and/or inshore reefs. It is these inshore reefs[1] that are at greatest risk from catchment run-off. While coral reef systems can grow in a variety of conditions in shallow water tropical habitats, well-developed reef systems (such as the outer Great Barrier Reef) only occur where the waters are typically characterised by low suspended particulate and dissolved nutrient concentrations.

The ecosystem of the Great Barrier Reef has a complex inter-dependent relationship with adjacent river catchments. Many marine species rely on coastal freshwater wetlands and estuaries as breeding and nursery areas. Recreationally important fish species such as barramundi and mangrove jack are obvious examples.

The catchments adjacent to the Great Barrier Reef World Heritage Area are relatively sparsely populated, containing less than 1,000,000 of the State's 2.9 million residents.

Despite the low population, there has been extensive land modification with a focus on developing land and infrastructure for agricultural production, tourism and mining. More than 80% of the Great Barrier Reef catchment supports some form of agricultural activity.

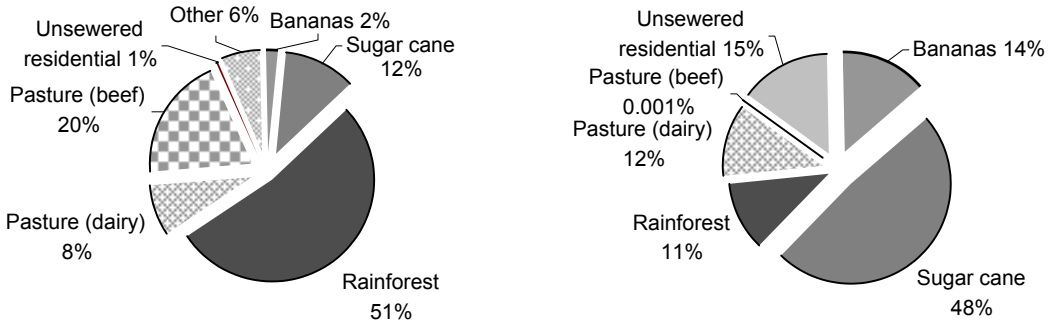
Agricultural activities that have resulted in increased erosion, the destruction of wetlands and stream bank vegetation, and run-off of sediment, fertiliser and chemical residues are the primary human impact on water quality in the Reef. The majority of the discharge of sediment and nutrient occurs during floods. Elevated sediment and nutrient concentrations have long been regarded as the most significant water quality threats to the inshore Reef. Based on the best scientific evidence, there has been a 4 to 9-fold increase in quantities of sediment entering the inshore lagoon of the Reef from the Great Barrier Reef catchment over the last 150 years. There has also been a 3 to 15-fold increase in phosphorus and 2 to 4 - fold increase in total nitrogen inputs. Inorganic nitrogen inputs to the catchments in fertiliser have increased significantly. This form of nitrogen has the most direct effect on marine ecosystems, as it is completely bioavailable[2]. Most of the increase in fertiliser nitrogen application has occurred in the last 40 years as a consequence of expansion of intensive

[1] Inshore reef habitats include fringing and near shore coral reefs, seagrass beds and other benthic communities inshore of the 20 metre depth contour.

[2] Bioavailable applies to the availability of the nutrient as a food source for organisms

agriculture. Secondary industry, urban run-off, aquaculture and sewage have also contributed to the pollution loadings of the Reef, but to a much lesser extent (Figure 2).

Figure 2. Example of a comparison of land uses and inorganic nitrogen sources, Johnstone River catchment. Source: Hunter and Walton (1997).



a. Landuse in the Johnstone River catchment (excluding sewered residential).

b. Nitrate nitrogen contributions to total catchment load (excluding sewered residential).

Considerable expansion of agricultural activity has occurred in the Great Barrier Reef catchments since 1990. Between 1990 and 1999, the area harvested for sugarcane grew by 26% in the Northern mill region, 65% in the Herbert-Burdekin region, 22% in the Mackay region and 6% in the Bundaberg region (Australian Sugar Year Book, 2001). Overall growth in land use for sugar cultivation in Queensland was 30%, from 323,000 ha to 424,000 ha. Rapid growth has also occurred in banana cultivation. Almost all of this expansion has been in the Tully and Johnstone River catchments. From 1990 to 1998, the area cultivated for bananas expanded by 126%, with around 60% of this increase in the Johnstone River catchment and 40% in the Tully - Murray River catchments. Between 1990 and 1999, the combined usage of nitrogenous-fertilisers for both sugarcane and banana production is estimated to have increased by 55% in the Johnstone River catchment and by 118% in the Tully – Murray River catchments.

Effects of elevated nutrient inputs to Reef waters range from reduced growth and reproduction in marine organisms through to shifts in the community structure and functioning of coral reef and seagrass ecosystems. The focus on water-borne pollutants has recently broadened to acknowledge the potential threat posed by pesticides and heavy metals (diuron, dioxins, dieldrin, mercury and cadmium), which have been detected in sediments and marine life along the Great Barrier Reef and southern Queensland coastline. In general, these pollutants originate in catchments dominated by intensive cropping agriculture, and in the wet tropics region of the Queensland coast, the inputs are exacerbated by high erosion and runoff rates.

Disturbance of acid sulfate soils in the course of drainage programs and coastal development also poses a significant potential risk to local estuarine environments from

The catchment plans should be submitted to the Great Barrier Reef Ministerial Council for consideration.

The water quality targets for these catchments will in this way be achieved in a similar manner to the NAP catchments; that is with Commonwealth input at a strategic level but with on-ground responsibility for the implementation devolved to the appropriate level. In this respect, it is noted that the Natural Heritage Trust (NHT) should be able to provide some funding through regional plans accredited by the Commonwealth.

It is important to ensure consultation with stakeholders in the development of the regional plans. However, the degree of consultation needs to be balanced against the urgent need for the implementation of plans and the requirement for substantive action to be taken as soon as possible to reverse the decline in water quality.

In order to meet the defined water quality targets, the relevant plans (both NAP and catchment plans) will need to include or be accompanied by an appropriate mix of regulatory and non-regulatory measures. Some reform of Queensland legislation or the manner in which it is administered may be necessary.

Examples of the actions that could be implemented to achieve the water quality targets include:

- Reforms to ensure that in the catchments adjacent to the Reef, all environmentally significant activities (including significant new agricultural activities or the significant intensification of existing activities) are subject to proper environmental impact assessment and approval processes. Environmental assessments should address potential impacts on water quality. Appropriate conditions should be attached to ensure that agricultural activities are carried out in a manner that protects and, as necessary, improves current water quality.
- Constraint mapping for current and future agricultural development in the Great Barrier Reef catchment should be promoted;
- Catchment habitats and features at risk such as, freshwater wetlands and riparian vegetation should be protected and rehabilitated;
- Standards for sewage, wastewater and stormwater discharge from coastal developments to watercourses should be established and enforced;
- Environmental management plans should be promoted for agricultural activities. These plans should promote farming practices that minimise downstream impacts, such as:
    1. minimising erosion through conservation cropping techniques and pasture management;
    2. minimising nutrient loss by aligning fertiliser amount, type and application methodology to the physiological requirements of the crop; and
    3. implementing integrated pest management techniques.
- Promote full compliance to Industry Codes of Practice; and
- Initiate public and catchment specific education program about the connectivity between land use and the impacts on the Reef.

Communication of water quality information and the outcomes of the Action Plan to stakeholders and the community will be a critical component of the reporting process.

Figure 3. Average chlorophyll results, 1993 to 2000.

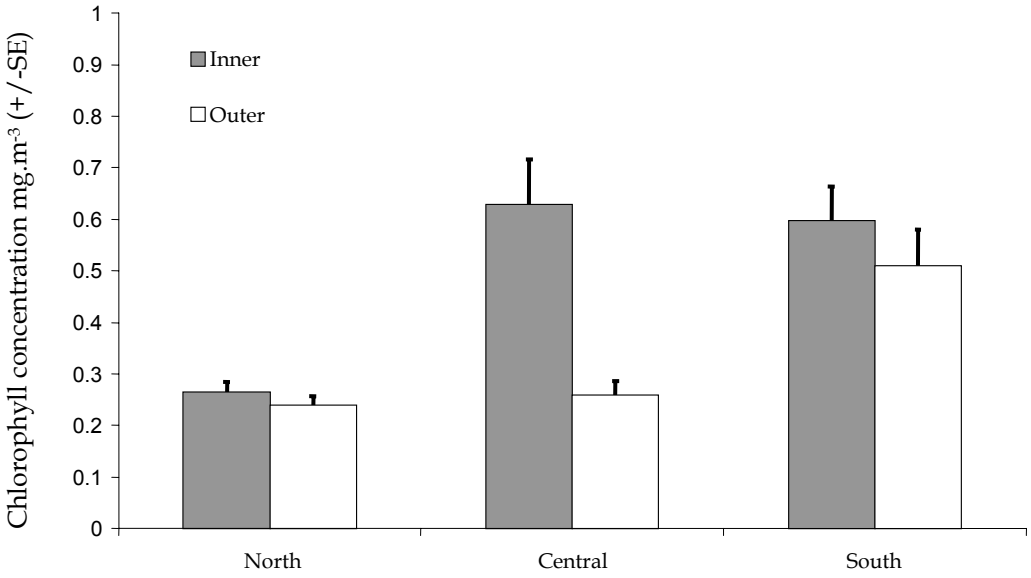
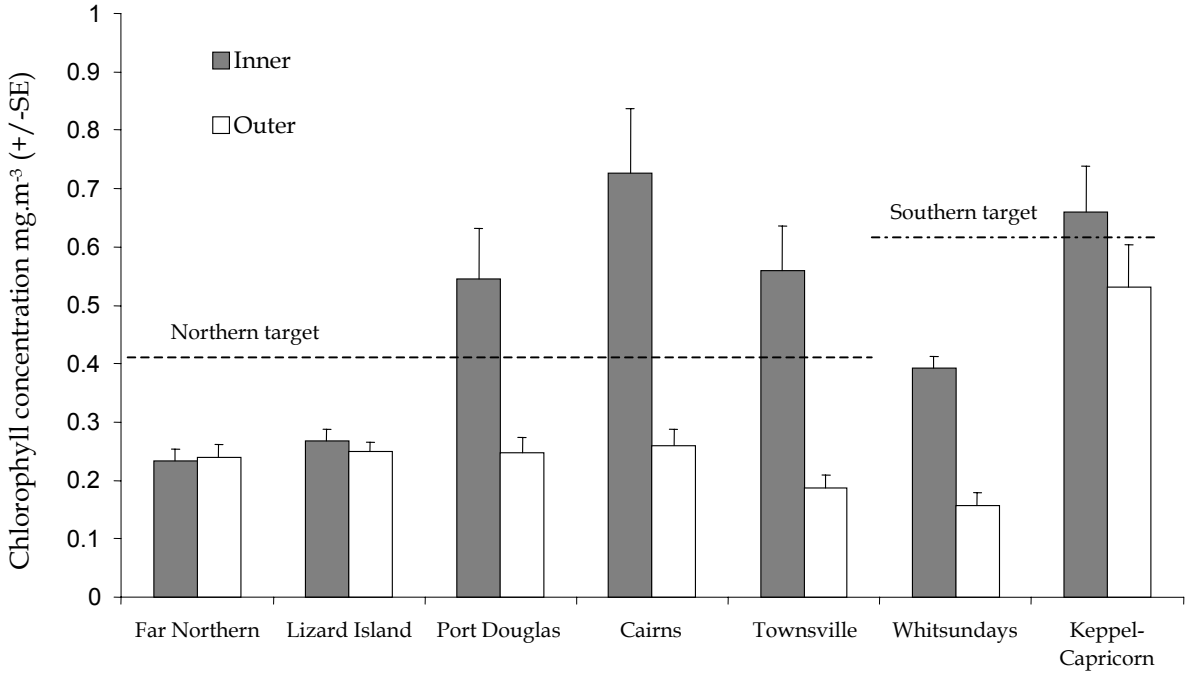



Figure 4. Average latitudinal chlorophyll results, 1993 to 2000.