2

Catchment management in context

2.1 'Catchment-based management' is the approach used for land and water resource management in Australian states and territories. In Australia, this management approach is implemented through the creation of partnerships between the different levels of government and non-government organisations. Although these groups gather around different interests – facilitation, regulation, agriculture, conservation, rural communities, large urban cities – they share a common goal: ongoing access to land and water resources. Successful catchment-based management relies upon communication, co-ordination and cooperation between all stakeholders to ensure that the catchment systems are managed for the benefit of all Australians.

2.2 The Committee believes that the most cost effective way to manage the nation's natural resources to produce an ecologically sustainable outcome is through the co-ordinated management of Australia's catchment systems. The present catchment arrangements are varied and present insights into improved catchment management practices that, the Committee believes, would be more effective and efficient. Consequently, in this chapter and in chapter 3 the Committee makes recommendations that, it believes, when implemented will improve the present arrangements and make them much more effective.

2.3 Despite the shared interest in the beneficial and responsible management of Australia's catchment systems, large scale environmental degradation has been identified. It does not threaten only those Australians who live on the land or in rural communities. It threatens agriculture, rural communities, urban communities and other environmental assets. This assessment was reported in starker terms in a recent discussion paper, *National Investment in Rural Landscapes*, commissioned by the Australian

Conservation Foundation (ACF) and the National Farmers' Federation (NFF), with assistance from the Commonwealth Government's Land and Water Research and Development Corporation (LWRRDC):

> Australia is facing a crisis. Our rural environment and natural resources are suffering. Problems such as salinity, river degradation and pollution, biodiversity loss, and soil degradation, show us that the way our land is used and managed is not sustainable.
>
> These environmental issues have significant economic and social dimensions:
>
> - the viability of farming (and, thus, our agricultural industry) is being undermined;
> - rural and regional infrastructure (such as roads, railways, pipelines and buildings) is being eroded; and
> - industries that depend upon our natural heritage, such as tourism, are being affected.[1]

2.4 The discussion paper went on to report that 2.5 million hectares of land (about 5 per cent of cultivated land) are affected by salinity and this is projected to increase to more than 15.5 million hectares (about 30 per cent of cultivated land) unless action is taken immediately. On current trends, 50 per cent of woodland birds may be extinct within decades. One third of Australian rivers are in extremely poor condition. Another report indicated that by 2020, Adelaide's drinking water will fail World Health Organisation salinity standards two days in every five.[2]

2.5 Many of the problems that confront Australia's environment have, after a long period of gestation, emerged very quickly and pose considerable and immediate challenges. For example, in the Murray Darling Basin Ministerial Council's (MDBMC) *Salinity Audit*, one agency reported that 'a $10 million waste water treatment plant which would normally have a life span of 100 years was expected to have a life of only 16 years'.[3]

2.6 The Audit also revealed that in response to salinity more than half of the households in the Loddon-Campaspe catchment region of the Murray-

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1 National Farmers' Federation / Australian conservationFoundation *National Investment in Rural Landscapes*, downloaded from www.acfonline.org.au / campaigns / landm / indepth / ACFNFFfullreport.htm, accessed 27 July 2000.

2 The Prime Minister, the Hon. John Howard MP, *Our Vital Resources: A National Action Plan for Salinity and Water Quality in Australia*, Canberra, 10 October, 2000, p. 1.

3 Murray Darling Basin Ministerial Council, *The Salinity Audit*, Murray-Darling Basin Commission, Canberra, 1999, p. 23.

Darling Basin had installed rainwater tanks, 13 per cent installed a water filter and 6 per cent were buying bottled water.

2.7 Catchments also face many infrastructure costs, such as damage to buildings, municipal water reticulation systems, household appliances damage to sewerage, water supply, telephone, gas and electricity supply systems as well as urban streets and country roads. The *Salinity Audit* quoted figures that indicated that 34 per cent of state roads and 21 per cent of national highways in south-western New South Wales are affected by high water tables.

2.8 The immediate and increasing cost of salinity has been revealed clearly in other information published by the Murray-Darling Basin Commission (MDBC). In general, water salinity of more than 700 EC[4] is unsuitable for irrigating most horticultural crops, while 800 EC is the accepted maximum level for domestic supplies in larger towns and cities; a level of 900 EC renders water unfit for human consumption. For some small communities, there is often no alternative to a poor quality supply:

- At Boorowa and Yass, salinity levels of over 1,400 EC have already been recorded in town water supplies.
- Barr Creek, which drains some of the salinised lands of the Kerang irrigation area and intersects saline groundwaters, has at times had salinity levels as high as 60,000 EC; sea water has a salinity of some 45,000 EC.

2.9 The effect of salinity of large regional communities is dramatic. For example:

- Some 60 per cent of the urban area of Wagga Wagga is at risk from highly saline watertables, rising by half a metre a year. Houses, public buildings, underground pipelines, public recreation areas, bridges, culverts and roads are all being affected.
- The playing fields on the campus of Charles Sturt University have been badly affected; even salt tolerant grasses are not surviving.
- Public facilities in Gunnedah, such as the school oval, have been severely effected by urban salinity.
- For Wagga Wagga City Council, the cost of dryland salinisation is at least $800,000 a year and growing. Rebuilding half a kilometre of the Sturt Highway on the western approaches to the city because of

4 The EC unit is a measure of electrical conductivity, commonly used to indicate the salinity of water. 1EC = 1 micro-Siemen per centimetre measured at 25° Celsius.

salinity damage cost $500,000. Many other towns and communities are similarly affected.

2.10 Rural shires, face considerable problems from the damage to roads and bridges. For example:

- In 1990, the Young Shire Council estimated the cost of road damage due to high watertables at $800,000.
- Boorowa Shire has returned over 30 kilometres of paved road to gravel because of high saline watertables and the resulting maintenance problems.
- The town of Yass is looking at the refurbishment of its water supply system. The cost of this may run into millions of dollars.
- Most salts, once dissolved in water, are not removed by natural processes. Using present technology their removal is financially prohibitive, as costs are around $100 per megalitre.

2.11 The present chapter aims to provide more detail to these claims by outlining the contours and context of the environmental problems facing Australia's catchment systems. The types of environmental degradation are outlined in the next section.

2.12 This chapter also outlines the framework for this inquiry: nature of a catchment, the present arrangements for catchment management in each Australian jurisdiction and the support for this approach to managing the environment. These matters are discussed in the second section of this chapter.

Environmental degradation in Australia

2.13 Degradation of Australia's catchment systems has many facets and as a result, all Australians have some experience of it. For example, nutrient rich sewage from towns and cities is released into waterways, contributing to toxic algal blooms in river ways and the pollution of river estuaries. This prevents water use for drinking or swimming, reduces aesthetic value, decreases tourism capabilities and diminishes the viability of oyster and shellfish industries.

2.14 In other areas the removal of native vegetation leads to unsustainable agricultural practices and harms the long-term outlook for many rural communities. It increases salinity levels or it may lead to the development

of acid soils. As a result, agricultural production is harmed, farms become less viable, and as in the case of salinity, downstream towns and cities face degraded water supplies and increased costs to provide potable water. Acid soils and salinity also lead to the decline of rural communities and the erosion of rural infrastructure, such as roads. The entire community faces increased costs to maintain and repair damaged infrastructure and to assist those people whose lives have been adversely affected by catchment degradation.

2.15 Environmental degradation is an expensive problem. A report released by the Prime Minister, the Hon. John Howard MP, estimated the annual cost of land and water degradation to be $3.5 billion per annum, excluding the cost of pests and weeds.[5]

2.16 A recent report commissioned by the ACF and the NFF has estimated that the annual cost of degradation in rural landscapes is at least $2 billion annually, and with no action, this could increase to $6 billion annually by 2020.[6] The following table sets out the estimated annual cost of the major forms of environmental degradation found in Australia's catchment systems, as estimated in that report. The estimates of cost do not include the cost of degradation on communities, the wider economy or infrastructure.

Table 2.1 Cost estimates of land and water degradation[7]

Form of degradation	Estimate ($M per year)
Salinity	270
Acid soils	300
Sodic soils or structural decline	200
Erosion	80
Irrigation salinity	65
Water quality	450
Total	**1,365**

Source: *NFF / ACF,* National Investment in Rural Landscapes, *April, 2000. Available at: http://www.acfonline.org.au/campaigns/landm/indepth/ACFNFFfullreport.htm*

5 The Prime Minister, The Hon. John Howard MP, *Our Vital Resources*, 10 October 2000, p. 1.

6 NFF / ACF, *National Investment in Rural Landscapes*, p. i.

7 It is important to note that this table does not include other major land and water degradation factors such as weeds, which are estimated to cost at least $3.3 billion per year, and pest animals such as insects, which are estimated to cost the agricultural sector $3.1 billion per year.

Types of environmental degradation in Australia

2.17 There are a number of environmental problems in Australia's catchments. Some are well known, such as salinity; others not so. This section outlines the problems.

Salinity[8]

2.18 Salinity occurs when rising water tables dissolve salts stored in the soil and brings them closer to the surface. The rising water tables lead to waterlogging, or if close enough to the surface, the water evaporates, and salt accumulates and concentrates in the soil and on the surface of the land.

2.19 All Australian soils are naturally saline. This means that, in general, Australian soils tend to contain large amounts of salt. Some groundwater bodies are saltier than sea water. Where there is low rainfall and high evaporation rates areas may develop where high levels of salt are accumulated. This is known as primary salinity. Lake Eyre is an example of a naturally occurring area of primary salinity.

2.20 There are a number of types of secondary salinity, distinguished from each other by their causes. Dryland salinity, like irrigation and urban salinity, occurs when salts stored in the subsoil and rock profile are dissolved and brought nearer the surface by rising water tables.

2.21 Clearing native vegetation and replacing it with crops and pastures causes dryland salinity. Dryland salinity occurs in non-irrigated areas. Native vegetation has deep root systems which tend to keep the water table further away from the surface of the land. Crops and pastures have shallow root systems and the absence of a deep root system causes the watertable to rise. As the water table rises, the salts stored in the subsoil and rock profile are moved to the surface, where they become concentrated as the water evaporates.

2.22 Irrigation salinity occurs where irrigation (or rainfall) waters 'leak' into the groundwater system, causing the water tables to rise. Rising water tables flush the salts stored in the subsoil and rock profile to the surface. As the

8 This information is collated from: Land and Water Resources Research and Development Corporation, *Data Sheets on Natural Resource Issues*, Occasional paper no. 24/99, p. 7; 'Salinity in NSW', downloaded from www.dlwc.nsw.gov.au/care/salinity/index.html, accessed 14 September 2000; Environment Australia, Submission no. 141, appendix C; Industry Commission, *A Full Repairing Lease,* pp. 34 –36.

water evaporates, concentrations of salt develop. Irrigation salinity may also be caused where the irrigation water itself contains high levels of salt.[9]

2.23 The major difference between dryland and irrigation salinity is that the application of irrigation water to land can exaggerate the leakage of surplus water past the root zone to groundwater thereby increasing the rate at which the watertable rises.

2.24 Urban salinity is caused by a combination of dryland salinity processes and the overwatering of urban areas.

2.25 The likelihood that salinity problems will occur in urban areas is increased by the fact that towns are often located in areas prone to salinity, such as plains, in valleys, or at the foot of a ridge. The likelihood is increased still further by urban activities adding seepage to the groundwater. For example, over-watering of gardens and sports grounds, disruption of natural drainage lines, leakage from water, sewage and drainage pipes, and septic tanks increase the amount of water entering the subsurface zone. This leads to a rise in the watertable and with it, the movement of salts from the subsoil and rock profile to the surface. Removal of vegetation for urban development further tends to increase the amount of water entering groundwater systems.

2.26 The costs of urban salinity and rising water tables in urban areas is high. Rising water tables cause structural damage to homes and commercial premises. Infrastructure, such as roads, underground telephone, water, electricity and sewage supply systems as well as vegetation in parks and gardens can be damaged or destroyed.

2.27 The NSW Department of Land and Water Conservation (DLWC) reported on its internet site that in NSW alone this problem is of concern in 'Western Sydney, Wagga Wagga and in many other towns in Central Western and southern NSW, including (in alphabetic order) Blayney, Boorowa, Canowindra, Condobolin, Cootamundra, Cowra, Crookwell, Dubbo, Forbes, Grenfell, Gunnedah, Harden-Murrumburrah, Junee, Lake Cargelligo, Leeton, Orange, Parkes, Queanbeyan, Tamworth, Wellington, Yass and Young among others'.[10]

2.28 River salinity is caused by water running from areas of dryland, irrigation and urban salinity. Water flows into creeks and rivers, raising their

10 'What is salinity', downloaded from www.dlwc.nsw.gov.au/care/salinity/whatis.html, accessed 14 September 2000.

salinity. As salinity in a catchment worsens, the rivers become more salty. The NSW DLWC reports that:

> According to the Murray-Darling Basin Commission Salinity Audit, salinity is likely to rise to high levels in future in the Bogan, Castlereagh, Lachlan, and Macquarie and Namoi Rivers. Already, in the Macquarie River west of the Great Dividing Range, about 630 ute-loads of salt pass Narromine every day…[11]

2.29 Some industrial processes concentrate salt in the water they use, thereby generating waste water which can contain high levels of salt. For example, the water used for cooling coal-fired power stations is partly evaporated thereby concentrating the salt in the water discharged from the coolers. Working coal mines generate saline water from groundwater seepage and from rainwater coming into contact with mine workings or spoil. In some areas abandoned mines are a major source of salinity.

2.30 The cost of salinity is significant and rising. Owing to the fact that the effects of salinity are not seen immediately, the true cost will not be known for many years. However, by 1995, approximately 2.5 million hectares of land in Australia were affected by salinity, and this could potentially increase to 15 million hectares.[12] In Western Australia 9% of agricultural land is presently affected by salinity and it is thought that this will increase to 32% of agricultural land within several decades.[13]

2.31 Lost agricultural production as a result of salinity has been estimated to cost $130 million annually, damage to infrastructure another $100 million and loss of environmental assets a further $40 million.[14] Other estimates place the cost of salinity alone, without including other difficult to quantify costs, at about $335 million per annum.[15]

2.32 Salinity damages infrastructure such as roads, footpaths and building foundations, and is a significant cost to local governments and rural

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11 'What is salinity', downloaded from www.dlwc.nsw.gov.au/care/salinity/whatis.html, accessed 14 September 2000.

12 LWRRDC, *Data Sheets on Natural Resource Issues*, Occasional paper no. 24/99, p. 7.

13 J Bartle, 'The new hydrology: New challenges for landcare and tree crops', *Reform*, National Farmers' Federation: Canberra, Autumn 2000, p. 3.

14 EA, Submission no. 141, Appendix C, p. 20.

15 NFF/ACF, *National Investment in Rural Landscapes*, p. iii. The other difficult-to-quantify costs include: the cost of degradation of terrestrial, aquatic, estuarine and coastal ecosystems to the Australian economy; the extent to which industries such as tourism and commercial fishing depend upon these ecological services; and the environmental costs (which are difficult or impossible to quantify monetarily).

communities. For instance, the cost of repairing salt affected national highways in the south west of NSW is $9 million dollars per year.[16]

2.33 Australian biodiversity is valuable for industries such as agriculture where native species help to pollinate crops and control insect pests.[17] As lands and waterways become increasingly salty, habitat for many of Australia's unique plants and animals becomes lost, and there is a significant decrease in diversity.

2.34 The problems posed by salinity cannot be fixed quickly. Evidence provided to the Committee as well as press reports indicate that salinity may not be remedied for at least two to three generations. It is, then, a long-term problem. Consequently, education campaigns aimed at preventing salinity are crucial.

2.35 While there are a number of activities undertaken to prevent and to combat salinity, the primary method of control is lowering the water table by replanting native vegetation. Other methods include:

- crop rotation planning;
- the use of deep rooted pastures to utilise water; and
- mechanical methods, such as processing water at desalination plants.

2.36 In the past, a major problem facing any program aimed at addressing the spread of salinity has been the lack of reliable information. The use of geophysical mapping can contribute to identifying potential salinity areas and to planning appropriate management strategies.

2.37 Rather than attempting to reduce and remedy salinity, an innovative approach to adapting farming practices to the realities of catchment degradation, and seeing salinity as an opportunity for new business ventures, has involved trials of the farming of snapper, a salt water fish, in the Murray Darling Basin in saline agricultural water. The farming of other salt water organisms, such as prawns, molluscs and seaweed is also being investigated.[18]

16 Environment Australia, Submission no. 141, Appendix C, p. 21.

17 *Moving Forward in Natural Resource Management: The contribution science, engineering and innovation can make,* paper presented by The Hon. Mark Vaile MP, to the Prime Minister's Science, Engineering and Innovation Council, p. 1.

18 A Wahlquist, 'Murray-Darling's Salvation Lies in the Salt of the Earth', *The Australian*, 11 April 2000.

Acidification

2.38 The application of nitrogen rich fertilisers, combined with the use of nitrogen fixing crops such as legumes can cause soil acidification.[19] Extreme acidification results in soil structure decline, which creates poor quality topsoils. Acid soils support very little vegetation,[20] and they have serious effects on agricultural productivity and biodiversity.

2.39 About 24 million hectares of agricultural land in Australia is considered to be acidic, and production losses associated with acidification are estimated at over $134 million per year.[21]

Acid Sulfate Soils

2.40 One form of soil acidification is acid sulfate soils. This is the common name given to naturally occurring soil and sediments which contain either iron sulphides or the acidic products of the oxidation of sulphides. As long as sulfide soils remain under the water table, they do not oxidise and the soils remain harmless. These soils are classified as Potential Acid Sulfate Soils (PASS). However, when exposed to air through practices such as excavation or drainage, the sulfides oxidise, to create sulfuric acid. These are known as Actual Acid Sulfate Soils (ASS).

2.41 Acid sulfate soils occur throughout Australia's coastal and inland regions. Nationally there is an estimated 40 000 km^2 of coastal acid sulfate soils.[22]

2.42 Sulfuric acid dissolves metals such as iron and aluminium, and is also capable of dissolving heavier metals such as cadmium. Increased soil acidity makes nutrients less available to plants, exposes them to toxic concentrations of metals, and decreases their ability to utilise water.[23] Acid from acid sulfate soils leach into waterways where it can kill fish and cause diseases. ASS contributes to habitat degradation and loss of biodiversity in both aquatic and terrestrial ecosytems.

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19 CSIRO Land and Water, *Acidification of Cropping Soils in South Australia – Causes and Effects* Research Paper Series no. 1, November 1997, p. 2.

20 'Soil Acidification', downloaded from www.netc.net.au / environ / fguide / soilacid.html, accessed 19 September 2000.

21 The Hon. Mark Vaile MP, *Moving Forward in Natural Resource Management*, p. 8.

22 EA, Submission no. 141, Appendix B, pp. 6, 14.

23 'Introduction to Acid Sulfate Soils', downloaded from www.environment.gov.au / marine / manuals_reports / coastnet / acid_soils, accessed 13 September 2000; CSIRO Land and Water, *Acidification of Cropping Soils in South Australia*, p. 1.

2.43 ASS effects a number of industries, including agriculture and aquaculture. Because ASS stunts plant growth and increases exposure to disease, overall grain yields are reduced. Many pasture species cannot be grown on acidified soils, and ASS decreases the area of land available for grazing cattle and sheep. 'Fish kills' and fish diseases reduce the amount of saleable product in aquaculture industries, for instance, production losses of Sydney rock oysters due to ASS were estimated at $7 million over a six year period.

2.44 ASS also impacts on industries such as urban and industrial development, and infrastructure. It is also possible that ASS can impact on the quality of drinking water and have negative effects on human and animal health.[24]

2.45 Prevention is the principal method of combating acidification and ASS. Identifying and mapping acidic and ASS soils, and incorporating this knowledge into land use planning is the best way to avoid potential problems. Once soils have become acidified, applying lime and avoiding acidifying fertilisers can help to alleviate acidity.

Erosion

2.46 Soil erosion effects land and water quality. Topsoil erosion removes nutrients, lowers productivity and contributes to soil structure decline. In areas where all topsoil has been lost, 'scalds' form, sometimes covering hundreds of hectares and rendering the land unusable.[25]

2.47 Soil erosion leads to the silting of rivers, waterways and dams,[26] When soil enters waterways it can carry with it acids, heavy metals, pesticides, chemicals, salt and nutrients, reducing water quality and impacting on agriculture, drinking water and biodiversity.[27]

2.48 Soils in Australia are generally formed at a rate of less than one tonne per hectare per year,[28] however, in some areas, soil erosion causes losses of up to 20 tonnes per hectare per year.[29] For this reason, soil erosion is a major

24 EA, Submission no. 141, Appendix B, pp. 9, 11-13.

25 'Natural Resources Management', downloaded from www.mdbc.gov.au/education/encyclopedia/land_degradation.htm accessed 20 September 2000.

26 Industry Commission, *A Full Repairing Lease*, p. 41.

27 State of the Environment Advisory Council, *Australia: State of the Environment 1996*, Commonwealth of Australia, Canberra 1996, pp. 6-27.

28 The Hon. Mark Vaile MP, *Moving Forward in Natural Resource Management*, p. 8.

29 'Natural Resources Management', downloaded from www.mdbc.gov.au/education/encyclopedia/land_degradation.htm accessed 20 September 2000.

factor limiting the long-term sustainability of broadacre agriculture in Australia.[30]

2.49 Accelerated soil erosion results from clearing, overgrazing and cultivation.[31] When soil is left bare, it becomes susceptible to dust storms caused by wind erosion. Wind erosion removes large amounts of fine topsoil, organic matter and nutrients,[32] and dust storms can create visibility and health hazards in towns and cities. Bare soils also suffer increased runoff from water erosion,[33] which has now damaged soils in all areas of Australia.[34] In NSW, 31.3 million hectares are subject to wind and water erosion.[35]

2.50 One common cause of soil erosion is the velocity of water run-off. When combined with the effect of rain water, the erosive effect of water velocity can increase up to 200 times.[36] Water velocity becomes an erosion problem as a result of other forms of soil erosion. As topsoils are eroded, a crust forms, which air and water can't penetrate. When this occurs less water soaks into the soil, causing more water to run-off and subsequently move at a higher velocity. High-velocity water erosion creates deep and wide gullies which increase in size as the edges collapse into the gully. Gullies up to 30 metres deep can be formed from the erosive action of water velocity.[37]

2.51 The principal method used to combat erosion is revegetation. This can be incorporated into farm planning through modifying cultivation and rotation techniques, and using methods such as strip cropping and stubble retention. Soil erosion caused by water runoff can be minimised by managing land in a way that maximises rainfall infiltration and increases the use of water by plants.

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30 LWRRDC, *Data Sheets on Natural Resource Issues*, Occasional paper no. 24/99, p. 22.

31 State of the Environment Advisory Council, Australia*: State of the Environment*, pp. 6-27.

32 The Hon. Mark Vaile MP, *Moving Forward in Natural Resource Management*, pp. 8-9.

33 State of the Environment Advisory Council, *Australia: State of the Environment*, pp. 6-27.

34 The Hon. Mark Vaile MP, *Moving Forward in Natural Resource Management*, p. 8.

35 'Natural Resources Management', downloaded from www.mdbc.gov.au/education/encylopedia/land_degradation.htm, accessed 20 September 2000.

36 'Sheet erosion', downloaded from www.netc.net.au/enviro/fguide/sheeterosion.html, accessed 20 October 2000.

37 'Gully erosion', downloaded from www.netc.net.au/enviro/fguide/gullero.html , accessed 1 November 2000.

Eutrophication and algal blooms

2.52 Eutrophication occurs when high levels of nutrients, particularly phosphate, and to a lesser extent nitrogen, occur in waterways. When combined with factors such as low water flows and increased water temperatures, eutrophication can lead to algal blooms.[38] Algal blooms clog water supplies, impart an unpleasant taste to drinking water, can be toxic to humans and animals, kill fish, are unsightly to the public and smell when decaying. They can cause the closure of recreation areas and local water supplies, and halt some aquatic industries, such as shellfish production.[39]

2.53 Algal blooms pose a serious threat of environmental degradation for nearly every state and territory in Australia. They are estimated to cost between $180 to $240 million per year.[40] In 1991-1992, the Darling River experienced a blue-green algal bloom that extended over 1000 kilometres,[41] and earlier this year, a blue-green algae bloom covered nearly 40 square kilometres in Moreton Bay in Queensland. The algae spread at a rate of up to 100 square metres per minute. In humans algae may cause a blistering rash similar to second degree burns, as well as asthma and eye irritation.[42]

2.54 Some of the major sources of nutrients include:

- naturally occurring nutrients found in rocks and soils;
- sediments on river and lake beds;
- run-off from agricultural land and forests;
- sewage treatment works;
- fish farms; and
- stormwater run-off from urban areas.[43]

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38 'Natural Resources Management', downloaded from www.mdbc.gov.au/education/encylopedia/water_quality.htm, accessed 20 September 2000.

39 LWRRDC, *Data Sheets on Natural Resource Issues*, Occasional paper no. 24/99, p. 38.

40 LWRRDC, *Cost of Algal Blooms*, Occasional paper no. 26/99, p. x.

41 'Natural Resources Management', downloaded from www.mdbc.gov.au/education/encyclopedia/water%5Fquality.htm, accessed 20 September 2000.

42 'Killer Algae Alert', *The Sunday Mail*, 2 April 2000.

43 'Natural Resources Management', downloaded from www.mdbc.gov.au/education/encyclopedia/water%5Fquality.htm, accessed 20 September 2000.

2.55 Since nutrients bind to soil particles, soil erosion also contributes significantly to the eutrophication of waterways.

2.56 According to the MDBC, research indicates that natural, not artificial, sources account for the majority of nutrient loads. However, it is considered that minimising human-induced impacts, for example less clearing and less fertiliser use, can contribute to a reduction in nutrient loads, particularly on a local scale.[44] There are a number of ways to minimise waterway eutrophication. At the farm level this can include the introduction of strict fertiliser regimes designed to maximise utilisation of nutrients by crops. Other methods include:

- increasing stream water flows to help prevent the warm, low flow conditions favoured by blue-green algae;
- improving waste management practices to prevent heavy metals and chemicals, and untreated sewage from reaching the streams;
- nutrient reduction through the creation of detention ponds and contour banks; and
- artificial wetlands designed to trap and utilise nutrients before they reach waterways.

Urban stormwater

2.57 Urban regions often have large areas with non-porous surfaces such as concrete, roads and driveways. In these areas, water is unable to soak into the ground, and instead it runs off into stormwater drains, carrying urban litter and pollution with it. The water in these drains runs directly to waterways and estuaries, such as Port Phillip Bay in Victoria or Gulf St Vincent. Stormwater runoff often contains high nutrient levels, which can come from dog and cat faeces and from excessive use of garden fertilizers.[45] High pollution levels in the water can come from car petrol and oil lifted off the road during rain periods, household chemicals and oil poured down the drain, heavy metals from industrial sites, and litter such as cigarette butts and plastic bags.[46]

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44 'Natural Resources Management', downloaded from www.mdbc.gov.au/education/encyclopedia/water%5Fquality.htm accessed 20 September 2000.

45 'Frequently asked questions' downloaded from www.epa.nsw.gov.au/stormwater/resourceskit/materials.faq, accessed 1 November 2000.

46 'Victoria Stormwater Action Program', downloaded from www.epa.vic.gov.au/stormwater/, accessed 15 September 2000; *Australia, State of the Environment*, pp. 8-9. Evidence was also provided to the Committee during inspections and discussions in the Adelaide region.

2.58 Pollution from urban stormwater can have a major impact on coastal waterways near large cities.[47] For example, one litre of oil can contaminate one million litres of water.[48] Additionally, a recent CSIRO study has identified stormwater as a major threat to the health of Melbourne's Port Phillip Bay,[49] which receives water from more than 300 stormwater drains.[50] Each year, the equivalent of 500 truckloads of nitrogen is added to the Bay from stormwater discharges.

2.59 There are a number of ways to reduce the pollution of urban stormwater. Education campaigns such as the recent 'The Drain is Just for Rain' campaign undertaken in NSW, attempt to make the urban population aware of their impacts on water quality, and encourage practices which minimise pollution, such as picking up dog droppings and not tipping paint and oil down the drain. Mechanical mechanisms of reducing stormwater pollution include the construction of pollution and trash racks to trap oil, grease and litter.[51]

2.60 Another commonly used method is to construct artificial wetlands, which trap and absorb nutrients before they can reach the waterways. For example, the artificially constructed Urrbrae wetlands in South Australia filters stormwater to improve the quality of the water released into Gulf St Vincent.[52] In addition, the wetland provides valuable habitat for native flora and fauna, and provides a recreation area for the local residents.

Pest plants and animals

2.61 Introduced plants and animals pose a considerable threat to biodiversity. According to Dr Mark Lonsdale, of the CSIRO, introduced plants and animals are regarded as second only to habitat clearing as a threat to biodiversity.[53]

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47 Senator the Hon. Robert Hill, 'Message from the Minister', *Stormwater News*, vol 1(1), September 2000, p. 1.

48 'Stormwater', downloaded from www.epa.vic.gov.au / beachreport / stormwater.htm, accessed 1 November 2000.

49 'Protecting Port Phillip', *Stormwater News*, vol 1(1), September 2000, p. 4.

50 'Stormwater', downloaded from www.epa.vic.gov.au / beachreport / stormwater.htm, accessed 1 November 2000.

51 'Frequently asked questions' downloaded from www.epa.nsw.gov.au / stormwater / resourceskit / materials.faq, accessed 1 November 2000.

52 'The Urrbrae Wetland', downloaded from www.cwmb.sa.gov.au / wetlands / urrbrae.htm, accessed 3 November 2000.

53 M Lonsdale, *Weed Invasion – Australia's $3 billion problem*, National Science Briefing, Australian Parliament House, 17 August 2000.

Weeds

2.62 Weed plants pose a significant threat to Australia's biodiversity and agriculture. Almost all of Australia's native vegetation has been, or is likely to be, invaded by exotic species,[54] and there are no Australian conservation areas free of environmental weeds.[55]

2.63 There are currently 2700 introduced plant species in Australia, and approximately 1000 of these are listed as weeds.[56] Agricultural weeds impact on agricultural production and environmental weeds invade natural ecosystems. Native plants can also be classified as weeds if they become established in areas outside their natural habitat or their population increases to a size where it effects biodiversity or agriculture.[57]

2.64 Weeds can be introduced into a region in a number of ways. Many weeds in Australia were originally garden plants that escaped and flourished in the Australian environment. Others, such as bitou bush, were introduced to stabilise coastal sand dunes. The uncapped bores of the Great Artesian Basin have created permanent water sources, leading to the establishment of woody weeds such as prickly acacia.[58] The open drains used to transport bore water have given these weeds the opportunity to disperse throughout the basin. Soil disturbance by feral animals in the basin has also provided an opportunity for weeds to establish.

2.65 Weeds affect the economic output and viability of primary industries such as agriculture in a number of ways. The effects include a reduction in yield and grain contamination. Aquatic weeds can choke irrigation and drainage channels, and streams.[59] Since they invade native plant communities and compete for space, weeds reduce plant diversity and degrade or destroy habitat for native animals.

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54 'Environmental Weeds in Australia', downloaded from http://www.anbg.gov.au/weeds/weeds.html, accessed 7 September 2000.

55 M Lonsdale, *Weed Invasion – Australia's $3 billion problem*, 17 August 2000.

56 M Lonsdale, *Weed Invasion – Australia's $3 billion proble*', 17 August 2000.

57 The Hon. Mark Vaile MP, *Moving Forward in Natural Resource Management,* p. 1.

58 A Van Dugteren, 'Conserving the Future', *GEO Australasia*, Vol 20(6), December/January 1999, pp. 22-37.

59 Agricultural and Resource Management Council of Australia and New Zealand (ARMCANZ), Australian and New Zealand Environment and Conservation Council (ANZECC) and Forestry Ministers, *The National Weeds Strategy – a Strategic Approach to Weed Problems of National Significance*, 2nd ed. Commonwealth of Australia, March 1999, pp. 7-8.

2.66 It has been estimated that weeds cost Australian agriculture $3.3 billion dollars per year. However, this figure does not include other costs which are more difficult to measure.[60] Brisbane environmental consultant Mr Tim Low, considers that if the social costs are added, the figure grows to $6 billion per year.[61]

Pest animals

2.67 A pest animal can be defined as one that occurs where humans do not want it.[62] Because many introduced pest animals such as cats, foxes, pigs and rabbits have very few predators in Australia populations increase rapidly, and have a serious impact on agricultural production and biodiversity.[63] When found in large numbers some native species can also be pests, for example the cotton bollworm moth, which severely damages cotton crops.

2.68 Pest animals compete with humans, livestock and native plants and animals for resources, including space and food. They contribute to land degradation. For example, European carp overtake native fish habitats,[64] cats and foxes prey on domestic stock and native animals, and hard hoofed animals such as pigs and goats create soil erosion problems. Many pest animals also carry diseases, which can provide a source of infection for domestic stock, for example hydatids.[65]

2.69 The economic cost of pest species is difficult to determine, however it has been estimated that the cost of rabbits to Australian primary industries is at least $90 million per year,[66] and insect damage costs Australian agriculture $3.1 billion per year.[67]

2.70 There are number of techniques available to deal with weeds, including spraying with pesticides, slashing and burning. Weed control is best undertaken in a coordinated manner. The Commonwealth government's National Weeds Strategy aims to provide a nationally coordinated program for effective weed management. The Australian Quarantine and

60 ARMCANZ, ANZECC and Forestry Ministers, *The National Weeds Strategy*. p. 8.

61 'Gardens Seen as Main Threat to Environment', *West Australian*, 11 October 2000, p. 44.

62 Industry Commission, *A Full Repairing Lease*, p. 43.

63 The Hon. Mark Vaile MP, *Moving Forward in Natural Resource Management*, p. 1.

64 Industry Commission, *A Full Repairing Lease*, p. 44.

65 'Feral Animals in Australia', downloaded from www.environment.gov.au/bg/invasive/feralintro.html, accessed 12 September 2000.

66 The Hon. Mark Vaile MP, *Moving Forward in Natural Resource Management*, p. 12.

67 Industry Commission, *A Full Repairing Lease*, p. 44.

Inspection Service (AQIS) also plays an important role in preventing weeds from entering the country.

2.71 Methods for pest animal reduction include culling, poisoning, biological control, including the introduction of viruses such as the rabbit calicivirus. A number of programs are underway in Australia to fence off areas of native vegetation, remove pest species and restock with native animals. One company, Charlie Carp, has provided an innovative solution to pest control by harvesting carp to provide high quality plant fertiliser.

Development of catchment management in Australia

2.72 The Committee was advised by the Department of Agriculture, Fisheries and Forestry (AFFA) that catchment management as an approach to the management of Australia's agricultural lands began in the early 1900s.[68] Following the Second World War it was recognised that the management of Australia's water resources would be critical to economic development and that the planning for the use of water resources would involve considering each river valley as a whole. During this time a number of people emerged as champions of the catchment approach to water resource management, including Mr Ernest ('Watershed') Jackson from Albury. He emphasised the importance of educating farmers to the practice of integrated management of entire valleys and catchments.

2.73 By the late 1970s environmental degradation caused by agricultural and other land use practices had been recognised by various state and national government agencies. As a result, soil conservation agencies moved towards taking a whole of catchment approach to natural resource management. The recognition of the existence of a significant problem requiring action at a national level led, from the early 1980s, to a series of targeted legislative interventions by national government and state governments. These included the formation, in 1988, of the MDBC, and culminated in the decade of Land Care and, beginning in 1997, the work of the Natural Heritage Trust (NHT).[69]

68 Water Corporation (WA), Submission no. 142, p. 3.

69 Agriculture, Fisheries and Forestry, Australia, Submission no. 142, pp. 3-4.

What is a catchment?

2.74 Catchments are naturally occurring divisions in the landscape, defined by the flow of surface waters. A catchment is the land that channels water into a particular watercourse or river. Dr Colin Balmer provided this formal definition to the Committee:

> … a discrete geographical area of land, comprising one or more hydrometric sub-catchments, whose boundaries are derived primarily from natural features such that surface water drains and flows to a river, stream, lake, wetland or estuary.[70]

2.75 The catchments of creeks, gullies and streams combine to form the catchments of small rivers, which together form the catchments, or river basins, of major rivers, and these combine to form "drainage divisions".[71] Within Australia there are twelve drainage divisions. These subdivide into 77 river basins, which in turn subdivide into 324 Surface Water Management, or catchment, areas.[72] Maps of these divisions are given in appendix E.

2.76 One of the best known drainage divisions in Australia is the Murray-Darling Basin. It is well known for its environmental problems, including salinity, acidification, irrigation and water quality. The Murray-Darling catchment includes not only the land channelling water into the Murray and Darling rivers, but land which channels water directly into the rivers that flow into them, including the Murrumbidgee, the Lachlan, Gwydir, and the Namoi.

2.77 Catchments are natural geographical structures. They transcend state and local government boundaries. This creates a number of administrative difficulties which are further discussed in Chapter 3.

Catchment management

2.78 'Catchment management' refers to the practice of managing natural resources using water catchment systems as the unit of management. As an approach to managing land and water resources, catchment management involves integrating ecological, economic and social aspects of natural resource management around an identified catchment system. It aims to integrate these considerations in the way that best ensures long-

70 C Balmer, Submission no. 96, p. 1.

71 P James, Submission no. 125, p. 2.

72 S Noble, National Land and Water Resources Audit, personal communication, 28 September 2000.

term viability whilst at the same time serving human needs. AFFA considers that:

> *Catchment management* is the holistic management of natural resources within a catchment unit encompassing interrelated elements of land and water, managed on an ecological and economic basis and incorporating social systems … . It is a system that favours the integration of environmental policy across government, community, and industry sectors through partnerships and extensive stakeholder inclusion.[73]

Catchment management by jurisdiction

2.79 In this section the approach to catchment management in each jurisdiction in Australia is briefly examined. All states and territories in Australia have some form of catchment, or natural resource, management. Some states and territories have legislation to support catchment management, whereas in other states management is voluntary or occurs as an element in a wider natural resource management practice.

2.80 What each jurisdiction does is determined by the responsibilities that it has in virtue of the provisions of the Constitution of the Commonwealth. These, however, are not clearly defined. As a result, a level of government may, more or less as an accident of tradition, exercise powers in respect of a certain matter because it has done so since Federation. It will continue doing so until the power is clarified by the High Court, and its competency confirmed or the power is allocated to another level of government. Table 2.2 outlines a traditional division responsibilities between the different levels of government in Australia, as outlined by Environment Australia (EA).

73 AFFA, Submission no. 142, p. 2.

Table 2.2 Traditional division of responsibilities between the levels of government and individuals.[74]

Jurisdication	Commonwealth	State	Region (ie Catchment Management Authority)	Local government	Individuals/ Corporations
Activity					
Adherence to international/national conventions	●●●	●●	●	●	●
Leadership and catalysing change	●●●	●●●	●●●	●●●	●
Administer land and water legislation and regulation	●	●●●	–	●●	–
Undertake regional and local planning	●	●●	●●●	●●●	●
Support for research and development	●●●	●●●	●	●	–
Development of national NRM policy	●●●	●●	●	●	●
NRM extension and community capacity building	●	●●●	●●	●●	●
On-ground management (except for crown lands)	–	–	●●	●●	●●●
On-ground management of crown lands	●●●	●●●	●●	●	–

Levels of responsibility

– Not relevant

● Low

●● Medium

●●● High

74 EA, Submission no. 141, p. 20. This table provides an indication of the various levels of responsibility for natural resource management areaas, as advised to the Committee by Environment Australia (EA). EA notes that this table can only be an indication; the particular responsibility will vary according to the legislative environment and the administrative arrangements within a particular region.

The Commonwealth

Legislative powers

2.81 The Constitution of the Commonwealth does not confer upon the Commonwealth Parliament any specific power to make laws in respect of the environment, land management or water use. The laws that are made for environmental matters draw their validity from other heads of power in the Constitution. Commonwealth powers that have been used to support legislation for environmental purposes include:

- trade and commerce power (s51(i));
- taxation power (s51(ii));
- quarantine power (s51(ix));
- fisheries power (s51(x));
- corporations power (s51(xx));
- race power (s51(xvi));
- external affairs power (s51(xxix);
- incidental power (s51(xxxix));
- power over customs, excise and bounties (s90);
- financial assistance power (s96); and
- territories power (s122)).[75]

2.82 As a result of the uncertain power to legislate, the primary responsibility for land use and land management has been assumed by the states and territories. The result of this, according to AFFA, is that the current role of the Commonwealth could be described as:

> … providing the policy and economic framework that will enable catchment management to be effective. The Commonwealth provides leadership and policy direction, funding, research and development, public awareness, supports education, information

75 Australian and New Zealand Environment and Conservation Council, *Guide to Environmental Legislation in Australia and New Zealand*, 5th ed, (Report No 31, 1997), quoted in the Senate ECITA References Committee report, *Commonwealth Environment Powers*, p. 7. Another power that could be used, but does not appear to have been used for environmental matters, hitherto, is the power of the Parliament of the Commonwealth to legislate in respect of any matters referred to the Commonwealth by a state or states (s. xxxvii).

exchange and intergovernmental coordination which support catchment level activity.[76]

2.83 The reliance of Parliament upon constitutional powers not directly related to environmental matters but which provide authority to legislate in respect of environmental matters is amply demonstrated by the external affairs power. The external affairs power of the Constitution has provided the basis for a body of environmental activities on the part of the Commonwealth. Australia is signatory to 65 international treaties relating to the environment, some dating back as early as 1946.

2.84 These treaties include the Convention on International Trade in Endangered Species of Wild Fauna and Flora (21/9/73); Convention concerning the Protection of the World Cultural and Natural Heritage (17/12/75); Convention on Wetlands of International Importance Especially as Waterfowl Habitat (8/5/74); and the Convention on Biological Diversity (5/6/92).

2.85 Relying in part upon these international treaties, the Commonwealth has introduced a number of pieces of legislation targeted at protecting the environment. These include, the *Endangered Species Protection Act 1992,* the *Wildlife Protection (Regulation of Exports and Imports) Act 1982,* and the *World Heritage Properties Conservation Act 1983.*

2.86 Australia is also signatory to Agenda 21, the global action plan for sustainable development, which was adopted at the UN Conference on Environmental and Development in June 1992.

2.87 A major legislative initiative occurred in 1999, with the enactment of the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*, (EPBC). This legislation came into force on 16 July 2000. The Act replaces five previous Acts – the *Environment Protection (Impact of Proposals) Act 1974, Endangered Species Protection Act 1992, National Parks and Wildlife Conservation Act 1975, World Heritage Properties Conservation Act 1983,* and *Whale Protection Act 1980.*

76 AFFA, Submission no. 142, p. 12.

2.88 The EPBC Act gives the Commonwealth significant environmental responsibilities in certain defined areas. For example, it establishes a new national process for assessment of proposed actions that are likely to have a significant impact on matters of national environmental significance, or on Commonwealth land. The six matters of national significance are:[77]

- World Heritage properties;
- Ramsar wetlands of international importance;
- nationally threatened species and communities;
- migratory species protected under international agreements;
- nuclear actions, including uranium mining; and
- the Commonwealth marine environment.

2.89 In the short time it has been operating, the EPBC Act has had an effect. By 20 September 2000, 36 projects had been referred under the Act. Seven have been determined to be environmentally significant, therefore needing assessment and approval. Of the remaining 29, 13 did not require assessment and approval, and 16 were still under consideration.

2.90 The Act also allows the Commonwealth to accredit assessment provisions of state and territory government through bilateral agreements. In certain circumstances, state and territory approval provisions may be accredited.

National strategies and initiatives

2.91 There are a number of national strategies and initiatives in the area of environmental management. The most recent and significant development has been the announcement by the Prime Minister, the Hon. John Howard MP, of the proposal to establish a single, national ministerial council, the Natural Resource Management Council. This council will involve the Commonwealth and the states which, together, will agree to targets and standards. This council is one element in a package of integrated measures designed to address salinity and water quality issues within the Commonwealth. The initiative also involves a

77 In addition to the six matters of national environmental significance, the Commonwealth government is currently considering a proposal to apply a 'greenhouse trigger' under the Commonwealth EPBC Act. Under the proposal, the trigger would apply to actions or developments likely to result in greenhouse gas emissions over 500 000 tonnes of carbon dioxide equivalent in any 12 month period. Projects emitting greenhouse gases above this level would trigger the requirement, under the EPBC Act, for assessment and approval. The Commonwealth government has released a model for a trigger that could be applied under the Act, and is currently consulting with the Australian states and territories.

commitment by the Commonwealth of $700 million over seven years, with a request that the states match this dollar for dollar making a seven year package of $1.5 billion.[78]

2.92 The council will also establish arrangements for monitoring progress in attaining these targets. Only those jurisdictions that agree to implement a salinity and water quality plan as a package will receive Commonwealth funding.[79] These arrangements would appear to rely, at least in part, upon the financial assistance power (s96) of the Constitution for their constitutional validity.

2.93 Some earlier examples of national approaches include the Council of Australian Governments (COAG) Water Reform Framework, the Intergovernmental Agreement on the Environment, the National Water Quality Management Strategy (NWQMS), the MDBMC, and the Australian and New Zealand Environment Council (ANZECC). National Strategies have included:

- National Weeds Strategy (1997);
- COAG Water Reform Agenda; and
- Murray-Darling Basin Natural Resources Management Strategy.

2.94 Prior to the announcement of the National Action Plan is put in place, the NHT was the Commonwealth Government's major contribution to natural resource management. Established in 1996, the NHT has been allocated $1.5 billion in funding for natural resource management, and is administered by a Ministerial Board, comprising the Minister for the Environment and Heritage, and the Minister for Agriculture, Fisheries and Forestry.[80] The NHT is expected run until mid-2001.

2.95 The NHT focuses of five main themes – land, water, vegetation, coasts and marine, and biodiversity. There are a number of programs funded under the NHT, including Murray-Darling 2001; Bushcare, the National Landcare Program, the National Land and Water Resources Audit,[81] and the Coasts and Clean Seas Program.

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78 The Prime Minister, the Hon. John Howard MP, *Our Vital Resources*; press conference transcript on the launch of *Our Vital Resources, a*vailable at: http://www.pm.gov.au/news/interviews/2000/interview475.htm

79 The Prime Minister, the Hon. John Howard MP, *Our Vital Resources*, pp. 6, 7.

80 EA, Submission no. 141, pp. 24, 80.

81 The importance of the NLWRA as an information sharing institution will be further discussed in Chapter 3.

New South Wales

2.96 The Department of Land and Water Conservation (DLWC) is the principal agency responsible for land and water resources in NSW. The state term for catchment management is 'Total Catchment Management' (TCM). This defined as 'the co-ordinated and sustainable use and management of land, water, vegetation and other natural resources on a water catchment basis so as to balance resource utilisation and conservation'.[82]

2.97 TCM began in NSW in 1984, and was formalised with the introduction of the Catchment Management Act in 1989. In TCM there are three levels of management organisation:

- State Catchment Management Coordinating Committee (SCMCC)
  - ⇒ NSW ICM has recently undergone a structural change, and the full extent of the role of the SCMCC is not yet known. The committee includes representatives of state and local governments, and relevant community and interest groups.
- Sydney Catchment Authority (SCA)
  - ⇒ The SCA was established by the *Sydney Water Catchment Management Act 1998*. The Authority is responsible for managing Sydney's catchments, dams, transfer pipes and other infrastructure. It supplies water to four million people in Sydney, the Blue Mountains, and some parts of the Southern Highlands.
- Catchment Management Boards (CMBs)
  - ⇒ There are currently 18 CMBs in NSW, established under the *Catchment Management Act 1989*. These came into effect on 31 May 2000. They replaced 43 catchment management committees and five regional catchment committees. Restructuring was undertaken because of concern about the large number of natural resource management committees in NSW.

2.98 Responsibilities for catchment management in NSW are allocated under a number of the 52 Acts administered by the Department of Land and Water Conservation.

82 *Catchment Management Act 1989* (New South Wales), s. 4.

Queensland

2.99 In 1991 the Queensland Government introduced a community-based Integrated Catchment Management (ICM) approach,[83] run through the Department of Natural Resources. Catchment Coordinating Committees (CCCs) were established across the state to take an integrated approach to water, soil and vegetation resources within specific river catchments.

2.100 There are currently over 30 Catchment management groups operating in Queensland.[84] In addition to these, there are 13 Regional Strategy groups, which develop regional natural resource management strategies.[85]

2.101 The Queensland Murray Darling Association was formed when Queensland entered the Murray Darling Basin Initiative in 1992. The Queensland Murray-Darling Association is the co-ordinating body for catchment management in south east Queensland.

2.102 There is no direct legislative base for the ICM framework in Queensland. The state government is investigating the possibility of statutory support for catchment management.[86] However, catchment management can be indirectly affected by a number of the 19 Acts of Parliament administered by the Department of Natural Resources.

Western Australia

2.103 The West Australian government supports an integrated approach to catchment management (ICM). The Western Australia government defines ICM as 'the co-ordinated planning, use and management of water, land, vegetation and other natural resources on a river or groundwater catchment basis'. The aim of Western Australian ICM is to bring all stakeholders together to form a plan of action that addresses social, economic and ecological concerns within a catchment.

83 Queensland government, Submission no. 138, p. 2.

84 'Integrated Resource Management', downloaded from www.dnr.qld/gov.au/community/irm/3_1_2.html, accessed 28 September 2000.

85 Queensland government, Submission no. 138, p. 2.

86 Queensland government, Submission no. 138, p. 2.

2.104 No single group or agency has overall responsibility for catchment management, and there is no legislation that provides a total framework.[87] A number of government agencies are responsible for catchment management in Western Australia. They include the:

- Water and Rivers Commission (WRC);
- Department of Environmental Protection (DEP),
- Department of Conservation and Land Management (CALM);
- Agriculture Western Australia (AgWA);
- Office of Water Regulation; and
- Water Corporation.

2.105 Together these agencies are responsible for 77 legislative Acts, and many of these have both a direct and indirect effect on catchment management.

South Australia

2.106 The Department for Water Resources is the principle agency responsible for the management and administration of South Australia's water resources. While catchment management falls directly under most of the 10 Acts of Parliament administered by the Department for Water Resources, it is also affected by many of the 24 Acts administered by the Department for Environment and Heritage.

2.107 Catchment management in SA is defined as 'the management of water resources in an integrated way to achieve economic, environmental and social goals', and is primarily undertaken in accordance with arrangements set up under the *Water Resources Act 1997*. The Act defines the following four major areas of catchment management planning:

- The State Water Plan (SWP)
  - ⇒ The SWP outlines the policy framework for water resource management and use throughout the state. It provides information on the condition and use of South Australia's water resources.
- Catchment Water Management Plans (CWMPs)
  - ⇒ CWMPs are undertaken by Catchment Water Management Boards (CWMBs) which are being established throughout South Australia.

87 Water and Rivers Commission, Submission no. 120, p. 1.

- Water allocation plans and trading rights
  - ⇒ These have been implemented to establish a system for the use and management of the state's water resources. They are carried out either through CWMBs, or Water Resources Planning Committees.
- Local Water Management Plans(LWMPs)
  - ⇒ LWMPs are carried out by local councils for water resources found within their area.

Victoria

2.108 The Department of Natural Resources and Environment is responsible for catchment management in Victoria, where it is defined as 'Integrated Catchment Management' (ICM). In Victoria, the primary goal of catchment management is 'to ensure the sustainable development of natural resource-based industries, the protection of land and water resources and the conservation of natural and cultural heritage'.[88]

2.109 The principle ICM legislation in Victoria is the *Catchment and Land Protection Act 1994*. The Act established the Victorian Catchment Management Council, a peak body that provides advice to Government on natural resource management issues. Nine regional Catchment Management Authorities (CMAs) and a metropolitan Catchment and Land Protection Board (CALP) have also been created under this Act.[89]

2.110 Regional Catchment Strategies (RCSs) have been formed across the state. These are recognised as the over-arching strategy for the development, management and conservation of land and water resources in each region. The primary role of the CMAs and the CALP is to co-ordinate the RCSs.

2.111 The Department of Natural Resources and Environment is responsible for administering 103 Acts of Parliament, with many of these relating to ICM.

88 Victorian government, Submission no. 127, p. 4.

89 Victorian government, *Transcript of evidence*, p. 310.

Australian Capital Territory

2.112 The ACT government defines Integrated Catchment Management (ICM) as 'an approach to planning and natural resource management based on ecological, social and economic considerations.'[90]

2.113 The ICM framework in the ACT is guided by the *ACT Decade of Landcare Plan (1991)* which recognised that a greater emphasis on ICM is required, and the *Territory Plan (1993),* which states that 'planning for land and water resources will be integrated, based on total catchment management principles.' The ACT government is in the process of planning and implementing an ICM framework.[91]

2.114 While there is currently no legislation which completely covers ICM in the ACT, it is partly covered by the *Environment Protection Act 1997,* the W*ater Resources Act 1998* and the *Nature Conservation Act 1980,*[92] and to a lesser extent, some of the 72 Acts of Parliament administered by the ACT Department of Urban Services.

Tasmania

2.115 The non-statutory Tasmanian Land and Water Management Council (TLWMC) was formed in 1994.[93] The TLWMC working group defines ICM as 'the co-ordinated and sustainable use and management of land, water vegetation and other natural resources on a regional water catchment basis so as to balance resource utilisation and conservation'.[94]

2.116 The Department of Primary Industries, Water and the Environment (DPIWE) has designated 48 catchments for the state. There are currently Natural Resource Management processes underway in 27 of these catchments.[95]

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90 ACT government, *An Integrated Catchment Management Framework for the ACT*, 2000, p. 1, downloaded from http://www.act.gov.au/environ/4483env.pdf, accessed 11 September 2000.

91 J Loveitt, Environment ACT, personal communication.

92 ACT government, *An Integrated Catchment Management Framework for the ACT*, 2000, p. 20.

93 Tasmanian government, Submission no. 143, p. 2.

94 'Integrated Catchment Management', downloaded from http://www.dpif.tas.gov.au/domino/dpif/LandAndWater.nsf/65cc7bcd0c35212e4a2564b20027ef3c/a964b7844fa914904a2564dc0008b91d?OpenDocument, accessed 31/08/00.

95 D Wright, Department of Primary Industries, Water and the Environment, Tasmanian government, personal communication, 1 September 2000.

2.117 The Tasmanian government is currently developing a state policy on ICM,[96] however ICM can also be influenced by many of the 95 Acts of Parliament currently administered by the DPWIE.

Northern Territory

2.118 The Northern Territory supports 'Integrated Catchment Management', which is still being developed. This is primarily undertaken through the Department of Lands, Planning and Environment, however it is also affected by legislation administered through the Department of Primary Industry and Fisheries, and the Parks and Wildlife Commission of the Northern Territory. These departments administer 83 pieces of legislation, many of which impact on catchment management. Important Acts include the *NT Water Act 1992,* which covers the investigation, use, control, protection, management and administration of water resources within the Northern Territory, and the *Fisheries Act 1999.*

2.119 At the end of the 1998/99 year, catchment plans existed for the Mary River Catchment, the Rapid Creek Catchment and the Ludmilla Creek Catchment.

Support for catchment management in Australia

2.120 This section outlines support for catchment management, and discusses the strengths and problems associated with the strategy.

2.121 The Committee stresses that it is not suggesting that catchment management, as the basis of the community's response to environmental degradation, should be abandoned. The catchment management approach enjoys widespread community support. It is also the approach suggested by the nature of the environmental problems facing the nation.

2.122 As noted, catchment management attempts to integrate social, economic and environmental needs. It provides a forum for communication, co-operation and co-ordination between a number of stakeholders with the

96 Tasmanian government, Submission no. 143, p. 2.

aim of ensuring sustainable use. The strengths of catchment management, the Committee was advised, include a clear focus, integrated planning and management, and community ownership.[97] It is also considered to be a cost-effective approach, that can achieve a number of desirable outcomes.[98]

2.123 The problems that beset catchment management at present do not emerge from the approach itself, but rather how it has been put into effect. The Committee's view, then, is that management of Australia's environment by way of its catchment systems should be strengthened, along the lines recommended in this report. If this occurs, this approach will be more cost effective and will reliably and efficiently attain the outcomes needed.

2.124 A recurring theme among many of the submissions was that catchment management has the potential to provide significant benefits, and is suitable to address environmental issues that have an impact at the catchment level. The Border Rivers Catchment Management Association considers that while catchments are not the only way to manage natural resources, they are clearly the most practical.[99]

2.125 An overwhelming number of submissions support the concept of a catchment management approach in Australia,[100] and the submission from the North West Catchment Management Committee advised the Committee that 'the value of a catchment approach cannot be underestimated'.[101] However, a number of witnesses have highlighted concerns about the application of the approach, particularly the need to take into account the social and economic aspects of catchment management, and the suitability of catchment management for all areas of Australia.[102]

97 Mallee Catchment Management Authority, Submission no. 90, p. 4.

98 Australian Water and Wastewater Association, Submission no. 102, p. 2; The Southern Sydney and Sydney Harbour Regional (Catchments) Coordinating Committees, Submission no. 112, p. 2.

99 Border Rivers Catchment Management Association, Submission no. 55, p. 2.

100 For example, Bennett Brook Catchment Group, Submission no. 72, p. 1; Forest Practices Board, Submission no. 25, p. 1; NFF, Submission no. 34, p. 1; Southern Riverina Irrigation Districts Council, Submission no. 10, p. 2.

101 North West Catchment Management Committee, Submission no. 124, p. 2.

102 For example, Bombala council, Submission no. 39, p. 1; NFF, Submission no. 34, p. 2; Snowy Mountains Hydro Electric Authority, Submission no. 23, p. 1.

Environmental issues

2.126 A number of submissions argue that catchment management is practical because it is a clearly defined unit that provides important links between land and water resources, and human activity.[103] It is also a natural, self-contained system occurring at a scale where the development and use of natural resources have a number of interrelated attributes.[104] The North Central Catchment Management Authority considers that a catchment management approach can achieve a number of outcomes that would not be possible through an issue specific approach.[105]

2.127 However, a number of submissions noted that some aspects of natural resource management, for instance, weeds or feral animals, can encompass several catchments and may need other, more appropriate boundaries.[106] The LWRRDC considers that:

> There are also regions of Australia where catchment management is probably not the most appropriate scale for managing natural resources. This is certainly the case in much of the rangelands, where water flows are infrequent and episodic, and planning and management is better related to land systems or sociologically-defined regions.[107]

2.128 Additionally, AFFA notes that catchment management may not be suitable in areas of Australia which have poorly defined catchments.[108] Also, in some regions of Australia the movements of groundwater may not be the same as surface water movement, and it may not be suitable to manage these areas at the catchment scale.[109]

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103 For example, Integrated Catchment Assessment and Management (ICAM) centre, Submission no. 85, p. 2.

104 G Brierly, K Fryers and P Batten, Submission no. 130, p. 1.

105 North Central Catchment Management Authority, Submission no. 11, p. 3.

106 For example, EA, Submission no. 141, p. 9; NFF, Submission no. 34, p. 2; LWRRDC, Submission no. 66, p. 2.

107 LWRRDC, Submission no. 66, p. 2.

108 AFFA, Submission no. 142, p. 7.

109 AFFA, Submission no. 142, p. 7.

2.129 Other alternative scales for management include Interim Biogeographic Regionalisation for Australia (IBRA) units, and agro-ecological regions.[110] IBRA regions divide Australia into major environmental units, such as vegetation types. Agro-ecological regions divide Australia into areas according to their climate, ecology and agricultural activities.

Social context

2.130 While catchment management may be practical on an environment level, grouping people on the same basis may not be effective.[111] From a practical viewpoint, a region's population size or geography may hamper management strategies, for example, in some sparsely populated areas of Australia catchment management may not be appropriate because of the lack of human resources available to deal with the issues.[112] Alternatively, where a catchment is small, it may be better to deal with resource management issues across a number of catchments.[113]

2.131 Densely populated areas such as Sydney or Melbourne may also require a different management scale. For example, the Sydney region has a number of catchments within the city boundaries. Given the complex nature of city's water supply and sewerage pipes, and the interaction of these pipes across the catchments, it may be more practical to manage Sydney as a whole, rather than at the catchment level.

2.132 From a social perspective, Australians tend to group themselves according to factors such as economic, historic and cultural contexts, rather than catchment boundaries.[114] For example, in regions where catchments cross state borders,[115] communities may have a far greater affinity with people in different catchments but neighbouring towns, rather than communities in the same catchment, but across the state border. It is considered that one of the difficulties with implementing catchment management is that people see themselves primarily as part of a community or a locality rather than of a catchment.[116]

110 AFFA, Submission no. 142, pp. 7-8.
111 K Cotterell, Submission no. 84, p. 2.
112 NFF, Submission no. 34, p. 5.
113 LWRRDC, Submission no. 66, p. 2.
114 K Cotterell, Submission no. 84, p. 2.
115 See appendix E.
116 Western Catchment Management Committee, Submission no. 57, p. 2.

Community ownership

2.133 Successful catchment management may be a result of how much the community owns, and has some control over the issue. In some regions, communities feel as though they are not adequately represented on the committees, and that their views are not taken into account.

2.134 The Pastoralists and Graziers Association of Western Australia considers that:

> The best regional approach, with a regional committee in place, will not succeed when the community do not perceive this to be representative of community views or aspirations. This resistance is compounded when the regional committee is consulted by state level committees on aspects of natural resource management without the knowledge of the community they purport to represent.[117]

2.135 While the aim of many catchment management committees is to equally represent all relevant stakeholders, there is a view among some areas of the community that catchment management organisations are elitist and removed from the community.[118] For example, the Goulburn Valley Environment Group states that the interests of primary industry dominate catchment management in their region.[119] Alternatively, the NSW Farmers Association considers that farmers feel poorly represented on committees, and are alienated by the level of government involvement.[120]

2.136 There is also concern about the plethora of committees now in existence.[121] For example, there are currently 127 natural resource management and catchment groups in NSW alone. The large number of committees can make communication extremely difficult, resulting in a lack of co-ordination, and reducing the ability to effectively manage catchments. The committee believes that this is a serious problem, and addresses the issue in more detail in chapter 4.

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117 Pastoralists and Graziers Association WA, Submission no. 137, p. 4.

118 Bombala council, Submission no. 39, p. 1.

119 Goulburn Valley Environment Group Inc., Submission no. 27, p. 1.

120 NSW Farmers Association, Submission no. 73, p. 2.

121 NFF, Submission no. 34, p. 5; NSW Farmers Association, Submission no. 73, p. 2.

Administrative boundaries

2.137 A major difficulty associated with catchment management is the fact that catchments cross over a number of local and state government boundaries,[122] creating administrative and political difficulties.[123] The Murray Darling Association Inc is aware of this problem, and argues that the catchment management should apply to all parts of a catchment, irrespective of political boundaries.[124]

2.138 The Committee recognises the difficulties associated with cross-border issues, and acknowledges that current arrangements are poorly co-ordinated both within and between states. The Committee considers that this is a major impediment to the successful implementation of catchment management in Australia, and discusses the issue at length in the next chapter.

Conclusion

2.139 Australia faces a number of serious environmental issues which can be addressed adequately only if all states, territories and the Commonwealth provide long-term support and co-operation to deliver appropriate programs.

2.140 The Committee applauds the work of the many community groups who have already achieved valuable outcomes in terms of sustainable catchment management. These groups represent a particular community's concerns in environmentally sustainable catchment management, based on local knowledge and local concerns. It is clear to the Committee from the work of these groups, that the programs that the various levels of government must facilitate will, in the end, be delivered to specific locations and problem areas by local community groups.

2.141 On a larger scale, when these groups work together, they create a community of shared interest that, when empowered with information and resources, will be motivated to implement appropriate responses to the environmental problems facing the nation.

2.142 Many of these problems result from factors which operate over long time frames and affect vast areas of the Australian continent. Some of the problems are a legacy of past practices, while others are the result of contemporary land use practices. Many occur in both rural and city areas.

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122 Patrick James, Submission no. 125, p. 3.

123 See appendix E.

124 Murray Darling Association Inc., Submission no. 30, p. 3.

As the ACF / NFF discussion paper reported, 'These stem from a long history of inappropriate land use, of past and present government policies, and of a failure of markets to adequately value soils, water and vegetation.'[125]

2.143 Consequently, and as will be seen in the next two chapters, the problems require a variety of substantial financial support for a long period of time and administrative arrangements that are reliable and stable over at least three generations. The Committee notes that the catchment management approach combines three ingredients necessary to address the environmental problems facing the nation:

1. natural geographic divisions that are readily understood and already accepted;
2. a basis upon which to link communities of similar and shared interests into regions of interest, in order to build a stronger and co-ordinated response to environmental degradation; and
3. widespread community acceptance of the approach and existing infrastructure.

2.144 For these reasons, the Committee concludes that an approach based on the management of catchment systems must underpin the identification of the problems, the administrative arrangements and ultimately the delivery of appropriate remedial action. Not only is this approach based upon natural facts about the landscape, but this approach already enjoys considerable and widespread community support.

2.145 The Committee believes that the foundation of successful catchment management programs is community acceptance of any particular catchment management approach that may be adopted. The Committee also recognises that community acceptance and motivation in the delivery of any remedial program must include the economic and social issues relating to catchment management. The Committee believes, then, that the need for community input and ownership of catchment management issues must not be underestimated and that community involvement is required at all stages of program development and delivery. As a result, the proposals recommended in this report are designed to empower communities by providing them with the resources to implement ecologically sustainable catchment management programs.

125 ACF / NFF, *National Investment in Rural Landscapes*, p. 4.