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**ENVIRONMENTAL AND HEALTH-RELATED
STANDARDS INFLUENCING AGRICULTURE
IN AUSTRALIA**

Randy Stringer and Kym Anderson

March 2000

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CIES DISCUSSION PAPER 0010

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ABSTRACT

ENVIRONMENTAL AND HEALTH-RELATED STANDARDS INFLUENCING AGRICULTURE IN AUSTRALIA

Randy Stringer and Kym Anderson

This report is part of a five-country study focusing on how environmental and human health related standards apply to the agricultural sector. The overall study is coordinated by the Agricultural Economics Research Institute (LEI) in the Netherlands. The five countries include Australia, Canada, the European Union, New Zealand and the USA. Each country study provides an overview of its agricultural sector; explains government policy objectives; outlines public sector approaches to the various environmental and health-related issues confronting agriculture; details a comprehensive inventory of environmental and health-related regulations; and draws out key economic implications of complying with both current and prospective environmental and health-related policies, particularly as they impact on the international competitiveness.

Keywords: Environmental and food safety management, environmental policy, health policy, agriculture, international competitiveness, natural resource

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NON TECHNICAL SUMMARY

This report is part of a five-country study focusing on how environmental and human health related standards apply to the agricultural sector. The overall study is coordinated by the Agricultural Economics Research Institute (LEI) in the Netherlands. The five countries include Australia, Canada, the European Union, New Zealand and the USA. Each country study provides an overview of its agricultural sector; explains government policy objectives; outlines public sector approaches to the various environmental and health-related issues confronting agriculture; details a comprehensive inventory of environmental and health-related regulations; and draws out key economic implications of complying with both current and prospective environmental and health-related policies, particularly as they impact on the international competitiveness.

Until recently, Australia's farmers have been largely insulated from the demands of environmental groups and from government restrictions on their activities. Now, however, various local, national and international pressures are forcing policymakers to address agricultural environmental and health-related issues and to examine ways to promote more sustainable farming practices. Australian policy recognises that environmental and ecologically sustainable development issues must be dealt with at all levels of government if the resource base is to be used optimally.

Australia has begun responding to this environmental challenge by committing to a process of adapting sustainable development concepts, programs, and policies to suit domestic socioeconomic conditions, including prevailing agricultural production, consumption and trade patterns. It also has been a keen participant in international agencies such as Codex Alimentarius, WTO, IOE and IPPC, whose foci are on global food safety and plant and animal health issues.

Environmental and food safety management involves a mix of government regulations and voluntary approaches. Voluntary measures and agreements between governments, industry and community groups play a key role, with an increasing emphasis on economic (ie. price-based) instruments. For example, the current water reform agenda that is gradually being accepted across the country includes moves towards full cost pricing of water delivery and tradeable water rights.

The Commonwealth Government is currently undertaking a comprehensive reform of the country's environmental law regime. The objective of this process is to deliver better environmental outcomes in a manner that promotes greater certainty for all stakeholders and minimises the potential for delay and intergovernmental duplication (DE, 1998). Fundamental to the reform package is the integration of environmental, economic and social considerations through the implementation of the principles of ecologically sustainable development. The precautionary principle and the principle of intergenerational equity are expressly recognised. Two other guiding principles of the reform process are the need to maintain and enhance international competitiveness in an environmentally sound manner and the adoption of cost-effective and flexible measures.

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Chapter 1 INTRODUCTION

Agriculture is more important to the economic prosperity of Australia than to most other advanced industrial countries. While primary agriculture's current contribution to national production is not large (around 3 per cent of GDP), it is expected to play a significant role as a foreign exchange earner well into next century. The contribution of the entire agricultural and food industry is much larger and considered crucial to the Australian economy, accounting for 12 per cent of GDP (DFAT, 1999).

Four-fifths of Australia's agricultural production is exported, the value of which accounts for one-fifth of all goods and services exported. Hence any downturn in agricultural exports has important macroeconomic policy implications. Agriculture employs about 418,000 people, or 5 per cent of the work force (ABS, 1998).

The food and beverage sub-sector has the largest turnover and is the second largest employer among all manufacturing sub-sectors (FRRC, 1998). It accounts for 20 per cent of manufacturing output and approximately 10 per cent of the total number of manufacturing establishments. Food retailing represents some 36 per cent of all retail turnover. Food and beverage processing has contributed more than 18 per cent of value added in manufacturing in recent years (ABS, 1997).

The food processing sector is diverse, ranging from small specialist processors to large multinational corporations. Processed food exports comprise half of all food and agricultural exports. Highly processed food exports increased by 155 per cent between 1990 and 1997, while exports of unprocessed agricultural products grew by just 8 per cent (DFAT, 1997).

During the past four decades, total factor productivity growth in Australian agriculture is estimated at 2 to 2.5 per cent per year (Chisholm, 1995). This is substantially higher than productivity growth rates in the rest of the Australian economy and in the agricultural sectors of other developed countries taken as a whole. For example, Australia's rate of increase in output per unit of land over the past three decades has been higher than for all other OECD countries (Alston et al, 1993).

Australian agriculture is less likely to continue its relative decline in economic importance over the next decade if the APEC region delivers on its promise to achieve free trade by 2010 for industrial countries and by 2020 for developing countries. If agriculture is included as part of that liberalisation, as currently promised, exports of farm products from Australia, particularly to East Asia, would grow very substantially (Anderson et al, 1997a; 1997b).

Since the early 1970s, Australian governments have pursued a gradual transition away from price supports, statutory marketing arrangements and trade protection, policies which insulated food and agricultural producers from both domestic and international market signals. The effective rate of government assistance to the sector was close to 30 per cent of value added in 1970, whereas over the past two decades it has averaged

around 10 per cent, fluctuating between 7 and 13 per cent because of international price changes (PC, 1998).

The current farm policy objectives are to increase international competitiveness, encourage sustainable agricultural practices and promote social and economic opportunities for rural communities (DPIE, 1998). Agricultural policies are oriented towards facilitating market responsiveness and largely self-reliant risk management. An important consequence of improving market responsiveness is further integration of food and agriculture production with downstream processing industries.

The trend in Australia's agricultural policies is to continue to reduce and eventually remove remaining impediments to efficient markets and trade, including excessive quarantine restrictions at state/territory and national borders, thus making the sector even more market responsive and better integrated with the rest of the world.

Until recently, Australia's farmers have been largely insulated from the demands of environmental groups and from government restrictions on their activities. Now, however, various local, national and international pressures are forcing policymakers to address agricultural environmental and health-related issues and to examine ways to promote more sustainable farming practices. Australian policy recognises that environmental and ecologically sustainable development issues must be dealt with at all levels of government if the resource base is to be used optimally.

Australia has begun responding to this environmental challenge by committing to a process of adapting sustainable development concepts, programs, and policies to suit domestic socioeconomic conditions, including prevailing agricultural production, consumption and trade patterns. It also has been a keen participant in international agencies such as Codex Alimentarius, WTO, IOE and IPPC, whose foci are on global food safety and plant and animal health issues.

Environmental and food safety management involves a mix of government regulations and voluntary approaches. Voluntary measures and agreements between governments, industry and community groups play a key role, with an increasing emphasis on economic (ie. price-based) instruments. For example, the current water reform agenda that is gradually being accepted across the country includes moves towards full cost pricing of water delivery and tradeable water rights.

The Commonwealth Government is currently undertaking a comprehensive reform of the country's environmental law regime. The objective of this process is to deliver better environmental outcomes in a manner that promotes greater certainty for all stakeholders and minimises the potential for delay and intergovernmental duplication (DE, 1998). Fundamental to the reform package is the integration of environmental, economic and social considerations through the implementation of the principles of ecologically sustainable development. The precautionary principle and the principle of intergenerational equity are expressly recognised. Two other guiding principles of the reform process are the need to maintain and enhance international competitiveness in an environmentally sound manner and the adoption of cost-effective and flexible measures.

Finally, three other reform processes deserve mention by way of introduction. One is the implementation of many of the recommendations of the Nairn Report (1996) on Australia's quarantine policy following the signing of the Uruguay Round's Agreement on Sanitary and Phytosanitary Measures in April 1994. The second, which will affect non-farm as well as farm policies, is the Commonwealth Government's economy-wide Regulatory Review process (PC 1998). The third is a review of food regulations in particular. All three reform processes are discussed in some detail in Chapter 3 below.

The rest of the report is structured as follows. Chapter 2 provides an overview of agriculture in Australia: its production features, how the sector differs from agriculture in other countries, and the government's policy objectives for the sector. Chapter 3 discusses governmental approaches to the various environmental and health-related issues confronting Australian agriculture at present. Chapter 4 provides a comprehensive inventory of environmental and health-related regulations, both at home and abroad, that are currently influencing Australian agriculture. Then, in Chapter 5, we attempt to draw out key economic implications of complying with both current and prospective environmental and health-related policies, particularly as they impact on the international competitiveness of Australian agriculture. The final chapter brings together the main conclusions from the study.

Chapter 2 AGRICULTURE IN AUSTRALIA

2.1 Features of production

Australia is the driest inhabited continent. Most of its soils are shallow, infertile and deficient in phosphorous and/or nitrogen. Some 60 per cent of the country's land area is used for agriculture, mostly lightly stocked grazing of animals for meat and wool. Arable land totals 6 per cent of the land surface, compared to 20 per cent in the United States, 26 per cent in the United Kingdom and 30 per cent in Spain. From 10 to 12 per cent of the total agricultural land area has improved pastures or crops.

Four commodities dominate the value of primary agricultural production: beef, wheat, milk and wool. These typically account for more than 50 per cent of agricultural GDP and more than one-half of rural export income. Fruit and vegetables are the next most important commodity group in terms of production value (Table 2.1). About 60 per cent of holdings produce beef, sheep and/or grain as the main activities (Table 2.2).

Australian agriculture tends to be extensive, characterised by grazing of domesticated animals on outdoor pasture. Stocking rates are low compared with other countries because of the low quality and quantity of grass feed as a result of low rainfall and poor soils. Most sheep and cattle are grazed in the higher-rainfall mixed-farming zones, with a much smaller proportion in the arid and semi-arid rangelands that cover the majority of the continent. Arid and rugged lands held under grazing licences account for 88 per cent of the agricultural land area, where livestock mainly graze on native grasses. Only 4 per cent of Australia's agricultural land is sown to improved pastures and less than 5 per cent of agricultural land is cropped (Table 2.3).

During the past four decades, Australia's total agricultural land use has changed considerably: the area has increased by more than one-third in aggregate; the average farm size has doubled in area; and the area under irrigation has expanded sixfold. As well, the volume of farm chemicals used per year has trebled. Between 1950 and 1998, the volume of farm production rose by 250 per cent and the real gross value of farm production rose by 25 per cent, despite falling real prices for farm products (ABARE, 1997b; 1998; Chisholm, 1997). However, those declining product prices, together with rising prices of inputs and wages, resulted in a drop in the net value of farm production of more than 50 per cent in real terms during the same period (Garnaut and Lim-Applegate, 1998).

Seasonal conditions and international market price volatility have always impacted greatly the variability in farm income at the producer, industry and regional levels (ABARE 1995; Wright *et al*, 1994; Garnaut and Lim-Applegate, 1998). Over time, producers have reduced the effects of those fluctuations by adopting flexible management systems, developing new production practices, and establishing marketing methods designed to counter adverse seasonal conditions and market instability. Even more adaptation would have taken place had the national government not provided five-year income averaging for tax purposes and occasional assistance

following droughts or floods.

The number of persons employed in the agricultural sector declined by 20 per cent between 1955 and 1993. Since then, however, agriculture employment has increased by more than 6 per cent, with the numbers rising to 418,000 in 1997-98. Today, agriculture accounts for around 1 in 20 Australian jobs, compared with 1 in 10 in the 1960s.

Since the 1950s, the total number of farms dropped from 200,000 to 120,000 (ABS, 1996b). On average, cropping businesses are larger than other businesses in terms of carrying capacity (sheep equivalents) and have tended to increase in size over time. Over the past five decades, the number of dairy businesses fell by 68,600, to 13,753 during the past five decades (Table 2.4). During the same period, milk production per cow increased from 1,746 to 4,678 litres per cow (Table 2.5). Sheep farms have more than halved in number since 1989-90, partly in response to falling wool prices. The number of pig producers has been in decline, too, from 19,279 in 1980 to 3,522 in 1996.

Beef and sheep producers have a higher proportion of small-sized businesses because of the relatively low technical, managerial and capital inputs required (Garnaut and Lim-Applegate, 1998). That also was true for dairying, wine and numerous other activities in the past, but recent technological changes have encouraged expansions of optimal enterprise size for those industries.

Livestock production represents around 43 per cent of the gross value of all farm production (Table 2.1). The meat industry includes beef and sheep meat producers, processors, lot feeders and live exporters, among which there is a significant diversity of size and structure. Meat production (mostly beef, veal, mutton, lamb and pigmeat) has not shown much of a trend during the 1990s, with the exception of beef. Overall, meat production has averaged around 3.2 million tonnes per year between 1992 and 1998 (Table 2.6). Since 1990, total livestock slaughtering has increased by about 9 per cent, with cattle increasing by 8 per cent, poultry by 26 per cent and pigs by 3 per cent. Meanwhile, sheep and lamb production fell over this period by 6 per cent (Table 2.7).

Within the livestock sub-sector, the beef industry contributes from 12 to 20 per cent of the gross value of agricultural production and around one-eighth of agricultural export income. Australia exports around 60 per cent of its production, with Japan and the United States purchasing two-thirds of those exports. Most specialised beef operations are located in three states: New South Wales (31 per cent), Queensland (28 per cent) and Victoria (26 per cent) (Martin *et al*, 1998).

Pig production accounts for around 2.5 per cent of the gross value of agricultural commodities. The Australian pig industry has restructured significantly over the past two decades as smaller producers have left the industry, while larger producers have increased herd sizes. In 1996, producers with more than 400 sows accounted for less than 3 per cent of pig producers and for 50 per cent of the total number of pigs. The ongoing trend is for vertical integration by corporate producers with investments in processing and wholesale/retail activities.

Dairy farming is one of Australia's largest rural industries. The majority of Australia's milk is produced in Victoria (63 per cent), while New South Wales is the second largest producer (13 per cent). Dairy operations are located in all Australian states, across a wide range of climates, from cool temperate to semi-tropical (Table 2.4, 2.5, and 2.9). Production is based on grazing on sown pastures, with no shedding of animals and relatively little intensive feeding, compared with densely populated industrial countries (although relative milk and grain prices influence the use of feed grain and concentrates). National milk production in 1996-97 totaled just over 9,040 million litres from around 1.9 million cows, some 3.7 per cent higher than 1995-96 production (ADI, 1999) and up by 44 per cent from 1990 (Table 2.10).

Dairy farms are typically family-owned and -operated with most of the labour supplied by the owning husband and wife (ADI, 1999). Farms tend to be specialist dairy farms, though some maintain small sideline beef activities. The average herd size is almost 150 cows; the dominant breed is Friesian Holstein but other important breeds are Jerseys and Australia's own breed, the Illawarra Shorthorn (ADI, 1999). Most breeding is by artificial insemination and herd recording is widely used. Genetic evaluation is conducted by the Australian Dairy Herd Improvement Scheme using one of the most sophisticated evaluation systems in the world. In fact, Australia is a leader in the development of dairy and beef genetic evaluation programs (ADI, 1999).

Some 80 per cent of milk production is used in the manufacture of dairy products; the remainder is used as fresh milk for drinking (Table 2.10). Drinking milk is controlled through state government marketing arrangements. There is a minimum farm gate price for drinking milk but, unlike many other dairy-producing countries, no minimum price arrangements exist for manufacturing milk.

Winter cereals (wheat, barley and oats) are the major broadacre crops, accounting for 17 to 20 per cent of total agricultural production (Table 2.8 and 2.11). More than 10 million ha of land are devoted to wheat-growing, representing one-half the total cropped area (Tables 2.7, 2.8 and 2.12). The wheat belt stretches in the form of an inland corridor from central Queensland, through New South Wales and Victoria, into South Australia. Western Australia also produces wheat in the south-west of the state.

Horticultural products account for about 15 per cent of Australia's total value of agricultural production (Table 2.13). The real value of fruit and vegetable production has increased more than 20 per cent since the early 1980s. Five products account for nearly 75 per cent of total production value: bananas, grapes (drying, table and wine), apples, oranges and stonefruit (Tables 2.13, 2.14 and 2.15). Since the early 1990s, fruit production value has increased by nearly 40 per cent and vegetable production value by 22 per cent (Table 2.14). Some crops are concentrated in specific areas: bananas in Queensland and northeast New South Wales; pear production in Victoria; citrus in New South Wales and South Australia; and wine grapes in South Australia.

Around 130,000 ha are planted to vegetables. Potatoes occupy about one-third of the area planted to vegetables, while tomatoes account for about 6 per cent of the vegetable area (Tables 2.16 and 2.17).

The majority of Australia's 35,000 commercial fruit and vegetable producers have

small-scale farms cultivating a range of crops (Carroll, 1996). More than half the horticultural farms are less than 10 ha in size and the number of farms producing fruits and vegetables has increased slightly during the past decade (ABS, 1996b). Fruit and vegetable industries employ approximately 80,000 people in fresh production and some 11,500 in processing. These jobs are the most labour intensive of Australia's agricultural industries (Carroll, 1996).

Wine production in Australia has boomed during the past decade with the rapid growth in global demand for premium red wine (Table 2.18). The acreage of wine grapes has doubled and, whereas the country was a net wine importer in the early 1980s, one-third of wine production is now exported at ever rising prices (Osmond and Anderson, 1998).

The river system contained in the Murray Darling Basin (MDB) dominates food production and irrigation in Australia. Roughly equal to the geographical area of France, the MDB covers one-seventh of Australia's landmass, crosses four states (Queensland, New South Wales, Victoria and South Australia) and drains a 1500-km by 1000-km region. Known as the nation's 'food bowl', the MDB produces a large proportion of most fruit and vegetables for both export and local consumption and is home to a concentration of dairy farms. It supports more than 50 per cent of the country's crop land and produces more than 40 per cent of the country's total agricultural output, valued at more than A\$10 billion per year (ABS, 1996b).

The Basin also contains 75 per cent of the country's irrigated area and produces 90 per cent of the value of irrigated food crops. Some 95 per cent of MDB water diverted for human use goes to agriculture and the flows of all but one of the rivers within the system have been modified to support the growth in agricultural industries. Today, the competing demands for agricultural, industrial and domestic water are exerting enormous pressures on MDB irrigators. Additional pressures are stemming from the fact that the MDB is rich in Aboriginal cultural heritage sites and includes some 140 conservation areas and numerous internationally-recognised wetlands.

At the national level, agriculture is Australia's largest sectoral water user, consuming 70 per cent of the country's stored water, including ground water. The 2.5 million ha of irrigated crops and pastures is less than half of 1 per cent of the total agricultural land and about 12 per cent of the total area of crops and pastures (Table 2.19). More than half the irrigated area is supplied via state/territory government irrigation schemes (Aeuckens, 1998).

The value of irrigated production fluctuates between 25 and 30 per cent of Australia's gross value of agricultural output (Cape, 1997). Irrigation traditionally has been dominated by use on pastures. Today, however, irrigation use is shifting to higher-value crops such as cotton, sugar cane, vegetables and fruit (including wine grapes). Irrigation supports production of all rice, most vegetables, milk, fruit, cotton and significant amounts of soybeans and sugar, but its contribution to meat, cereal, pulse and oilseed production is relatively minor (DPIE, 1996).

While almost all fruits and vegetables are produced with some form of irrigation, water costs make up a very small proportion of production costs: for vegetables, water

accounts for only 1 per cent of average cash costs; for fruits, it represents about 4 per cent (IC, 1993).

One of the most controversial issues related to irrigation in Australia stems from the fact that it continues to be concentrated on low value crops. Many irrigated crops and pastures have low value in relation to their water requirements, although they may be major export earners (Meyer 1992). A common conclusion of agricultural water use studies is that historically the price of water has not been a critical factor in the choice of crop under irrigation (Smith, 1998).

Irrigated crops vary greatly in terms of the area irrigated, amount of water used and production values. In the southern Murray Darling Basin, citrus, grapes and other horticulture account for 16 per cent of total water use and more than 50 per cent of total gross margin. Rice accounts for 25 per cent of total water use but only 8 per cent of total gross margin (Hall *et al*, 1994).

Soil nutrient deficiencies are common throughout the country and chemical fertilisers, particularly phosphate, are applied. Their use is limited where low rainfall limits yields and returns on fertiliser expenditure. Despite its low soil fertility, Australia uses much less fertiliser than comparable countries: 0.03 tonne of fertiliser per hectare of arable land and 0.13 tonnes of fertiliser per hectare fertilised (Table 2.20), which is one-quarter of the amount used in the United States and Spain and one-twelfth of that used in the United Kingdom (SEAC, 1996). Where high rates of fertiliser are applied on some irrigated crops, nutrient run-off may have potentially serious impacts on waterways and coastal zones (SEAC, 1996).

Agricultural chemical use in Australia is low by OECD standards; nonetheless, data indicate that producers use 2,500 types of farm chemicals and 2,000 animal health products containing some 500 active ingredients to control 5,000 significant pests (ABS, 1996b). They also treat some 15 million ha of land with herbicides, 3 million ha with insecticides, and close to 1 million ha with fungicides. Estimates of annual net productivity gains attributed to farm chemical use range from A\$2.5 billion to A\$5 billion (ABS, 1996b).

While the area planted to fruit and vegetables represents only around 1 per cent of the country's cropped area, it accounts for more than 15 per cent of fertiliser use, reflecting a much more intensive use than other products. Pesticide is also used more intensively on horticultural crops. It is generally sprayed directly onto crops and can contaminate non-target areas, entering the soil or washing into river systems and marine environments. Since a large proportion of fruit and vegetable production occurs near rivers or within 100km of the coast, the environmental damage potentially caused by pesticide spraying is serious, particularly given the country's high propensity for run-off. The scope of the problem varies with the number of applications, size of vapour droplets, weather conditions and the presence of buffer vegetation (ABS, 1996b).

2.2 Australian agriculture in global perspective

Because the bulk of Australia's food and other agricultural production is exported, farmers rely heavily on world markets for their returns and hence are directly affected by changes in world commodity prices. Just three commodities - wheat, wool and beef - account for 45 per cent of farm exports by value.

Exports of some Australian agricultural products are substantial as a proportion of world trade: the country accounts for approximately 50 per cent of world trade in wool; 20 per cent of beef and veal; 12 per cent of sugar; 10 per cent of wheat; and 10 per cent of dairy products. Australian exports comprise around 3 per cent of global exports of agricultural products.

In recent years, a greater proportion of wheat and coarse grain has been consumed domestically due to the growth in demand for feed grains by intensive pig and poultry industries and to the greater use of grain for beef cattle fattening. Exports as a proportion of total production are around 75 per cent for wheat and sugar, 60 per cent for beef and rice, 45 per cent for milk, 35 per cent for coarse grains and 20 per cent for sheep meat.

An important trade development has been the shift in Australia's export markets away from traditional trading partners in Europe and North America towards Asian countries. Asia as a whole now takes about 60 per cent of Australia's merchandise exports compared with 46 per cent a decade ago. In 1996-97, the major destinations for Australia's agricultural exports were: Japan (17 per cent); Southeast Asia (17 per cent); China (7 per cent); Republic of Korea (5 per cent); other Asia countries (11 per cent); Middle East (12 per cent); Europe (11 per cent); and the United States (5 per cent). The rest of the world takes just 15 per cent.

In 1997-98, Australia's total food exports generated more than A\$18 billion. Sixty per cent of these exports were purchased by Asian countries (DFAT, 1999) and total food exports to Asia expanded by 2.2 per cent in 1997-98. Australia's food exports to Japan alone increased by around 9 per cent, to \$5 billion, in the same period.

Most foods imported by Australia are destined for household consumption. More than half are comprised of vegetables, fruits, coffee, tea, cocoa, and fish and seafood products. About 25 per cent of food imports are used in food processing (Tanner *et al*, 1998). Over the past two decades, the country has maintained a fairly constant ratio of 4 to 1 food exports to imports.

Australia is a small producer of milk at the global level but a significant exporter. In 1995-96, Australia produced 2 per cent of world milk yet accounted for 10 per cent of world milk export sales. These exports, valued at around A\$1.8 billion, accounted for about 45 per cent by volume of the country's total milk product. Australia is the third largest exporter of milk products, behind the European Union and New Zealand (IC, 1997).

2.3 Policy objectives for the sector

The Commonwealth Government's Advancing Australia Initiative, launched in September 1997, aims to increase the profitability, competitiveness and sustainability of the farm sector. The initiative provides A\$525 million over four years for programmes to help farmers and communities profit from change, to encourage ongoing farm adjustment, to promote further community development and to give farm families in need greater access to welfare support.

One of the aims of Australia's current agriculture policy strategy is to enhance the country's reputation as a 'clean' place to grow and process food. The country's 'clean and green' reputation is seen as a way to gain an edge in markets that are increasingly concerned about food quality and human health. For instance, quality assurance systems on farms and along the supply chain are encouraged, as is the use of generic marketing to support brand promotion and to boost sales prospects (DPIE, 1998).

The long term objectives and goals for the agricultural sector are outlined in the federal government's Action Plan for Australian Agriculture - Actions, Roles and Responsibilities 1998-2008 (DPIE, 1998). The priority actions for the 1998-2001 period include:

- **sustainable agriculture:** the expansion of whole farm planning and catchment management at local and regional levels, with support from the A\$1.25 billion Natural Heritage Trust;
- **microeconomic reform:** key areas targeted for reform are the waterfront, land transport, energy supply and the manufacturing industries, including food processing (by capturing productivity improvements available through labour market reform);
- **trade liberalisation:** the objective is to eliminate all production and export subsidies in the next WTO round; federal government agencies such as Austrade, the Australian Quarantine and Inspection Service (AQIS) and the Prime Minister's Supermarket to Asia Council provide high quality assistance and advice towards this end;
- **taxation reform:** the burden imposed on export industries by the cascading impact of indirect taxes (such as wholesale sales tax and fuel excise) along the supply-chain will be relieved as part of a proposed overhaul of Australia's entire tax system; currently, such taxes must be built into input costs and end prices, making Australian goods less competitive in world markets;
- **telecommunications:** the federal government will work with farmers and service providers to ensure rural, remote and regional areas have access to competitively priced, high standard telecommunications services; the A\$250 million Rural Telecommunications Infrastructure Fund is a key vehicle for achieving reform in this area;
- **research and development:** priority areas are sustainable land and water use, biotechnology, pest and disease control/eradication, opportunities for value adding

and market development; the federal government matches industry levies up to 0.5 per cent of the gross value of production among participating industries.

A principal policy strategy cutting across all these programmes is the promotion of ecologically sustainable development. This implies structural changes as policy-induced cost changes alter opportunities for competing land and resource uses. Australia has developed a comprehensive framework for water policy reforms to address widespread natural resource degradation (see Appendix A). The key components are: water pricing reform; clarification of property rights; allocation of water to the environment; adoption of water trading arrangements; institutional reforms; and public consultation and participation. Now under way in all states and territories, the water policy reforms are expected to be fully implemented by 2001.

The agriculture sector receives assistance through a wide range programmes and policies (see Appendix B). Statutory marketing and regulatory arrangements comprise the major component, while budgetary assistance (research and development, adjustment assistance and tax concessions) and tariffs on outputs are less important. The effective rate of assistance for agriculture was 10 per cent in 1996-97 (PC, 1998). Dairy remains one of the most highly assisted activities, receiving nearly 6 times the average level; when these activities are excluded from calculations, the 1996-97 effective rate of assistance for agriculture falls to 6 per cent (PC, 1998).

The Commonwealth Government has committed to reducing assistance to the manufacturing milk sector over the next few years. Reforms have already been carried out in the market milk sector, but in most states/territories these reforms have occurred only downstream from the farm gate (PC, 1998). As part of the Competition Principles Agreement, states/territories have either concluded or committed to review marketing arrangements at the farm gate level. Overall, the assistance provided to the dairy industry dominates the estimates for the agricultural sector.

Reforms for many other commodities in Australia began in 1996-97. Tariff levels fell from 8 to 5 per cent for wine grapes and dried vine fruits, and sugar industry assistance was reduced through the removal of the sugar import tariff and reforms to marketing arrangements.

Pressures to change Australia's environmental, health and safety regulations and policies may be traced to three sources: domestic concerns, international developments and national initiatives. Domestic concerns include consumer expectations, health considerations, occupational health and safety issues, environmental considerations, trade-related issues, residue in primary produce, sustainable land and water use, wetland and coastal protection, genetically modified organisms and the overall regulatory environment. International developments include UNCED follow-up obligations, post-Uruguay Round and WTO obligations, environmental treaties on climate change, biodiversity and desertification and adoption of internationally-accepted codes and practices such as CODEX, HACCP and ISO. National initiatives include the Business Plan for Australian Agriculture, the National Landcare Program, Natural Heritage Trust, the COAG Water Reforms, and the Supermarket to Asia programme, to name a few.

Chapter 3 ENVIRONMENTAL ISSUES AFFECTING THE AGRICULTURAL SECTOR

3.1 Agriculture and the Environment in Australia

Australia's 18 million inhabitants are heavily concentrated in urban centres along the south-eastern and south-western coastlines, with most people living and working in cities. More than 80 per cent of the entire population occupy just 1 per cent of Australia's land surface. The country's eight state and territory capital cities account for two-thirds of the population and more than two-thirds of employment (SEAC, 1996).

Australia's geographical location and relative isolation provide it with several environmentally-related food producing and trade advantages. For example, the southern hemisphere, which consists mainly of water, is markedly less affected by human activities than the northern hemisphere, and the fact that the country is an island continent means that transborder pollution is not as significant an issue as in other parts of the world. Australia faces less population pressure than most other countries and has a rural sector generally free of polluting industries.

The environment is a mainstream political concern in Australia and community participation is recognised formally in agricultural programmes, initiatives and legislation (Campbell, 1994; 1996; Alexandra *et al*, 1996; Thomas, 1996; EDO, 1996; Sarkissian *et al*, 1997; Archer *et al*, 1998;). Government agencies and large and small businesses incorporate environmental concerns into their overall management structures. Firms, local communities and environmental organisations are increasingly cooperating in environmental management initiatives (Cato, 1995). For example, the Australian Conservation Foundation and the National Farmers' Federation jointly address land degradation issues (Campbell, 1994). Many environmentally relevant decisions are made by industry, special-interest groups and individuals, either acting alone or collectively (SEAC, 1996).

The agriculture-related environmental concerns currently receiving programme and/or policy attention are: biodiversity loss; dryland salinity; introduced pests and plants; soil acidification; soil structure decline; soil erosion; and water quality and scarcity issues.

Most reduction in the biological diversity of the continent is due to destruction or disturbance of natural habitats and the introduction of non-native species of plants and animals for use in agriculture. Land degradation and water mismanagement are considered the most serious problems affecting the country's terrestrial environment. An overview of agricultural impacts on the environment and health and the responses to those pressures is presented in Table 3.1.

Environmental issues are not the province of any one sphere of government. Although

the Commonwealth Government has powers to enact laws affecting the environment and sustainable development, the Australian Constitution does not specifically deal with environmental powers.

Most environmental and food safety legislative responsibilities rest with state/territory governments and most decisions that affect the environment occur at the local level. When international treaty obligations are at stake, however, the Commonwealth takes precedence over state/territory and local powers. The state and territory governments are responsible for administering some 150 separate pieces of environmental legislation, which are broad ranging and cover areas such as pollution of land, water and air, waste disposal, environmental planning and protection, protection of endangered species, forestry, wildlife, water and catchment management, and natural resource usage (OECD, 1998).

The Commonwealth Government guides, manages and coordinates state/territory and local governments through councils, programmes, inquiries, and mutually-developed policy strategies. Several of these national processes are having a significant influence on food safety and agriculturally-related environmental management.

The *Council of Australian Governments* (COAG), which includes the Prime Minister and the leaders of the state, territory and local governments, is the peak body overseeing closer cooperation on issues concerning clarification of roles and responsibilities in environmental regulations. Among other tasks, COAG has been responsible for overseeing the finalisation of the InterGovernmental Agreement on the Environment and the National Strategy for Ecologically Sustainable Development.

The *InterGovernmental Agreement on the Environment* (IGAE) was established in 1992 to avoid damaging disputes about environmental matters between the different levels of government and to establish conditions under which the various governments will interact. The Agreement provides a mechanism to: define the roles of each level of government; reduce intergovernmental environmental disputes; provide greater certainty in government and business decision making; and provide better environmental protection.

The IGAE sets out four main principles to inform government policy making and programme implementation: (1) the precautionary principle, which stipulates that where the threat of environmental damage is serious or irreversible, lack of scientific proof of damage is not a defence against action to prevent the degradation; (2) inter-generational equity, which stipulates that the health of the environment should not be eroded for the benefit of the present generation at the expense of the future generations; (3) conservation of biological diversity and ecological integrity; and (4) improved valuation, pricing and incentive mechanisms such as including environmental factors in valuation of assets and services, introducing polluter-pays principles, and introducing market mechanisms to maximise benefits (COAG 1992).

The Agreement also outlines three ways in which governments should incorporate environmental issues into their decision making processes: first, ensure that environmental issues are considered when formulating policies; second, ensure that the identified environmental issues are properly examined; and third, ensure that

measures adopted are cost effective and not disproportionate to the significance of the environmental problem.

Ministerial councils and their advisory groups involve Commonwealth, state and territory ministers responsible for various common matters. There are numerous councils relevant to the environment, including the Australia New Zealand Environment and Conservation Council (ANZECC), which is the primary ministerial coordination committee related to the environment and consists of Commonwealth, state, territory and New Zealand ministers responsible for the environment and conservation. The Commonwealth provides a secretariat through the Department of the Environment and Heritage. The council provides a forum for the exchange of information and experience and develops coordinated policies on national and international environment and conservation issues (ANZECC, 1997).

National inquiries into agriculture-related environmental issues may be initiated at the political level by Parliament, governments, individual ministers or ministerial councils.

National strategies are included under the National Strategies for Ecologically Sustainable Development, Greenhouse Response and Biodiversity. All levels of government, in theory, use national strategies to guide their decision making. The Murray Darling Basin Commission is an example of a strategic management arrangement for a drainage basin and ecosystem. Thirty-three different government departments and 268 local governments have a stake in and some responsibility for the river system (SEAC, 1996).

Commonwealth legislation is the only means by which specific aspects of environmental management can be consistently governed throughout Australia.

Complementary legislation is legislation mirrored in each jurisdiction to ensure a national approach. Federal funding and/or other services are made available to those states/territories and communities enacting complementary legislation or adopting the guidelines, principles and initiatives established through these processes. For example, states/territories adopting COAG water reform policies receive Commonwealth tranche payments to assist in their water policy reform process only if they adhere to a specified implementation timetable. This provides a powerful incentive since state/territory and local governments have limited revenue raising powers.

The National Strategy for Ecologically Sustainable Development (NSES) provides the guiding framework for most environmental and natural resource management efforts (see Appendix C). The Strategy defines 'ecologically sustainable development' as a pattern of development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends. It aims to enhance individual and community well-being and welfare by following a path of economic development that: safeguards the welfare of future generations; provides for equity within and between generations; protects biodiversity; maintains essential ecological processes and life support systems.

The NSES calls for pricing and economic instruments as means for achieving better

management of Australia's natural resources and to ensure that adequate attention is given to social and environmental costs when assessing the use of pricing, taxation and other economic instruments (NSES, 1992). The overall policy approach is to promote research and adoption of sustainable development and best practice techniques. Local and state/territory governments are, however, increasingly experimenting with economic policies such as property rights (establishing tradeable water entitlements and tradeable salt discharge rights), as well as imposing full cost resource use pricing to cover environmental damage.

Ecologically sustainable development is also promoted by the Commonwealth via the Natural Heritage Trust (NHT), which funds programmes important to agricultural producers. NHT represents a practical example of how resource management in Australia has moved away from technical forms of centralised government planning to a more community-based, participatory resource management regime that recognises the plurality of stakeholder interests (Crean *et al*, 1999).

NHT-funded programmes relevant to agriculture include the following.

The National Landcare Program involves farmers working together with the community and governments to address environmental problems too large for individuals to handle. More than one-third of Australia's farm population are members of Landcare groups. The NHT contributed A\$92.2 million to Landcare in 1998-99. Recent assessments conclude that the Program has been successful in using an integrated approach to natural resource management problems and in achieving genuine public ownership (Cullen, 1997).

The National Rivercare Program is a major investment in activities to improve the health of Australia's river systems outside the Murray Darling Basin. It targets on-ground works, research and development with practical application and community awareness. Total funding for this programme is A\$96.7 million. Some activities already funded include action by community groups to improve water quality in local rivers, stormwater management, water quality and nutrient management and activities focusing on environmental flows.

The Murray Darling 2001 Initiative provides A\$163 million over five years to improve water quality, restore riparian land systems, wetlands and floodplains, integrate catchment management and flow management strategies, and encourage economically and environmentally sustainable development. It is rehabilitating the Basin's natural systems while protecting its productive assets.

The National Land and Water Resources Audit aims to identify the true extent of rising salinity, erosion and other degradation of land and water that threatens national prosperity. The A\$32 million audit provides an independent, objective assessment of the degradation arising from approximately 20 key types of land and water problems and includes an economic analysis of each problem. It is the most comprehensive audit of its kind ever undertaken in Australia.

The National Weeds Strategy Provides a framework for the identification and management of weeds of national significance. Weeds cost Australia about A\$3.3

billion annually, excluding associated health and environmental costs (Combella, 1989). Annual crop losses due to weeds are estimated at 10–15 per cent of crop value. Funding of A\$24 million over five years has been provided to implement the Strategy.

The most common policy response to land and water degradation problems is the promotion of information, education, community participation and dissemination of research. The National Landcare Program (originally called the National Soil Conservation Program) is one such response, as described above. The Landcare philosophy advocates a 'whole systems' approach to natural resource management, based on the idea that land, water and vegetation are elements of integrated systems, rather than separate entities. It promotes partnerships and integrated action among governments, industries and communities in order to bring about lasting change in land management practices. The Program's activities are focussed on raising awareness of sustainable farming practices, ensuring the transfer of information about such practices and encouraging their widespread adoption. It also establishes institutional arrangements to develop and implement policies and programmes that support sustainability.

Australia's major research on sustainable agricultural practices is organised by industry-specific research and development corporations (RDCs), which are self-supporting government statutory organisations. RDCs are funded on an equal cost sharing by industry and the federal government on a dollar-for-dollar basis up to a maximum level based on 0.5 per cent of the industry's gross value of production. Each year, RDCs invest millions of dollars in developing integrated pest management programmes, disseminating training packages for sustainable practices, and promoting reduced chemical use. Best practice research is conducted for almost every crop.

While research and extension on sustainable practices dominate Australia's policy response, full cost resource pricing and overcoming market failure through the creation of property rights are also being encouraged. Tradeable water entitlements are being used to delink water rights from land rights so they may be traded as a separate commodity. Transfers may be restricted to a single year, allowed for several years or be made permanent. In addition, water may be differentiated in terms of location, quality, environmental constraints and security of supply (James 1997). All four states in the Murray Darling Basin have introduced legislation for transferable water use rights.

In addition to the greater involvement of communities in policy making and resource management, a major policy trend during the 1990s has been the move away from an almost total reliance on the use of regulations to manage food safety and agriculture-related environmental objectives.

Over the past several years, the regulatory approach has been complemented by or, in some cases even replaced with, economic incentives, market instruments and property rights systems (Corbyn, 1996; Jones, 1997; Gunasekera, 1997). Market mechanisms are currently being introduced to meet strategic objectives, including implementing the polluter pays, beneficiary pays and user pays principles. This more market-oriented approach also involves assessing total economic values for the costs and benefits attributed to environmental policies and government regulations, as well as

the positive and negative externalities generated by agricultural production activities.

In April 1995 COAG laid the foundation for more emphasis on market mechanisms by establishing principles and guidelines for national standard setting and regulatory reforms. These principles and guidelines, which were amended in November 1997, require a review of existing regulations to determine whether effective alternatives to explicit government regulation exist. The implication is that state/territory and local governments must ensure their regulations and quasi-regulations governing the agricultural and food industry meet economic efficiency and cost minimisation objectives by undergoing cost-benefit analyses in the form of regulatory impact statements (RISs).

The aim of the COAG principles and guidelines is to reduce the use of government regulations and to encourage 'minimum effective regulation'. Regulations are supported only where a well-defined social or economic problem exists, where other solutions such as market mechanisms or self-regulation are inappropriate, and where expected benefits exceed likely costs. The guidelines do not prescribe what type of regulation should be used in particular circumstances but set out principles and analytical requirements to be followed in the development of regulation.

The review process involves asking a series of questions for each current and planned regulation:

What is the problem that needs to be addressed?

Why should governments intervene?

What are the alternative approaches to dealing with the problem (both regulatory and non-regulatory)?

What are the costs and benefits (to all affected parties) of these options?

What is the least interventionist/least regulatory approach possible to address the problem effectively?

Which approach will have the greatest net benefit?

How should the approach be implemented to best achieve the objectives?

When should it be monitored and reviewed?

Table 3.1

Impacts of Agriculture on Environment and Health in Australia

Pressures	Impact	Responses	Effectiveness of responses
Agricultural land use	Loss or fragmentation of most of native vegetation, exposing areas to many of the soil issues listed below and contributing to greenhouse gases	Legislation and controls on tree clearing; monitoring; One Billion Trees program; Landcare	Effective in many areas but not implemented in others; the efficacy of the recovery programs is not tested
Pastoralism	Changes in the density and species composition of vegetation; widespread establishment of weeds and feral animals.	Research and extension; legislation; leasehold conditions (animal stocking rates, soil status); National Strategy for Rangeland Management; inventory and monitoring; Landcare; structural adjustment programs; multiple use policies.	Only limited success through lease administration; localised successes in weed and feral animal control but little progress in many areas; variable trends in vegetation on a regional basis.
Salinisation due to tree clearing for agricultural and grazing land; over irrigating.	Rising groundwater levels; in some areas salt is Clearing of agricultural and grazing land; over irrigating	Landcare and catchment planning, Murray-Darling Basin Commission; salt quotas and Saltwatch; monitoring; expenditure on salinity management	Only minor and localised successes through planting and changed management. Regional-scale responses are inadequate
Soil structure decline, especially tillage systems that lead to loss of soil organic matter	Reduced permeability and increased run off and erosion; poor root vigour leading to reduced productivity	Soil conservation research and extension especially into improved farming systems; Landcare	Increased awareness of the issue, but problem is still widespread
Soil erosion: agricultural land use leading to the loss of soil cover	Loss of soil depth; loss of nutrients; off-site effects such as saltation	Land management research and extension; expenditure on structural works; land care	Uptake of advice still inadequate in most areas
Soil nutrient decline: agricultural land use, excessive cultivation	Decline in soil organic matter and major nutrients (N and P)	Research and extension on cropping systems, rotations and fertiliser use; promotion of N utilisation, fertiliser applications rates.	Varies from successful framing systems, incorporation legume rotations, to reliance on artificial fertilisers to little effective response
Soil nutrient loss due to	Wind and water erosion leading to	Improved stock management, fencing and water	Varies from property to property

pastoralism	redistribution and loss of nutrients	distribution	
Soil nutrient accumulation from intensive horticulture	Accumulation of nutrients with risk of water pollution	Guidelines and regulations for effluent discharge and drainage in some area, improved irrigation techniques; soil conservation; education, industry restructuring, water reforms	Locally effective but often problem transferred further downstream; guidelines often based on poor biological knowledge; too early to judge impacts
Soil acidification from fertiliser use and removal of plant products and natural processes	Increased soil acidity (low soil pH) and the release of toxic levels of aluminium and manganese in some soils; poor root growth. Some calcareous soils benefit from the higher acidity	Research and extension; liming and changed fertiliser practice.	Very poor uptake of appropriate measures
Soil acidification from agriculture	Impacts include cadmium contamination from phosphate fertilisers; increased herbicide use in minimum tillage systems; pesticide pollution in cattle and sheep dipping sites.	Reduction in cadmium levels in fertilisers and use of cultivars that restrict its uptake; regulations on pesticide and herbicide use; education	Cadmium levels are generally low by world standards; more work on identifying and rectifying other contamination problems.
Food quality due to hormones, pesticide and fertilisers	Food contamination	Legislation; new farming practices, integrated pest management; reduction in pesticide use.	Successful in most cases, but risks of accumulation of residues poorly known.
Groundwater	Overuse of water and contamination	Bore metering and licensing; regulations and tradeable water rights.	Limited effect
Farm dams	Proliferation has reduces streamflow particularly during dry conditions.	Local restrictions and moratoriums	Farm dams only recently considered in water resources planning.
Irrigation systems	Major user of stored water with salinisation, waterlogging, nutrients, pesticides.	Water pricing, reform and restructuring of industry, demand management; improved technology.	Still minimal application.
Catchment pollution	Most waterbodies in areas of agriculture affected by fine and coarse sediment, elevated nutrients loads, and increased volume and rate of run off in some areas.	Strategic revegetation and farm forestry; clearing bans; drainage; soil conservation and fertiliser management; tree planting to reduce salinity; streambank stabilisation, catchment management and Landcare.	Landcare working in some areas, Streambank stabilisation is costly and partially successful.

Source: Adapted from SEAC, 1996.

3.2 Environmental policies and regulations affecting agricultural production

3.2.1 Water

The quality of drinking water has never been a major concern in Australia (Maher, 1997). While occasional minor contaminations of rural catchments by agricultural chemicals do occur, evaluations and surveys of drinking water quality conclude that the health risks to humans and livestock presented by organic chemical contaminants from human activity are either not present or extremely rare (NHMRC/ARMCANZ, 1996). Similarly, naturally occurring nitrates are an infrequent issue. For example, no cases of the nitrate-induced methaemoglobinemia have been recorded in Australia (Maher, 1997).

Salinity, nutrients, toxicants, eutrophication and sediment are all important issues for Australia's inland and coastal waters (DWR, 1992; MDBC, 1994).

Toxic substances such as cadmium have been present in waters that may potentially be used for water supply. In practice, however, monitoring programmes have identified and addressed cadmium contamination. Around 1800 water monitoring programmes are in place to evaluate quantity, quality and environmental indicators throughout the country. These programmes are supplemented by community initiatives such as Waterwatch, which began in 1993 and now involves more than 50,000 rural people monitoring nearly 5000 sites (OECD, 1998).

Ecosystems and amenity issues are a major concern. In the Murray Darling Basin, extensive use of superphosphate fertiliser has been singled out as the primary source of phosphorous, which led to the world's largest toxic blue-green algal bloom in the summer of 1991-92. The algae expanded over a 1000-km stretch of the Darling River, resulting in the closure of water supplies and major disruptions to local communities. Local, state and national governments responded by establishing the Murray Darling Initiative. This environmental crisis is credited as the single most important impetus in generating cooperative action and the development of best practice management activities to address water issues in Australia (ABS, 1996b).

Naturally occurring concentrations of many common elements range widely across Australia. For example, levels of suspended solids, turbidity and nutrients exhibit significant regional differences in concentration between coastal and inland streams (Listen and Maher, 1997). The basis of water quality assessment is that aquatic ecosystems are adapted to site-specific water quality and that any change from such conditions impacts on the ecosystem (ANZECC, 1992).

The four primary agricultural activities causing water-related environmental problems in Australia are (Cullen and Bowmer, 1995): (1) allowing runoff from fields to carry sediments, nutrients, organic matter and agricultural chemicals; (2) extracting too much water for irrigation, resulting in severe impacts on aquatic ecosystems, water quality and groundwater supplies; (3) inverting the natural pattern of river flows in southern Australia (high demands and high irrigation flows in summer and low

demands and low flows in winter); and (4) clearing and using land and water in ways that result in rising water tables and salinity.

One major programme drives water policies: the 1994 COAG water reform agreement (see Appendix A), which incorporates the 1992 National Water Quality Management Strategy (NWQMS). Since the states and territories have prime constitutional responsibility for natural resource management, COAG represents the nation's attempt to integrate and coordinate water policies and avoid fragmented efforts, policies and activities. The Commonwealth, New South Wales, Victoria, South Australia and Queensland governments established an inter-governmental agreement to provide for a special ministerial council to organise the Murray Darling Basin. Figure 3.1 below provides an overview of the linkages between responsible agencies.

Figure 3.1. National water policy coordination



Through COAG the state/territory governments agreed that: water should be priced to reflect social cost and benefits; subsidies and cross subsidies should be removed; tradeable property rights would be established; and market mechanisms would be used to encourage more efficient management and use. COAG aims to sustain and restore ecological processes and biodiversity of water-dependent ecosystems.

In addition to water pricing, entitlements and trading arrangements, COAG set out recommendations covering institutional reforms, environmental considerations, water-related research, taxation issues and consultation and public education. Community participation in the development and implementation of COAG objectives is encouraged either indirectly through Integrated Catchment Management (ICM), which is partially funded by the Commonwealth, or directly through state/territory legislation requiring community consultation before catchment plans are approved. The main principles include the following.

- **Pricing and asset provision and management:**
 - pricing based on the principles of full-cost recovery and transparency;
 - future investment in new schemes, or extensions to existing schemes, to be undertaken only after appraisal indicates it is economically viable and ecologically sustainable.
- **Water allocations and trading:**
 - comprehensive systems of water allocations or entitlements, backed by separation of water property rights from land title and clear specification of entitlements in terms of ownership, volume, reliability, transferability and, if appropriate, quality;
 - formal determination of water allocations or entitlements, including allocations for the environment as a legitimate user of water;
 - trading, including cross-border sales, of water allocations or entitlements within the social, physical and ecological constraints of catchments.
- **Institutional arrangements:**
 - the separation of resource management, standard setting and regulatory roles of government from the roles of providing water services;
 - a greater degree of responsibility for local management of water use.
- **Water and the wider natural resource base:**
 - administration and decision-making to provide for an integrated catchment management approach to water resource management;
 - public education about water use and consultation in implementing the water reforms;
 - appropriate water-related research and use of efficient technologies.

Full implementation of the COAG water principles is expected by the end of 2001. The National Competition Council is responsible for monitoring compliance. An ARMCANZ Task Force representing all governments reports annually to COAG on implementation in all jurisdictions and investigates ways to clarify issues and ensure consistency across jurisdictions (Aeuckens, 1998).

The COAG water principles have spawned new water legislation in most states and territories. For example, South Australia's Water Resources Act 1997 provides a

comprehensive system of transferable water property rights, incorporates principles of ecologically sustainable development, provides holistic water resources management within the context of integrated catchment management, establishes water for the environment, and devolves greater responsibility for water resources to local communities through the establishment of catchment management boards.

The New South Wales government established a framework of water reforms aimed at achieving a better balance in the sharing of water between the environment and water users to ensure long-term sustainability consistent with the COAG requirements. The Water Legislation Amendment Act 1997 allows key aspects of the COAG reforms to be implemented, including: ecologically sustainable development principles applied to all decisions made under water legislation; new opportunities for temporary trading on regulated streams; and new powers for managing groundwater. Likewise, Victoria passed the Water Resources Act 1997 to amend the Water Act 1989 and to provide for similar COAG-induced reforms.

Four national level programmes assist COAG's water agenda and influence how agricultural activities use water resources: (1) the Wetlands Policy; (2) the National Land and Water Resources Audit; (3) the Australian National Water Quality Management Strategy; and (4) the Murray Darling Basin Ministerial Council. The Wetlands Policy focuses on wetlands protection and management to meet Australia's obligations under the Ramsar Convention on Wetlands. It thus has direct implications for agricultural water users close to identified sites and indirect implications for upstream and up-catchment water users. The purpose of the National Land and Water Resources Audit is to undertake an economic evaluation of environmental degradation. The information is then used to adapt water policies and programmes to changing ecological and environmental circumstances.

The Commonwealth and all state/territory governments participate in the National Water Quality Management Strategy (NWQMS). This Strategy aims to achieve sustainable use of the nation's water resources by protecting and enhancing their quality while maintaining economic and social development. It applies five environmental values to fresh, marine and estuarine waters: ecosystem protection; recreation and aesthetics; raw water for drinking water supply; agricultural water; and industrial water.

The NWQMS 1992 water quality guidelines (ANZECC, 1992), which are currently under review, characterise the elements of its management approach:

- identifying the environmental values of particular waterbodies to be protected;
- establishing the objectives that will achieve the required level of protection in terms of key indicators of quality (physicochemical and biological), using the collated scientific information relating to each indicator and each environmental value;
- establishing water quality management strategies (eg policies covering water, effluent, non-point source pollution and catchment management) that provide instruments for achieving the objectives;

- developing a monitoring and surveillance programme to ensure that the water quality (or environmental) objectives are maintained; and
- initiating a research programme to refine scientific information relating to each particular aquatic system.

The NWQMS suggests the following administrative process for implementing the water quality guidelines:

- each state/territory uses its own water quality planning and environmental policy tools to set water quality objectives and goals consistent with the national guidelines;
- regional communities are encouraged to participate in the identification of local environmental values to be protected and the associated water quality guidelines to achieve that protection; and
- local management strategies are developed and implemented by relevant stakeholders.

To achieve the NWQMS objectives, local and state/territory governments focus attention on diffuse sources of pollution in the rural environment. This includes improving the quality of run-off of agricultural land through improved natural resource management, best management practices and codes of conduct. Attention is given to point sources of pollution in the rural sector, such as dairy shed effluent, dairy processing waste, winery waste and other water-intensive industries. The NWQMS envisages that regulatory, market-based and education approaches should be used in developing water quality management plans (ANZECC, 1998).

Water bodies are protected from all agricultural activities including as intensive livestock, dairy and agricultural processing activities through specific legislation, codes of conduct and best practice guidelines.

Australian codes of practice are generally sector-based, providing guidance to specific industries on a range of environmental issues such as resource usage, emissions, waste generation and disposal, animal welfare, occupational or health hazards and regulatory standards. Codes of practice improve industry performance by providing: relevant information and suggesting management practices and production processes that individual producers can adopt; advice about how to implement environmental improvements; and a means by which regulatory bodies can work with smaller producers, firms and industries. Best practice guidelines are used most often as a benchmark for measuring industry progress (EPA, 1999).

The Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) produces a series of model codes of practice and guidelines. The Council consists of Australian federal, state/territory and New Zealand Ministers responsible for agriculture, soil and water. See Appendix D for examples of current guidelines and model codes of practice published in the SCARM Report Series.

To address problems associated with nutrient loads and eutrophication, increasing water salinity, declining wetlands and declining river health, the Murray Darling Basin Ministerial Council imposed a cap on water diversions in 1997. This involves the complex task of allocating water for environmental needs as well as for agricultural producers and other users. The cap is set according to the volume of water necessary to flow to keep the entire river healthy.

The cap on water diversions represents the most significant water resources initiative since the establishment of the MDB Ministerial Council in 1985, and is widely recognised as a landmark decision in Australia's natural resource management (MDBC, 1998). The Council aims to balance economic and social benefits and the environmental uses of water in the rivers. The cap is defined as 'The volume of water that would have been diverted under 1993/94 levels of development. In unregulated rivers this is expressed as an end-of-valley flow regime. The states agreed that:

- for New South Wales and Victoria, the cap is the volume of water that would have been diverted under 1993/94 levels of development subject to two small allowances for Pindari Dam (NSW) and Mokoan Storage (Victoria);
- for South Australia, diversions should be capped at the level that enables the development of its existing high security entitlements; this represents a small increase in diversion over 1993/94 levels of development and is equal to the long term climate adjusted average of 90 per cent of the amount on very high security licences that existed in 1993/94;
- for Queensland, the cap is to be determined after an independently audited Water Allocation Management Planning (WAMP) process is completed and is expected to be in terms of end-of-valley flows; diversions will vary in accordance with seasonal stream flow conditions and, as water use is mostly in unregulated streams, diversions will be greater in wet years than in dry.

Protection of water resources from pesticide and fertiliser residues is directly influenced by regulations controlling their registration, sale and use. Assessment and registration of agricultural and veterinary chemicals is the responsibility of the Commonwealth, while sales and use are controlled by the states/territories. The regulatory approach to agricultural chemical use has changed significantly since the late 1980s, reflecting the need for a more consistent national approach and greater protection of the environment, worker safety and public health (EA, 1998). National programs operate on full cost recovery.

Key laws controlling the impacts of agricultural and veterinary chemicals on the environment and food safety have been enacted during the past decade. The overall management of these products reflects Australia's export-orientated and highly competitive agricultural sector. A single inappropriate use of an active constituent could potentially result in bankruptcy, loss of trade, ecosystem damage and public and worker health injury. The relatively small number of agricultural and veterinary chemicals (600) and limited number of specific products registered and used (5,000)

means that it is both practical and effective to develop and enforce a uniform system of management at the national level (EA, 1998).

Early in the 1990s, the Commonwealth and state/territory governments agreed to establish a single National Registration Scheme for agricultural and veterinary chemicals and products. This replaced existing state/territory schemes and became fully operative in 1995. The National Registration Authority (NRA) for agricultural and veterinary chemicals was established by the Agricultural and Veterinary Chemicals (Administration) Act 1992. The Commonwealth and state/territory governments provided the NRA with extensive powers in 1994 by introducing legislation known as the Agricultural and Veterinary Chemicals (Code) Act 1994. This legislative network requires that before any chemical or product can be supplied or sold in Australia, it must be registered by the NRA (see Appendix G).

The National Registration legislation comprises seven Acts:

1. Agricultural and Veterinary Chemicals Act 1994 [No. 36 of 1994]
2. Agricultural and Veterinary Chemicals (Code) Act 1994 [No. 47 of 1994]
3. Agricultural and Veterinary Chemicals (Consequential Amendments) Act 1994 [No. 37 of 1994]
4. Agricultural and Veterinary Chemical Products (Collection of Levy) Act 1994 [No. 41 of 1994]
5. Agricultural and Veterinary Chemical Products Levy Imposition (Customs) Act 1994 [No. 39 of 1994]
6. Agricultural and Veterinary Chemical Products Levy Imposition (Excise) Act 1994 [No. 38 of 1994]
7. Agricultural and Veterinary Chemical Products Levy Imposition (General) Act 1994 [No. 40 of 1994].

This legislation provides the NRA with its full range of powers, including: to evaluate, register and review agricultural and veterinary chemical products; to control the importation, manufacture and export of chemical products; and to ensure compliance with and enforcement of the Code.

The last four Acts in the package contain the cost recovery mechanisms - in particular, the imposition, assessment and collection of a levy on sales of chemical products - which establish the NRA as an independent, self-funding regulatory body.

The Agricultural and Veterinary Chemicals Code is managed via a national compliance programme administered by the NRA up to and including the point of retail sale. Legislation provides for strict penalties for non-compliance. A licensing scheme for manufacturers of veterinary drugs is also administered by the NRA to ensure that the manufacturers meet appropriate practice standards.

The registration process is rigorous, involving an evaluation of each chemical's effect on the safety of humans and the environment, the safety of non-target plants or animals, and the impact on trade. The NRA also evaluates the chemistry and efficacy of products and the presence of residues in food (EA, 1998). These components are addressed separately by different organisations according to areas of expertise and

responsibility, with the NRA receiving professional advice in the form of risk assessments from the federal Department of Health and Aged Care (on human health effects), Environment Australia (on environmental impacts) and the National Occupational Health and Safety Commission (on worker safety).

Any product deemed to pose a high risk to safety is not registered or has restrictions placed on its use. When the review is complete, the NRA also approves the manufacturer's label, which describes the product and specifies (through state/territory legislation and enforcement) how a product may be used, including safe handling information.

The NRA is also charged with reassessing registered chemicals to identify and manage any problems that have emerged since registration. If new information raises doubt about the safety of a product, the NRA can deregister it or impose additional restrictions on its use. In recent years, numerous products have been withdrawn or have had severe restrictions placed on their use. Examples include certain persistent organochlorines, mercurial fungicides, dithiocarbamates such as Ferbam, Maneb and Nabam, and nitrofurans. The Existing Chemical Review Program (ECRP), which commenced in late 1996, has reviewed twelve chemicals, finalised three reviews (mevinphos, atrazine and endosulfan), and has another three close to completion. To complement the ECRP, the NRA also conducts special reviews, which tend to focus on particular applications of, or concerns with, certain products. In 1996-97, 19 reviews were processed, 14 more were proposed and eight were completed (EA, 1998).

States and territories are responsible for the use of products beyond the point of sale and administer a range of legislation controlling use. The NRA interacts with the state/territory agencies responsible for administering such legislation. Important legislation includes various pesticide acts that enforce requirements for the storage and disposal of registered products (as defined by the product label and by OH&S legislation enforcing worker protection requirements) as follows:

Aerial Spraying Control Act 1966 (Western Australia);
Aerial Spraying Control Regulations (Western Australia);
Agricultural Standards Act 1994 (Queensland);
Agricultural Standards Regulations 1997 (Queensland);
Agricultural Chemicals Act (South Australia);
Agricultural and Veterinary Chemicals (Control of Use) Act 1992 (Queensland);
Agricultural and Veterinary Chemicals (Control of Use) Act 1995 (Tasmania);
Agricultural and Veterinary Chemicals (Control of Use) Regulations 1996 (Tasmania);
Agricultural and Veterinary Chemicals (Control of Use) Regulations 1996 (Victoria).

The fundamental requirement of the state/territory legislation is the enforcement of the label directions specified by the NRA. The other important objectives of this legislation include:

- licensing of commercial pest control operators, ground and aerial spray operators, and pilots;

- investigation of, and remedial action for, adverse incidents such as spray drift and poisoning of wildlife; and
- monitoring programmes for detecting violations of standards for agricultural product residue.

All states and territories have research, extension and education activities aimed at reducing the risks from chemical use and improving the efficiency and effectiveness of such use. These activities include (EA, 1998):

- extension/promotional programmes on safe, effective and approved use of pesticides, aimed primarily at growers;
- development and promotion of integrated pest management (IPM) techniques;
- development and promotion of innovative production techniques to reduce the need for pesticides (eg out-of-season production, hygiene, rotations);
- promotion and involvement in the generation of efficacy and residue data for quarantine treatments;
- accredited training programmes (eg Farmcare), usually run in association with professional course providers and relevant industries, on safe handling and effective use of pesticides, aimed at farmers, commercial operators and retailers;
- development and promotion of more cost-effective application rates and improved application technology; and
- informing members of the public.

3.2.2 *Soil*

Soil erosion, salinity and acidity are important concerns in Australia. Estimates suggest that 2.5 million ha are subject to dryland salinity, mostly due to land clearing practices that replace deep rooted vegetation with shallow rooted crops. Around 20 percent of the country's soil is considered to be highly erosion-prone and more than half of the remainder is moderately erosion-prone (OECD, 1998b). While naturally acid and acidifying soil is extensive, the rate of acidification is increased by some agricultural practices.

Dryland salinity is concentrated in south-western Western Australia, with a reported 70 percent of the country's problem (IC, 1998). Much of the remaining affected land is within the Murray Darling Basin. The current cost of dryland salinity is estimated to be \$243 million per annum in lost agricultural production alone (Hill, 1997). Other on-farm costs include: secondary degradation of saline land; increased salinity and silting of on-farm water supplies; increased fertiliser requirements; and loss of aesthetic values. Off-farm costs include: damage to buildings and infrastructure such as roads, bridges, sewerage pipes and water supply systems; flood damage caused by increased run-off; reduced service life of electrical equipment; increased water

treatment, cooling and steam generation costs; habitat decline (on land and in-stream), with consequences for biodiversity; and loss of aesthetic, recreational and tourism values (IC, 1998; Watson *et al*, 1997).

Maintaining native vegetation and planting deep rooted perennial plant species are the major initiatives undertaken in Australia to reduce groundwater recharge and to manage rising water tables.

Pastures based on annual grasses and subterranean clover the use of certain nitrogenous fertilisers on crops are contributing to soil acidity. Acidification causes nutritional disorders in plants as some elements (eg aluminium) become available to plant roots in toxic quantities, while other trace elements essential for good plant growth become unavailable (IC, 1998). Induced acidity occurs in Victoria, southern New South Wales and Western Australia, covering around 29 million ha in total (SEAC, 1996). Estimates of the costs, in terms of lost production, range from \$134 million annually (DPIE, 1991) to \$300 million annually (CSIRO, 1990a; 1990b).

Liming is the main measure used to redress soil acidity in Australia. However, its cost often makes it too expensive for pastures with low carrying capacity. Other solutions include the use of non-acidifying fertilisers and acid-tolerant plant species (IC, 1998).

A high proportion of Australian soils have poorly developed structures in their natural state. European cultivation methods are ineffective in maintaining or improving soils structure. Areas most affected by soil structure decline in Australia are those west of the Great Divide in Victoria, New South Wales and southern Queensland, and the southern part of Western Australia (IC, 1998). Soil structure decline is costing Australian farmers an estimated \$200 million annually in lost production (LWRRDC, 1993).

Minimum tillage, stubble retention, mulching, contour cultivation, crop rotation, avoiding bare fallows and ensuring ground cover are the main measures used to combat declining soil structure.

Natural soil erosion in Australia has been exacerbated by land management practices poorly suited to dry, shallow soils in extremely variable climatic conditions. The Queensland Government estimates that soil erosion costs associated with road and rail maintenance, water treatment, dredging and agricultural inputs to maintain the same level of production exceed \$30 million per year (IC, 1998).

Land management practices, including contour banks to control and reduce water run-off, stubble retention, strip cropping, returning land to native forest and changes to cultivation methods, are all contributing towards control of the problem.

Catchment management and the voluntary Landcare Program are the primary responses to soil and land management issues in Australia. Victoria has assigned 10 catchment authorities with responsibilities for implementing regional catchment strategies. New South Wales and South Australia are establishing similar structures associated with their water legislation. Landcare is considered reasonably successful at dealing with land resources issues and has attracted A\$4 in private investment for

every A\$1 in government grants (OECD, 1998).

Land degradation is addressed through regulatory controls and legislation in most states and territories.

In Victoria, the Catchment and Land Protection Act 1994 states that landowners must take all reasonable steps to:

- avoid causing or contributing to degradation to another's land;
- conserve soil;
- protect water resources;
- eradicate regionally prohibited weeds;
- prevent the growth and spread of regionally controlled weeds; and
- prevent the spread of, and as far as possible, eradicate established animal pests.

In Queensland, the Environmental Protection Act 1994 imposes a duty of care on everyone to take all reasonable and practicable measures to prevent or minimise environmental harm. There are no legal consequences for not fulfilling this duty. The legislation is intended to encourage industry self-regulation through codes of practice.

In South Australia, the Environmental Protection Act 1993 sets out a general environmental duty of care requiring that a person must not undertake an activity that pollutes or might pollute the environment unless that person takes all reasonable and practicable measures to prevent or minimise any resulting harm. The Soil and Landcare Act 1989 states, 'It is the duty of an owner of land to take all reasonable steps to prevent degradation of the land.'

In Western Australia, a Task Force appointed to review natural resource management recommended, in its Draft Report, the codifying a duty of care as follows: 'It is the duty of an owner of land to take all reasonable steps to: protect natural resources and sustainably manage the land; and avoid causing or contribution to land degradation which causes or may cause damage to land of another land owner.'

3.2.3 Air

While agriculture-related air quality issues associated with burning, odour, ammonia and noise are not major concerns in Australia, there are some controls. In most places, total fire bans often operate for long periods during summer. In South Australia, some local councils require rural properties to maintain water tanks in case of brush fires. Fire permits may be required for agricultural properties located within or close to towns.

Odour and noise associated with agricultural activities (eg intensive livestock, dairy or mushroom production) are controlled by local councils, often using guidelines provided by Commonwealth and/or state/territory agencies, industry bodies and, in some cases, state/territory legislation. Local council planning and building requirements may limit agricultural activities to an isolated area or prohibit it completely. In general, dairy and feedlot operations must be sited, designed, constructed and operated so as not to cause unreasonable interference with the comfortable enjoyment of life and property off site or with off-site commercial

activity. Special consideration is given to odour, dust, flies and noise above appropriate background levels and to off-site transport effects.

Pesticide drift is considered an important problem in Australia and is more widely addressed at the state/territory level. State/territory legislation prohibits agricultural spraying which injuriously affects any plants or stock outside the target area or any land outside the target area so that growing plants or keeping stock on that land can be reasonably expected to result in the contamination of the stock or of agricultural produce derived from the plants or stock. (See section 3.2.1 on water for relevant Acts).

3.2.4 Nature Conservation, Biodiversity and Landscape

Australia is one of the few countries in the world with mega-biodiversity. The continent contains about 10 percent of the world's biodiversity, with more than a million species of plants, animals and micro-organisms, though only 15 per cent have been described (SEAC, 1996). A large proportion of these are endemic - around 85 percent of the flowering plants, mammals, reptiles and inshore temperate zone fish. (SEAC, 1996).

The country is widely recognised for its contribution to international cooperation for ecosystem and biodiversity management, as well as its leading role in developing national responses and new international regimes for marine issues.

Unfortunately, its ecosystems and biodiversity are under a range of agricultural pressures from grazing, land clearing and irrigation, to name a few. The extent and intensity of pressures leading to habitat loss and modification for both terrestrial and aquatic ecosystems continue to present an extremely serious threat to Australian biodiversity, with a very high number of threatened and endangered species (OECD, 1998). The status of some marine species, including mammals, reptiles and fish, is of particular concern. In the Murray Darling Basin an estimated 80 percent of the median river flow is extracted, mostly for agriculture. In parts of the Basin and in eastern coastal regions where water is also over-allocated, aquatic environments are under severe stress (IC, 1998).

An OCED review of Australia's biodiversity and conservation efforts concluded: 'The coverage and management of protected areas may not be adequate to deal with the pressures involved. In the system of reserves, some areas of poor biodiversity are better protected than areas with high biodiversity. Outside of protected areas, while there has been progress in conservation of natural resources (land, soil and water), progress in conservation of biodiversity (habitats and species) has been extremely limited.'

The Natural Heritage Trust, devoted to sustainability of land, water, coastal and marine resources, aims to integrate environmental and natural resource management programmes. The 1996 National Strategy for the Conservation of Australia's Biological Diversity is supported by sectoral strategies.

In addition, many voluntary, community-based programs with significant grass-roots participation help raise awareness of environmental trends and challenges.

States and territories have enacted a range of legislation and programs aimed at improving land management practices. In particular, recent legislation aimed at protecting the nation's biodiversity resources has greatly limited vegetation clearance, even on private land (see Appendix E). In South Australia, consent is required to clear any native vegetation and no broadacre clearing has been approved since 1991. Queensland has a satellite monitoring program to enforce its new land clearance rules, while Victoria requires permits to clear any block greater than one hectare. The National Landcare Program has played an important role in developing evolving land use legislation at the state/territory and community levels.

Coral reef degradation in Australia's Great Barrier Reef is attributed primarily to agriculture. A catchment study quantifying the principal sources of sediment and nutrients discharged to coastal waters off Queensland estimates that grazing lands contribute approximately 80 percent of nutrients and that sugarcane areas contribute 15 percent (Moss *et al*, 1992). Nutrients lost from grazing lands are largely those naturally present in the soil and not originating from added fertiliser. The principal causes of the nutrient loss are land clearing and overgrazing, both of which increase the soil's susceptibility to erosion (Beckman, 1991; Gardner *et al*, 1988). Sugarcane cultivation results in loss of both natural soil nutrients and added fertiliser, with fertiliser addition and loss far more important than in grazing situations (Prove and Hicks, 1991).

Policy responses aimed at changing management practices through education and the promotion of best practice have been successful in both the beef and sugarcane industries (Cosser, 1997). ICM programs have raised awareness and reduced agricultural sources of sediment and nutrients through better land management methods, including: stubble retention on cropping lands; retention and rehabilitation of riparian zones and wetlands; vegetation management on grazing lands; and better application technology to reduce fertiliser use (QDPI, 1993). ICM is the principal tool of the Queensland Government for reducing catchment-based pollutant discharge to the coastal zone. Sugar cane producers have cut down on nutrient runoff through green cane harvesting and trash blanketing, both of which reduce soil erosion and phosphorus loss (Prove and Hicks, 1991).

The proposed Biodiversity Conservation Act of 1998 is the first comprehensive legislative attempt in Australia to address the conservation and sustainable use of biodiversity. The Act will adopt several integrated approaches:

- protection of wildlife, especially endangered and vulnerable species and migratory species;
- protection of ecosystems through: the establishment, management and conservation of parks and reserves, World Heritage properties and Ramsar wetlands; recognition of critical habitat; the protection of endangered ecological communities; and the promotion of off-reserve conservation measures;
- recognition of processes that threaten all levels of biodiversity, particularly endangered and vulnerable species, and implementation of plans to address these

- processes;
- providing for the sustainable use of wildlife, and the regulation or prohibition of trade in native wildlife and internationally protected wildlife;
 - ensuring that activities and proposals that may have a significant impact on endangered or vulnerable species or endangered ecological communities are properly assessed under the Environment Protection Act; and
 - promoting a partnership approach to biodiversity conservation through bilateral agreements with states/territories, conservation agreements with landholders and the involvement of the community in management planning.

The most important new initiatives relate to:

- the identification and monitoring of Australia's biodiversity and the promotion of bioregional planning;
- ensuring that the Commonwealth's protected area system covers the full range of IUCN categories, from strict nature conservation to multiple use;
- recognising that matters of national environmental significance which trigger the assessment and approval process under the Environment Protection Act include World Heritage properties, Ramsar wetlands, nationally endangered and vulnerable species and endangered ecological communities, and migratory species;
- providing for conservation agreements to protect biodiversity on private and public land; and
- increasing the emphasis on biodiversity considerations in the assessment of proposals for the sustainable use of wildlife.

The release of GMOs into the environment is currently examined by the Genetic Manipulation Advisory Committee (GMAC), a non-statutory expert body that assesses the biosafety risk factors of transgenic organisms and advises the federal Minister for Science and Technology on regulating genetic engineering technology. Major environmental risks include the potential for herbicide-resistance genes from transgenic herbicide-resistant crops to escape into weedy relatives (Mikkelsen *et al*, 1996) and excessive use of herbicides to control weeds growing in a tolerant crop, leading to over-exposure of the environment to chemicals, and possibly to the emergence of resistance (Holland and McDowall, 1995).

3.2.5 *Animal welfare*

Each state and territory has a Prevention of Cruelty to Animals Act to control all uses of animals. Most legislation lists those acts of commission or omission deemed to be acts of cruelty. Aggravated cruelty is said to occur where the animal dies or is seriously disabled.

Model Australian Codes of Practice for the Welfare of Animals are developed by the Commonwealth for use by the states/territories after adaptation to suit their particular circumstances (Wirth, 1998). Animal welfare organisations have opportunities to contribute to the content and direction of the Codes. Proven adherence to the

provisions of the Codes may assist a person defending a charge of cruelty. In South Australia, codes of practice are regulatory, while Victoria follows the English system of non-regulatory codes proclaimed under the Act. In all other states and territories codes of practice are not recognised by the Prevention of Cruelty to Animals Acts.

Since 1980, responsibility for the administration of each state/territory's Prevention of Cruelty to Animals Act has been vested in the ministers for agriculture, except in South Australia and Western Australia. Australian Prevention of Cruelty to Animal Acts recognise by statute full-time officers of the RSPCA, members of the police force, and designated officers of the state agencies as delegated by the responsible minister to enforce the Act. Officers of the RSPCA undertake the bulk of prosecutions.

The Commonwealth Government is advised by the National Consultative Committee on Animal Welfare, which is composed of representatives of the national animal welfare organisations, of national non-government organisations that deal with animals, of Commonwealth departments that deal with production and native animals, and of each state and territory minister who administers the Act.

Producers are obliged under the Act to provide animals with proper and sufficient food, drink and shelter, which it is reasonably practicable in the circumstances for the person to provide. The general approach to transport is to not allow persons to carry or convey an animal, or to authorise the carriage or conveyance of the animal, in a manner, which unreasonably, unnecessarily or unjustifiably inflicts pain upon the animal.

Although pigs can live outdoors throughout the year, they are provided housing in Australia due to the potential for sunburn. Most pigs are now group-penned; although continued use of single stalls is a problem in some cases. Tethering has been illegal since 1996.

All states and territories legislated a minimum cage floor space of 450 sq cms per bird for chickens weighing 2.4 kg or less, and 600 sq cm per chickens weighing above 2.4 kg. Breaches of these requirements can be prosecuted.

The egg producing industry also agreed to the introduction of Animal Care Statements. These are registered documents written by individual producers to explain precisely how the provisions of the Australian Code of Practice are implemented on the farm and which employee will be responsible for implementing which provision. This allows farmers self-regulation, but with community accountability, and increases the credibility of codes of practice. The RSPCA, in conjunction with the egg industry, has established guidelines for producers on RSPCA policy requirements.

The definition of free-range chickens and free-range egg production differentiates clearly from intensive systems of production. A 'free-range', 'open range' or 'range' chicken or egg is produced according to the standards and in compliance with the Model Code of Practice for the Welfare of Animals No. 2 -Domestic Poultry, endorsed by the Australian Agricultural Council:

- hens have permanent access to a weatherproof house with a deep-litter or slatted floor, and equipped with feeders, drinkers, nest boxes and perches;
- the stocking rate of the house does not exceed 5 birds per square metre of deep-litter floor space or 10 birds per square metre of slatted floor space;
- housing, space allowance, equipment, lighting, ventilation, temperature, food, water, health and management practices are within the limits of the Model Code;
- hens have access to open-air runs during daylight hours;
- hens must be protected from predators at all times;
- the ground to which hens have access is mainly covered with palatable vegetation and has some shade;
- the stocking rate of the runs does not exceed 1.5 birds per 10 square metres, or 1500 hens per hectare (600 hens per acre);
- beak-trimmed stock (hens and pullets) must not be used; and
- induced moulting must not be practised.

Beef feed-lotting occurs mostly in northern New South Wales and southern Queensland. Most of the meat produced in feedlots is destined for sale in Asia. National Feedlot Guidelines were developed in 1996 to control environmental and animal welfare issues associated with feedlots and are administered by local governments in conjunction with state/territory departments of agriculture. The protection of animal welfare is via a specific Code of Practice in conjunction with an Animal Care Statement.

The Australian climate allows animals to be kept outdoors throughout the year. The size of farms varies from several hundred has with high stocking density in the south to extensive stations measured in square kilometres with very low stocking densities in the north and centre of the continent. Animal welfare issues include surgical husbandry procedures without anaesthetics, problems of handling, including round up, and the consequences of drought, bushfire and poor shelter. Abattoirs are usually located on the coast, making transport problems such as lengthy time and distances inevitable.

3.2.6 Human Health

No significant human health problems related to pesticide misuse have occurred in the recent past. Studies in New South Wales catchments have regularly detected pesticide residues in surface waters used for town supply and domestic use, but levels rarely exceed current drinking water health guidelines (Korth *et al*, 1994). Monitoring recently found that 20 to 25 percent of groundwater samples within South Australia's portion of the MDB tested positive for residues of pesticides (mainly triazines). However, concentrations seldom exceeded 1 microgram per litre, which is well below current health guidelines (NHMRC/ARMCANZ, 1996).

The results of Commonwealth, state/territory and industry-sponsored monitoring programs indicate that misuse of agricultural and veterinary chemicals is low (Rowland *et al*, 1997). Most analyses record no residues or residues below established limits (ANZFA, 1996; NFA, 1992). The cost of agricultural and veterinary chemicals

generally represents a small, although not insignificant, part of the overall cost of production; pesticides are commonly used as insurance (Stirling 1994). The rate and frequency of pesticides applications tend to vary among growers, depending on their individual perceptions of risk (Penrose *et al*, 1994).

Australia has developed a national response strategy to phase out methyl bromide use and thus meet its treaty obligations under the meeting of parties to the Protocol in September for the Montreal Protocol on Substances that Deplete the Ozone Layer (MBCG, 1998). Australia currently imports 1000 tonnes of methyl bromide, with more than two-thirds used by horticulturalists to fumigate soils for a range of pests, pathogens and weeds. About 2000 of the country's 35000 horticultural producers use methyl bromide. The farm gate value of methyl bromide-using horticultural sectors is less than 10 percent of the total horticultural farm gate market value (MBCG, 1998). The response strategy concludes that the phase-out will not significantly slow horticultural expansion: decreases in short term productivity are expected with small farms more susceptible to decreases in profitability. The long run expectation is for continual expansion of horticultural sector output through both land expansions and productivity increases (MBCG, 1998).

Australia's food and agricultural production and processing regulations are a complex and often fragmented collection of laws, rules, standards, and procedures involving numerous federal, state/territory and local government agencies and legislation. Some 150 acts and associated regulations control food and agribusinesses, including imported food and food produced for export and domestic consumption. In addition, there are more than 90 separate national food standards (FRRC, 1998). Laws and standards are administered by more than 40 state/territory agencies and departments, more than 700 local governments and various Commonwealth agencies.

An important aspect of food controls and regulation is the monitoring of agricultural chemicals. The Australian Total Diet Survey (formerly the Market Basket Survey) monitors dietary intake of agricultural and veterinary chemicals and heavy metals to determine whether they are within the safe limits set down by the World Health Organisation (WHO). The survey samples 'market baskets' of over 70 food types for about 50 pesticides, arsenic, cadmium, copper, lead, mercury and aluminium. The National Antibacterial Residue Minimisation Program monitors antibacterial levels in meat and alerts producers to the risks to trade if safe levels are violated. The National Residue Survey (NRS) monitors chemical residues and heavy metals in raw food commodities, largely those destined for export.

The NRS is fully-funded by participating industries (see Appendix F for a description of the NRS). Since December 1996, it has been compulsory for meat from all species slaughtered for export or domestic use in Australia to be tested for some 90 chemicals by NRS, under the Australian Standard for the Hygienic Production of Meat for Human Consumption.

The NRA for Agricultural and Veterinary Chemicals recommends Maximum Residue Limits (MRLs) for chemicals in food commodities to the Australia and New Zealand Food Authority (ANZFA). MRLs are designed to reflect good agricultural practice and are based on the residue levels expected if producers follow the label

recommendations. They are adopted into the Food Standards Code, which automatically becomes part of all state/territory food laws (Rowland *et al*, 1997). With the exception of Tasmania, the Australian Capital Territory and the Northern Territory, all states have established monitoring programs for agricultural and veterinary chemicals, and some selectively survey for heavy metals as well. (See Appendix G for details on the NRA functions.)

Cadmium has captured attention in Australia because its capacity to transfer from soils to the edible portions of food crops is significantly greater than for other heavy metals (McLaughlin *et al*, 1996). The problems stems from the fact that producers have applied superphosphate fertilisers to Australia's nutrient deficient soils for more than 100 years and cadmium accumulates in the soil over time - a single application of 100 kg per hectare of superphosphate can raise cadmium levels in the top soil by 9 percent (Wiseman, 1994). The superphosphate fertilisers obtained from Nauru, Christmas and Ocean Islands (until recently the primary sources of phosphate in Australian fertilisers) contain relatively high levels of cadmium.

Cadmium regularly exceeds the Maximum Permitted Concentration (MPC) in offal and potatoes (Taylor, 1995). The NRS reports that eight percent of offal samples in 1991-92 exceeded the established MPC. More than 10 percent of samples in the Victorian clean agriculture produce monitoring program of 1992-93 had cadmium levels above the MPC, with violations detected in carrots, potatoes, spinach and safflower. From 15 to 20 percent of surveyed potatoes have had cadmium concentrations above the MPC. Cadmium residues present a special problem for horticultural producers because vegetables, especially potatoes and lettuce, have high uptake of cadmium.

Concern about cadmium is such that authorities have taken specific steps to limit dietary intake, including: (1) reducing the level of cadmium allowed in phosphatic fertilisers; (2) eliminating the feeding of phosphate supplements with high levels of cadmium to cattle; (3) banning the sale of offal from aged sheep and cattle (there is an age-related increase in cadmium concentrations in animal offal such as liver and kidney); (4) regulating the disposal of industrial wastes into urban sewerage systems to minimise contamination of agricultural lands by cadmium; and (5) monitoring cadmium levels in fertilisers, soils and commodities by Commonwealth and state/territory agencies.

Other chemical use problems have risen in the recent past. For example, in Western Australia, potatoes are rotated with pastures for sheep and beef grazing. In the mid-1980s, farmers used organochlorin insecticides (DDT, benzene hexachloride, and dieldrin) on the potato crop (Ralph, 1992). These insecticides contaminated pastures which were then grazed by cattle, resulting in organochlorin residues in Australian beef. A ban on all beef exports to the United States was avoided only after intensive cattle lot testing was introduced. The testing procedures alone cost the cattle industry an estimated A\$50 million (Hill *et al*, 1997).

Targeted testing programs (with a focus on red meat) are supervised by SAFEMEAT in conjunction with the Australian Quarantine Inspection Service (AQIS), the states/territories, the NRA and industry to meet monitor chemical residues that pose a

risk to Australian export markets. The major programmes are:

- Hormonal Growth Promotants Audit Program (HGP);
- National Organochlorine Residue Management (NORM);
- National Antibacterial Residue Minimisation (NARM);
- Chlorfluazuron (CFZ) and Endosulfan Survey.

The NRS manages and coordinates these programmes, receiving and collating the results, making payments to state/territory governments, laboratories and abattoirs, and auditing the operational and financial aspects of the programmes.

The NRA introduced an HGP control system after concerns were raised by the European Union about Australian meat and meat products containing hormonal growth promotants. The control system is the responsibility of the states/territories and involves importers, wholesalers and retailers. HGP supplies must be registered, suppliers and manufacturers must keep records of the treatment and sale of livestock, and audits are carried out regularly by the states/territories. The system is also liable to audit by European Union auditors at any time.

There are 277 suppliers of HGPs in Australia, the majority of which are in Queensland where most HGPs are used (NRA, 1999). During 1997/98, the NRA audited 80 premises. The auditor checks the suppliers records to ensure that each entry is complete and that a purchases declaration has been received for each supply of HGP. Stock on hand at last audit and subsequent acquisitions are also calculated to ensure that all units of HGP are accounted for.

The NRA reports that auditing during 1997/98 found 20 minor breaches of the regulations such as stock on hand not consistent with records, monthly returns not provided to the state/territory department or records not kept for two years. Auditors also detected 26 major breaches, including failure to obtain a purchaser declaration before supply, incomplete declarations and failure to keep proper records. Critical breaches lead to prosecution.

Requirements relating to the supply of HGPs are (NRA, 1999):

- a person or company must not sell or supply HGPs unless they have a notification number and the recipient has quoted a notification number or has supplied a completed purchaser declaration form;
- at the time of sale or supply the supplier must complete a record of particulars in a form approved by the NRA (there is an approved form for each state or territory);
- any person who supplies HGPs must provide the NRA with a copy of the records of the supply within two weeks of the end of each calendar month (nominated state/territory departments of agriculture receive this information) or the notification number will be withdrawn;
- all records regarding the purchase and supply of HGPs are to be kept for at least two years, even though the retailer might have ceased to supply and/or purchase HGPs and has had the notification number withdrawn.

Organic foods are required to comply with Australian standards such as the MRLs and MPCs set for all foodstuffs. In addition, organic producers must comply with industry production standards for organic produce, which differ from standards for other foodstuffs in that production procedures are an intrinsic part of the identification, labelling and claims for such products. These standards are designed to protect consumers against deception and fraud, establish production principles at the farm level, and list the substances approved by the organic industry for soil fertilisation and the control of pests and diseases.

Organic produce standards are established by the Organic Produce Advisory Committee (OPAC) and the Committee for the National Standard for Organic and Biodynamic Produce for exported produce - the first nationally-agreed standard for organic produce outside the European Union. The Committee is answerable to the Minister for Primary Industries and Energy. Individual organisations enforcing OPAC standards, such as the Biological Farmers of Australia (BFA), the Biodynamic Farming and Gardening Association of Australia (BDFGAA) and the National Association of Sustainable Agriculture Australia (NASAA), are audited regularly by AQIS.

As part of its quality assurance program, the Australian Wheat Board (AWB) monitors residues such as pesticide levels in grain after harvest and fungicides and heavy metals before harvest. The AWB standards are stricter than the international MRLs and residue samples are taken to ensure that the requirements of customers (including overseas and domestic government authorities) are met. The Australian Wine and Brandy Corporation (AWBC) also monitors residue levels to ensure that their products meet international MRLs.

Australia's food industry legislation and acts have recently undergone a regulatory review process (see Appendix H for a summary). The Food Regulation Review investigated all food regulatory matters, focusing on regulations administered by agricultural and health agencies and involving the three spheres of government (FRRC, 1998) It included government regulation-making, compliance and enforcement activities in relation to imported food and food produced for export and domestic consumption and covered the whole of the food industry, including primary production, processing and retail. The Review concluded that the food regulatory system in Australia is complex, fragmented, inconsistent and wasteful. Specifically, it noted the following problems.

The food industry incurs costs due to duplication of effort between regulatory agencies, overlap of legislation and functional responsibilities, inconsistency of regulatory approaches between jurisdictions and difficulty in dealing with the large number of agencies and laws involved.

- The current regulatory framework for food involves a large number of agencies and legislation spread across three spheres of government. Approximately 150 acts and associated regulations control food or agrifood businesses in Australia. In addition, there are over 90 separate national food product standards.
- Food laws and standards are developed, administered and/or enforced by more

than 40 state/territory agencies and departments and over 700 local governments.

- Many of the current food regulatory reforms are independent, while others are closely interrelated.
- Most agrifood businesses employ practices and equipment that match or exceed the standards required by law. Many proprietors and managers have difficulty separating what they do as a natural part of good business practice from what they do solely to comply with food-specific or food-related regulations. Regardless of regulations, most food suppliers have strong incentives to produce safe food of the type consumers want and for which they will pay.

The Review noted that despite extensive consultations with industry and systematic investigations of costs, it was not possible to identify the dollar cost of the regulatory burden on the food industry. Instead, indicative costs were provided. For example, the report provides information on the costs of complying with government food-related regulations for 37 small businesses from four states and the ACT.

Firm size ranged from annual turnover of less than A\$100,000 through to about A\$13 million, with up to 100 employees. The average cost of food-related regulatory compliance per firm was just over A\$13 700, representing 0.3 per cent of average annual turnover. The main elements of the regulatory costs are the cost of the firms' time (44 percent), capital expenditure (26 percent), inspection fees and charges (14 percent), licence fees (9 percent) and test fees (7 percent).

The major proposal presented by the Review is a coregulatory approach to food regulation based on government, industry and consumers working together. Government's aim is to set minimum performance-based standards through consultation, and to give business greater flexibility in how it meets the standards, without reducing business' responsibility for meeting the standards. The proposals include a package of structural, legislative and administrative rearrangements to reduce the costs of compliance. Adoption of the recommendation would provide for significant medium to long-term cost savings to governments and to the agrifood industry through reduced fees and charges and through reduced compliance and paper work burden.

Chapter 4 ENVIRONMENTAL AND HEALTH-RELATED AGRICULTURAL POLICIES AND REGULATIONS

Australia's primary approach to protecting water, soil, air, animal welfare and human health and safety is through research, education, voluntary adoption of best practice, and the use of guidelines developed collaboratively between governments, industries and communities. Best management practice manuals and published environmental, health and safety guidelines outlining accepted practices are used by: (a) local councils to determine whether to accept new agricultural activities or allow existing activities to expand; (b) courts to determine how to litigate property damage or human injury cases; and (c) purchasers of commodities, including livestock, grains, horticultural and dairy products, to meet quality assurance objectives.

4.1 Water

4.1.1 Water quality (nutrients)

a) On-farm nutrient budgets

Maintenance of records documenting on-farm nutrient budgets is not a legislated requirement for agricultural activities in Australia. Nutrient loads (potassium, phosphorus and nitrogen, among others) are monitored in rivers, streams and groundwater. Nutrient readings above normal levels and/or above national guidelines trigger investigations into causes and remedial actions. Voluntary water monitoring programs, eg Waterwatch, play an important role.

Before constructing an intensive piggery or expanding a beef feedlot (with more than 50 head), documentation on nutrient and salt balance is required to show that the size of the application area is sufficient to handle the expected nutrient and salt levels.

One purpose of the cap on water extractions in the Murray Darling Basin is to allow sufficient drainage to dilute nutrient loads. Reducing water available for irrigation to meet environmental flow requirements may raise costs to producers either through higher water prices or through lower yields and production.

The national guidelines for the protection of aquatic ecosystems recommends that salinity should not be permitted to increase above 1,000 mg/L. Recommended total nitrogen in rivers and lakes is 100-750 µg/L and in estuaries and embayments NO₃ at 10-100µg/L and NH₄ < 5 µg/L. Recommended phosphorus levels in rivers and lakes is total P 10–100 µg/L and in estuaries and embayments 5-15 µg/L.

b) Discharge consents or permits

Consents and/or permits for point source discharges from agricultural activities may be required. Environmental legislation protects surface and groundwater from livestock effluent, as well as pesticides. Guidelines for the management of dairy and intensive livestock effluent provide information for state/territory

authorities and local councils authorised to approve new developments or expansions of existing operations. Environmental protection agencies and the courts use these guidelines to assess violations and determine liability.

c) Manure storage requirements

The national guidelines for managing dairy effluent advise taking into account the following set of factors when choosing a site and managing manure storage (ANZECC, 1995).

1. Dairy farmers have a legal responsibility to contain all dairy shed wastes within their farm boundaries.
2. Existing operations with site constraints (eg proximity to surface and groundwater) should: (a) liaise with regional planning/zoning agencies; (b) make appropriate modifications of the dairy; (c) adopt effective housekeeping and best management practices; (d) update the operator's knowledge; (e) innovate and use effective technologies to minimise effluent and allow for its reuse; (f) make the design of the plant effective; (g) use an effective monitoring system to enable potential problems to be detected early; and (h) replace obsolete technology.
3. If the operation cannot overcome the constraints, its scale should be reduced to a manageable level, or be relocated in a suitable area, or closed.
4. Siting of new operations should consider: (a) the amount of land required for the treatment, storage and application of solid waste/sludge and effluent; (b) on or off site characterisation of the soil to determine its suitability for the storage, treatment and application of shed effluent and other wastes; (c) estimation of the quality and quantity of effluent and solid wastes/sludges produced at all stages of the process (ie raw, post treatment, post storage, etc); (d) land suitability (including topography, slope, wind, and drainage); (e) climate (including rainfall, prevailing winds); (f) type of treatment system to be used; (g) neighbouring land use, including residential, commercial, industrial and agricultural; (h) proximity to sensitive sites, including surface and groundwater, and areas containing unique, uncommon or endangered fauna and flora; (i) proximity to areas of scientific value or of Aboriginal significance; (j) the proximity of services and amenities, including water supply; (k) the need for appropriate buffer zones between the enterprise and sensitive areas.
5. Effluent management systems must provide storage for the effluent (including spoiled milk) until they can be used or disposed in a manner which will not adversely impact on the environment. Because of potential odour, wastewater may have to be applied directly to land within a few hours of production or treated to reduce the strength of the waste.
6. Storage tanks and storage and treatment lagoons should be designed to safely contain their maximum operational load and to comply with local regulations. This should take into account the maximum volumes of effluent to be stored

during seasons when land application may not be possible, as well as increased effluent volumes resulting from above average rainfall. Storage systems should also incorporate a spillway to prevent damage during any overtopping.

7. The base of storage facilities should be constructed or lined with low permeability materials to prevent leakage and to minimise the impact on groundwater resources. In addition, lagoons should be designed and constructed to prevent potential pollution of surface water through runoff.
8. Storage installation should take account of soil characteristics, slope of the land, odour management potential and catchment hydrology, and should conform to and be part of a whole farm plan. Storage should be designed to cater for future farm expansion and maximum load, including the total volume of effluent produced during periods when soils may be saturated or periods of prolonged or heavy rainfall.
9. Storage facilities should be designed to impound wastewater during the required storage period for the highest rainfall year in a ten-year cycle.
10. Experience has shown that simple systems in which the farmer is responsible for overseeing the design work best. The cost of such systems is not great in comparison with other on-farm costs, eg earthwork costs are small relative to the cost of pumps, pipes and sumps.

d) Manure application requirements

The dairy guidelines (ANECC, 1995) recommend land application of effluent as the most efficient means of recycling valuable water along with the effluent's nutrient and organic components. The amount of land required depends on a number of factors, including: (a) susceptibility to surface runoff and soil erosion; (b) potential effect on groundwater and surface water; (c) climatic conditions (amounts of rainfall, wind speed, evapotranspiration); (d) the nature of pasture or crop grown; (e) pastoral, agricultural and horticultural practices; (f) the properties of soils (infiltration rate, phosphorus absorption capacity, moisture storage capacity in the root zone, and chemical and physical characteristics); (g) the quality and quantity of the effluent; and (h) the maximum operational life of the application site as determined by phosphorus absorption capacity and predicted salt accumulation.

To select land for irrigation, soils should have the following characteristics: (a) a structure that permits air movement and water penetration; (b) sufficient depth to permit optimum root development; (c) adequate natural drainage, or suitable artificial drainage; (d) sufficient capacity to hold water for shed use between successive irrigations; (e) nutrients in sufficient quantities for adequate plant growth; and (f) moderate pH (ie neither too acid nor too alkaline).

Soils for solid wastes/sludge application should be suitable for improving pasture or dryland cropping, able to withstand cultivation without incurring significant

erosion or major structural declines, and not be prone to water logging.

Before and during land application, scheduling and application rates based on the properties of the effluent, including its salinity and nutrient content, pH and BOD, need to be considered and assessed seasonally. Maximum application rates for land treatment of effluent depends on site-specific conditions. In general, they are limited by one or more of the following: (a) hydraulic loading; (b) nutrient loading/balance (K, N, P); and (c) salt loading.

Effluent loadings aimed at maintaining rates, which, after accounting for rainfall, are balanced by evapotranspiration, are inadequate to protect groundwater. This is especially important in areas where rainfall can exceed evapotranspiration over periods that are sufficiently long that excess water (and solutes) can leach beneath the root zone. As rainfall cannot be controlled, the only effective way of preventing excessive contamination of groundwater is to ensure that concentrations of nutrients and salt below the root zone remain at an acceptable level.

A nutrient balance can be developed, where the losses from the system are confined to the uptake of nutrient by plants that are removed, gaseous losses of nitrogen, and net accumulation of nutrients in the soil. Balances should be calculated to account for seasonal variations in components of the nutrient budget (particularly plant uptake, net mineralisation and leaching). Long term nutrient monitoring of the soil and/or soil solution could substitute this approach.

Water budget studies are an important tool for quantifying land requirements and the volume of effluent that may be applied. To minimise surface runoff and soil erosion, effluent should not be used on land which is: immediately adjacent to streams and water courses; subject to flooding (flood risk analysis should be undertaken); waterlogged or saline; sloping with inadequate ground cover; rocky, slaking and highly erodible or of a highly impermeable soil type.

Irrigation runoff should be contained on site. Irrigating onto areas receiving surface run-off from higher land increases the risk of effluent moving offsite. Protection by diversion banks located upslope of the irrigated area is advisable.

Groundwater factors to consider are the level of the water table, groundwater quality and potential usage. Hydrogeological expertise is required to evaluate the characteristics of the groundwater beneath the land application area. This will include evaluation of mixing and dilution, travel times, direction of groundwater flow, and the possibility of denitrification occurring.

Surface water factors to consider are distances of various waterbodies and water uses from the proposed shed and/or land application site, catchment area and drainage patterns.

In Queensland, pig producers taking advantage of land application as a means of effluent disposal are considered to have a moral and legal obligation to ensure that the application is carried out in an environmentally sustainable manner. The

maximum total applications should be calculated for each sludge or effluent nutrient, according to the following formula: maximum total application = safe soil storage + amount removed in crop + allowable losses.

Table 4.1 Queensland's safe total net effluent applications*

Soil	Storage Capacity kg P/ha	Maximum Load (kg/year/ha)
Yellow Podzolic	2300	265
Red Podzolic	3700	405
Prairie	1200	155
Krasnozem	3400	375
Vertisol	700	105
Yellow Earth	1700	205

*Cumulative effluent-P + sludge-P application minus crop uptake, assuming an active root depth of 1 m).

Source: Redding, 1998

e) Intensive livestock facilities

The National Guidelines for Beef Cattle Feedlots (ARMCANZ, 1997) provide recommendations for site location and buildings standards. The Effluent Management Guidelines for Intensive Piggeries (ANZECC, 1995) provides similar information regarding protection of water resources.

A feedlot should not be sited above groundwater resources that are deemed to be vulnerable to contamination, unless those resources will be demonstrably protected, eg by one or more impervious geological strata and/or considerable depth.

The locations of pens and associated infrastructure, manure stockpiles, sedimentation basins and holding ponds should not be in flood-prone areas, unless adequate safeguards are incorporated. Special provisions may be required where effluent and manure utilisation areas and terminal ponds are located within such areas.

f) Soil testing requirements and monitoring costs

Around 1800 water monitoring programmes are in place to evaluate quantity, quality and environmental indicators throughout Australia. These programmes are supplemented by community initiatives such as Waterwatch, which monitors nearly 5000 sites.

On-farm testing and monitoring activities are imposed on farms, dairies and feedlots that obtain quality assurance status or HACCP accreditation. All dairy and feedlot operations in Australia are attempting to implement some form of quality assurance scheme or HACCP.

The national feedlots guidelines recommend that those feedlots that have caused significant environmental impact or which require consistently superior management practices as a consequence of siting or design/construction limitations should be required to submit a report on their environmental performance to the appropriate state/territory and/or local authority at least annually.

g) Maximum limits on nutrient inputs

Beef and dairy operations in Australia are based on pasture nutrients as the primary feed source. No maximum limits on nutrient inputs exist at present.

h) Buffer strips/riparian zones

Australia uses buffer zones, exclusion zones and chemical control areas. Buffer zones, also called boundary zones, describe an area around a single point (eg a house or a school) where spraying of chemicals cannot occur or where a special permit must be granted. The purpose of these zones is to protect people from nuisance or exposure to drift arising from a spraying operation under good conditions.

Exclusion zones and chemical control areas are areas wherein specific chemicals are restricted year-round or for a set period. Exclusion zones may include vineyards, residential areas, watercourses and national parks.

A reasonable buffer should be provided between the feedlot complex (including effluent and manure utilisation areas) and streams, rivers and other watercourses. The separation distance should be a function of the intervening topography, other site-specific factors and the management practices employed by the operation. In South Australia, the buffer zone for water courses is 200m, except for water protection zones, which require 5km from an existing major potable water supply or 2km from an existing minor potable water supply or greater than 0.5km from an existing private potable water supply. The fine for companies that illegally degrade water is A\$1,000,000.

i) Cover crop requirements

The use of cover crops is an optional conservation practice in Australia.

j) Environmental impact assessments and 'permission to construct' processes

Application documentation for feedlots, poultry, piggeries and dairy sheds are required. The details vary according to capacity. Feedlots with more than 50 head require information on most of the following: (a) climatic data; (b) site plan, pen layout, drainage plan; (c) effluent and manure utilisation plan; (d) traffic volumes

and routes; (e) water supply, bore locations, groundwater analysis, hydraulic balance, irrigation method; (f) vegetation, nutrient and salt balance; (g) manure stockpile, manure spreading program; (h) soil conservation plan; (i) odour, dust, noise, visibility; (j) animal care statement; and (k) pest control system.

Table 4.2 presents an illustrative example of the ‘permission to construct’ requirements for piggeries in New South Wales.

Table 4.2 Approval procedures for new or upgraded piggeries in New South Wales

<i>Size Location</i>	<i>Consent Authority</i>	<i>Documentation</i>	<i>Comments</i>
<200 pigs or 20 sows Non-sensitive area	Council	Development application	
<200 pigs or 20 sows Sensitive area	Council	Development application and Statement of Environmental Effect (SEE)	Development application and SEE lodged with council
>200 pigs or 20 sows Non-sensitive area	Council	Development application and Statement of Environmental Effect	Development application and SEE lodged with council and on public display for 14 days. Council decision in 40 days. Can be appealed.
>200 pigs or 20 sows Sensitive area	Council or Minister for Urban Affairs and Planning	Development application and Environmental Impact Statement	Designated development. Planning focus meeting required. Development application and SEE or EIS lodged with council and on public display for 30 days. Council decision in 60 days. Can be appealed by developer and objectors
>2,000 pigs or 200 sows anywhere	Council or Minister for Urban Affairs and Planning	Development application and Environmental Impact Statement	Designated development. Planning focus meeting required. Development application and EIS lodged with council and on public display for 30 days. Council decision in 60 days. Can be appealed by developer and objectors
> \$20 million capital investment or >20 employees anywhere	Minister for Urban Affairs and Planning	Development application and Environmental Impact Statement	SEPP 34 development. Ministerial decision. Draft and final EIS required. Development application and EIS lodged with Department of Urban Affairs and Planning and on public display for 30 days. Ministerial decision in 60 days. Can be appealed by developer and objectors.

Environmentally sensitive zones are those areas with one or more of the following characteristics: (a) within 100m of a natural water body or wetland and/or on a flood plain; (b) in an area of high watertable, highly permeable soils, acid sulphate, saline or sodic soils; (c) on land with a slope of more than six degrees within a drinking water catchment; (e) within 5km of a residential zone and in the opinion of the consent authority, having regard to topography and local meteorological conditions, are likely to significantly affect the amenity of the neighbourhood by reason of noise, odour, dust, traffic or waste.

4.1.2 Water quality (sediments)

For the protection of aquatic ecosystems, the national guidelines advise no more than 10 per cent change in seasonal mean concentration of suspended particulate matter and turbidity. Water guidelines are discussed in Section 4.1 above and presented in the various tables on water quality guidelines in Appendix K.

4.1.3 Water quality (pesticides)

- a) What pesticides can you buy and are available for use (following authorisation procedures)?

The NRA maintains a 24-hour database, 'PUBCRIS', which contains details of agricultural and veterinary chemical products registered for use in Australia (<http://www.affa.gov.au/nra/pubcris.html>). The data is updated nightly and includes the product name, registering company, active constituents, phase-out dates and product category. PUBCRIS does not currently include information on 'stopped' products, that is, those that may be legally available for a limited time after lapse of registration. Stopped products will be included as of August 1999. Currently hundreds of pesticides are available for use.

- b) Do phase-out actions exist and do they focus on harmful pesticides used on big crops?

The NRA conducts comprehensive reviews of registered agricultural and veterinary chemicals to ensure those chemicals meet current standards of registration and do not pose unacceptable risks to human health, the environment or trade.

The NRA's Existing Chemical Review Programme investigates older chemicals to ensure they meet contemporary standards of safety and performance, taking into account any new information and scientific data generated since their registration. The NRA also conducts special reviews of chemicals when issues arise that may alter the terms of their registration or cause them to be withdrawn. Chemicals recently reviewed include atrazine, chlorpyrifos, endosulfan, chlorfenvinphos, parathion, diazinon, parathion-methyl, monocrotophos, mevinphos, demeton-s-methyl, fenitrothion, and dichlorvos. Reviews published since September 1998 include: The Fenitrothion review; The Atrazine review; The Endosulfan review; The Parathion (ethyl parathion) review; and The Parathion-methyl review.

In March 1999, the NRA restricted use of the insecticide endosulfan on cotton following the detection of unacceptable levels of residues in beef. The restrictions are aimed at reducing spray drift to help avoid contamination of meat, as well as further reducing potential effects of endosulfan on the environment, worker safety and public health. The new restrictions include: (a) an absolute limit of three

sprays per crop, per season; (b) mandatory prior notification of neighbours within specified buffer zones; (c) a narrow time window of November to January; (d) adoption of application technology that reduces spray drift; and (e) mandatory downwind buffer zones.

c) What constraints apply to permissible use of individual pesticides?

Specific laws vary across states and territories. The following example illustrates what is required of agricultural chemical users in Victoria (Corry, 1996; CSB, 1998).

The Victorian Agricultural and Veterinary Chemicals (Control of Use) Act 1992 places controls on fertilisers and agricultural and veterinary chemical use and sets out offences for certain uses, including:

- use at a higher rate than the maximum rate specified on the label for that use;
- more frequent use than that specified on the label for that use;
- use contrary to a specific label restriction;
- use of a chemical that causes off-target damage;
- application of a chemical using defective spraying equipment; and
- failure to observe the withholding period for that use.

Victoria has established Chemical Control Areas to protect various horticultural and other crops from spray drift at particular times of the year and in specified geographic areas. Picloram, hexazinone liquid (eg Velpar), sulfometuron methyl (eg Oust), and triclopyr ester (eg Garlon, Grazon) are prohibited for aircraft spraying or mister in such areas. Permits are required for chlorsulfuron (eg Glean, Siege), clopyralid (eg Lontrel), metsulfuron methyl (eg Brush-Off), glyphosate, amine forms of 2,4-D, 2,4-DB, MCPA, MCPB, dicamba, mecoprop and triclopyr.

d) What control applies over use of pesticides (where, when and how)?

While not always required by legislation, agricultural chemical use is increasingly brought under quality control programs that require accurate records to be kept of dates, quantities, active ingredients and other related information. Producers tend to take certification courses for quality assurance programs, which may cost them several thousand dollars per course and impose ongoing administrative and record keeping expenses.

Victoria urges that records be kept on spraying (date, weather conditions, chemical, crop, growth stage, pest, operator, safety equipment), calibration (date, rate, settings, calibrator), maintenance (date, replacement of nozzles) and accidents (fire, spills, poisoning), as required under the Occupational Health and Safety Act 1985.

Any person offering ground-based agricultural spraying services must hold a Commercial Operators Licence from the Department of Natural Resources and Environment, including farmers who may provide a spraying service to their

neighbours or others for gain. (To obtain a three-year licence, one must satisfactorily complete an approved training program, such as the Farm Chemical Users Course, or a recognised equivalent, and pay the approved fee of \$380). The Department of Human Services is responsible for the licensing of commercial spray operations on Public Land and within urban areas.

Licence-holders must: (a) make and keep accurate written records for a period of two years of all herbicides, insecticides, growth regulators and fungicides used; (b) hold an insurance policy of an approved type with liability cover for property damage and bodily injury (caused by providing an agricultural spraying service) for at least \$30,000.

To operate a commercial aerial spraying service or to employ pilots to carry out aerial spraying, one must hold an Aircraft Operator Licence. Any pilot who conducts aerial spraying for a business must be the holder of a Pilot (Chemical Rating) Licence, while the owner/operator is required to hold both licences. To obtain an Aircraft Operator Licence, a business must be Operation Spraysafe accredited, or be assessed by the Department of Natural Resources and Environment as operating to an equivalent standard. The cost for a three-year licence is \$560 (\$640 for a combined licence).

The Aircraft Operator Licence requires the same insurance, record keeping and record certification requirements as the Commercial Operator Licence.

All users of the following agricultural chemical products (except pilots or commercial ground operators) are required to hold an Agricultural Chemical User Permit:

1. any Schedule 7 poison which is an agricultural chemical (eg. aldicarb, aluminium phosphide, chloropicrin, dichlorvos, diquat, endosulfan, fenamiphos, methomyl, methyl bromide, mevinphos, paraquat, parathion, etc), not including animal health products or veterinary preparations;
2. atrazine; metham sodium; and the ester formulations of MCPA; or 2,4-D; or 2,4-DB; or triclopyr (off label use of these chemicals is prohibited).

These requirements aim to ensure that people who use chemicals with the potential to cause problems undertake recognised training. The use of Schedule 7 poisons, for example, is regarded as an extreme hazard to human health by the National Health and Medical Research Council and users should be trained in effective risk management strategies, as well as appropriate action in case of poisoning or other emergency.

Other chemicals on the prescribed list raise different concerns associated with their use. The ester herbicides can potentially cause damage to susceptible crops through an insidious form of drift called volatile vapour drift, while atrazine has been implicated in groundwater contamination both overseas and in Australia. Metham sodium releases a volatile material that sterilises the soil when activated.

To obtain a ten-year Agricultural Chemical User Permit (ACUP) from the Department of Natural Resources and Environment, one must satisfactorily complete an approved training program and pay the approved fee of \$38. Individuals who do not hold an

ACUP are allowed to use prescribed chemicals only under the direct and immediate supervision of an ACUP holder, who takes responsibility for the chemical use, including the record keeping.

As with commercial ground and agricultural aircraft operators/pilots, any person who uses agricultural chemicals requiring an ACUP must make and keep for a period of two years accurate written records of their use. These records, which must contain the information as prescribed in the regulations, be in a form that can be easily retrieved, and is understandable to others, should include:

1. name and address of chemical supplier;
2. name and quantity of chemical product;
3. batch number and, where applicable, expiry date of the product;
4. any specific written precautions received with the product in addition to the label;
5. withholding period;
6. address or location of treated area;
7. type of vegetation in the treated area;
8. name of pest or disease to be controlled or eradicated;
9. weather conditions at time of application, including temperature, wind direction and speed;
10. date and time of chemical application;
11. rate of application;
12. method of application;
13. name and address of person applying the chemical or, if applicable, the person supervising the application;
14. any permit issued under Schedule 1 of the Act, or any permit issued by the National Registration Authority.

Where an enterprise is accredited under a quality assurance program recognised by NRA (eg CattleCare), there is no requirement for chemical users within the enterprise to hold an ACUP. There is also an exemption from the record keeping requirement if the records are kept by the recognised quality assurance program.

In addition to the requirements listed above, agricultural aircraft operators/pilots and commercial ground operators must also record:

- the name and address of the applicator of the chemical;
- the name and address of the person for whom the chemical was applied;
- the identification marks of the spraying equipment and the registration number of any vehicle from which chemical was applied.

Both aircraft operators/pilots and commercial ground operators must also include a signed and dated certification statement with every record, stating that it is a true and accurate record of the agricultural spraying.

It is a requirement under Victoria's Agricultural and Veterinary Chemicals (Control of Use) Act 1992 that specific records be kept when using scheduled chemicals (Schedule 7 poisons, atrazine, metham sodium, ester formulations of MCPA, 2,4-

D, 2,4-DB, triclopyr) and that commercial operators keep records for all chemicals used.

In August 1996, Victoria established Chemical Control Areas in which the spraying of certain chemicals at specified times of the year is prohibited. This is to protect sensitive crops such as grape vines, vegetables, and fruit trees grown within such areas. Chemical Control Areas operate from August 1 through until April 30 in two areas and from September 1 to April 30 the following year in the other six areas. The Areas are defined by Parish boundaries and the Lot numbers within those boundaries.

Use of the chemicals listed below is prohibited by the application methods specified while the Chemical Control Area is in operation:

1. any formulation of picloram, sulfometuron methyl, esters of triclopyr, and formulations of hexazinone when applied as a liquid (prohibited when applied by aerial application or by mister);
2. the ester formulations of MCPA; 2,4-D or 2,4-DB (prohibited by any method of application). The following chemicals may be applied by aerial spraying or mister only by the issue of a permit from the Department of Natural Resources and Environment: chlorsulfuron, clopyralid, glyphosate, metsulfuron, and the amine formulations of MCPA; MCPB; 2,4-D; 2,4-DB; dicamba; mecoprop and triclopyr.

- e) What advisory bodies strengthen regulatory action and aim to modify agricultural practices?

Landcare, Waterwatch, catchment management groups, environmental NGOs and commodity-specific research and development corporations promote actions to encourage best practice and sustainable agriculture.

- f) What constraints apply to farmers shifting from chemical pest control to Integrated Pest Management?

Research and extension offered by public agencies, private firms and non-statutory industry bodies encourage farmers to shift away from chemical intensive activities. Most of this research is commodity-specific.

- g) What taxes apply to the use of pesticides?

No environmental taxes apply to pesticides. Imported pesticides are subject to tariffs and wholesale sales taxes (approximately 17 per cent ad valorem).

- h) What standards apply to equipment, storage and disposal of pesticides (including packaging)?

In Victoria, chemicals intended for use or being held prior to disposal must be stored in a secure, well-ventilated and dry area out of direct sunlight to prevent rapid deterioration. The area should have bunding to contain chemical spills and should only be used for storing chemicals. The product label often contains information about a product's specific storage requirements. Chemicals should be stored in their original containers (with labels) and the containers checked frequently for leaks, etc.

Proper management of farm chemicals and empty containers is also essential. Label instructions for disposal of the chemical and the container should be followed. All containers should be emptied, triple-rinsed and disposed of by: returning to reseller if container is recyclable; returning through an industry, Avcare, or other commercial disposal program; puncturing or crushing and disposing at an approved municipal tip. Rinsing water must not be allowed to drain into ground water, storm drains or water supplies.

4.1.4 Water quantity (on-farm constraints).

Where direct constraints may not exist at farm level, policies provide a kind of 'smoke alarm' system. A broad range of policy mechanisms is available but these may only become operational if problems become evident.

- a) Permits (in perpetuity or time-limited)

Water rights are tradeable entitlements in Australia. Markets exist in both permanent and temporary entitlements.

- b) Controls on maximum abstractions due to minimum stream flows, control on water tables, and/or temperature needs

Caps on water extractions operate in Australia's major irrigation zones. The long-term impact on water users varies from basin to basin. In New South Wales, estimates suggest that, on average, water availability is reduced by about 7 per cent.

Embargos exist on further irrigation licences.

Irrigators must obtain licences to extract groundwater.

Constructing new farm dams is not permitted in much of South Australia. Rights to build farm dams are tradeable and trade exists in some regions.

Farms dams policy in New South Wales allows for the collection of a maximum of

10 per cent of the runoff from the landholding each year. Harvested water is non-transferable. The harvestable right is not licensed and is separate from existing water licences held by landholders.

In New South Wales, licences on unregulated rivers specify maximum pump size and maximum area that can be irrigated.

c) Abstraction charges

Fees, levies and related charges are applied for water delivery, maintenance, resource use, data collection and research activities.

The following example is based on 1998-99 water prices for Murrumbidgee Valley, New South Wales (assumed average farm size of 220 ha):

Unallocated fixed water costs (ie unrelated to volume of water used)

1. bulk water charge at 100% allocation	\$2.01/ML
2. administration/service fee	\$285.00/farm
3. rice environment monitoring charge	\$142.50/farm
4. outlet fee - large wheel	\$65.00/wheel
5. outlet fee - small wheel	\$50.00/wheel
6. pipe or door	\$10.00/pipe or door
7. asset replacement levy	\$1.78/ML based on allocation
8. entitlement fee	\$1.00/ML based on allocation
9. NSW irrigators council/research levy	\$0.05/ML based on allocation

Variable water costs (ie related to volume of water used)

1. - water supply	\$9.09/ML
2. - bulk water charge	\$0.72/ML based on usage

Spray irrigation (sprinkler irrigation - diesel pump)

1. water charges	\$10.67/ML
2. pumping costs	\$18.55/ML
3. water usage price	\$29.22/ML

River pumper (surface irrigation - diesel pump)

1. delivery service charge	\$0.75/ML
2. water usage	\$0.73/ML
3. resource management charge	\$1.35/ML (based on allocation)
4. pumping costs (over page)	\$4.22/ML
5. water usage price	\$7.05/ML

Murray Valley Berriquin irrigation district

1. water charges	\$7.53/ML
2. fixed Charge	\$5.43/ML
3. LWMP	\$2.19/ML
4. water usage price	\$15.19/ML

River pumper (surface irrigation - diesel pump)

1. delivery service charge	\$0.64/ML
2. metering charge	\$0.72/ML
3. resource management charge	\$1.35/ML
4. pumping costs	\$4.22/ML
5. water usage price	\$6.93/ML

d) On-farm water storage requirements

In areas prone to bush fires, farms are often required to maintain water tanks for fire brigades.

e) Controls on technology

Few irrigation areas place regulatory controls on irrigation system.

f) Seasonal and/or time of the day limits

Seasonal and time constraints on water use are a function of the water cap for environmental flows and droughts, as well as local rules developed within irrigation districts.

g) Restrictions on field drainage and/or requirements for flood control practices on farms

Field drainage restrictions vary by district, but are not yet viewed as causing cost-related problems for producers.

(h) Restrictions regarding development on floodplains and/or near coasts

Restrictions are place on designated water protection zones, wetlands, estuaries and related sites with biodiversity benefits.

4.2 Soil

Catchment management and Landcare activities are the primary response to soil and land management issues in Australia. These voluntary arrangements promote land management practices, including contour banks to control and reduce water run-off, stubble retention, strip cropping, returning land to native forest and changes in cultivation methods.

4.2.1 Soil quality

a) Quality and quantity constraints regarding inputs applied

Concern about cadmium is such that authorities have taken specific steps to limit dietary intake, including: (1) reducing the level of cadmium allowed in phosphatic fertilisers; (2) eliminating the feeding of phosphate supplements containing high levels of cadmium to cattle; (3) banning the sale of offal from aged sheep and cattle (there is an age-related increase in cadmium concentrations in animal offal such as liver and kidney); (4) regulating the disposal of industrial wastes into urban sewerage systems to minimise contamination of agricultural lands by cadmium; and (5) monitoring cadmium levels in fertilisers, soils and commodities by Commonwealth and state/territory agencies.

As part of its quality assurance program, the Australian Wheat Board (AWB) monitors residues such as pesticide levels in grain after harvest and fungicides and heavy metals before harvest. The AWB standards are stricter than the international MRLs and residue samples are taken to ensure that the requirements of customers (including overseas and domestic government authorities) are met. The Australian Wine and Brandy Corporation (AWBC) also monitors residue levels to ensure that their products meet international MRLs.

b) Constraints on usage of sewage sludge and other important non-agricultural wastes

See section 4.1.

4.2.2 Soil erosion

a) Any requirements related to salinisation and irrigation

Feedlots must provide documentation showing that the application area is sufficient to handle the salts expected in effluent used for irrigation.

b) Land disturbance rules

Feedlots must provide detailed data showing the suitability of soils for intended purposes.

c) Control plans and requirements regarding crop residues, green cover over winter

Control plans for crop residues and green cover are voluntary.

d) Forestry laws

Agricultural and residential properties are protected from plantation forestry practices.

e) Land care programmes

The National Landcare Program promotes partnerships and integrated action among governments, industries and communities in order to bring about lasting change in land management practices. Landcare activities are focussed on raising awareness of sustainable farming practices, ensuring the transfer of information about such practices and encouraging their widespread adoption. It also establishes institutional arrangements to develop and implement policies and programmes that support sustainability. More than one-third of Australia's farm population are members of Landcare groups. The OECD reports that Landcare activities have attracted A\$4 in private investment for every A\$1 in government grants (OECD, 1998).

f) Land classification procedures and constraints driving such classifications

The Standing Committee on Agriculture divides Australia into 11 agro-ecological regions for assessing environmental indicators, including soil conditions, soil erosion and nutrient balance.

g) Provisions in Codes of Good Agricultural Practice.

Australia uses a 'duty of care' approach to all activities that may impact on natural resources. Duty of care means that it is the duty of an owner of land to take all reasonable steps to prevent degradation of the land. See Appendix J for state by state criteria.

4.3 Air

4.5.1 Air quality (odour, ammonia, and noise) – at farm level

a) Distance and siting rules

The guidelines protecting communities from odours generated by feedlots, dairies and piggeries set out various factors to consider: the quality of effluent discharge (eg effluent containing concentrated sulphur compounds may yield odour problems); type of effluent treatment systems; methods used to minimise and treat odours generated from effluent treatment, storage and disposal; whether effective buffer zones have been considered at all stages of the planning process for the operation, including the distance between sites where operations are undertaken and the surrounding amenities; physical barriers (topography and vegetation);

climatic conditions, including wind direction, speed and turbulence (eg by plume modelling); and community consultation and involvement.

Piggery operators should keep a register of all odour complaints as part of a their Environmental Management Plan. This register should include time, duration of the event, meteorological conditions (temperature, humidity, wind speed, wind direction), and any changed management or operational practices at the time. The cause of the odour, if known, and any remedial action taken to rectify the problem should also be recorded.

See Table 4.1 above for additional rules and examples.

b) Housing requirements

See Section 4.1

c) Application of manure

See Section 4.1

d) Permits

See Section 4.1

e) Covers for waste stores

See Section 4.1

f) Provisions in Codes of Good Agricultural Practice

See Section 4.2 and Appendix J

4.5.2 Air quality (*pesticide drift*)

a) Application constraints

See Section 4.1.3

b) Label requirements

See Section 4.1.3

c) Spraying

See Section 4.1.3

d) Consent procedures

See Section 4.1.3

4.3.4 Air quality (burning)

a) Controls on crop residue burning

Most communities provide guidelines related to fire risk management practices that are not specific to crop residue burning. Permission may be required in areas close to populated centres.

4.4 Nature conservation, biodiversity and landscape

4.4.1 Biodiversity, endangered species, habitat conservation, cultural heritage, ancient monuments, protected landscapes

a) How much land is potentially affected by major constraints?

No credible estimates exist for Australia. Most of the affected land is in the Northern Territories and Queensland and most of this land is potential agricultural area, not existing farmland.

b) Rules on interstitial features

Approvals must be obtained for agricultural activities occurring close to sites of Aboriginal importance. See Section 4.1.

c) Control of farmland for habitat conservation

The states and territories have enacted a range of legislation and programs aimed at improving land management practices. In particular, recent legislation intended to protect the nation's biodiversity resources has greatly limited vegetation clearance, even on private land (see Appendix E). In South Australia, consent is required to clear any native vegetation and no broadacre clearing has been approved since 1991. Queensland has set up a satellite monitoring program to enforce its new land clearance rules, while Victoria requires permits to clear any

block greater than one hectare. The National Landcare Program has played an important role in developing evolving land use legislation at the state/territory and community levels.

In Victoria, the Catchment and Land Protection Act 1994 states that landowners must take all reasonable steps to:

- avoid causing or contributing to degradation to another's land;
- conserve soil;
- protect water resources;
- eradicate regionally prohibited weeds;
- prevent the growth and spread of regionally controlled weeds; and
- prevent the spread of, and as far as possible, eradicate established animal pests.

In Queensland, the Environmental Protection Act 1994 imposes a duty of care on everyone to take all reasonable and practicable measures to prevent or minimise environmental harm. There are no legal consequences for not fulfilling this duty. The legislation is intended to encourage industry self-regulation through codes of practice.

In South Australia, the Environmental Protection Act 1993 sets out a general environmental duty of care requiring that a person must not undertake an activity that pollutes or might pollute the environment unless that person takes all reasonable and practicable measures to prevent or minimise any resulting harm. The Soil and Landcare Act 1989 states, 'It is the duty of an owner of land to take all reasonable steps to prevent degradation of the land.'

In Western Australia, a Task Force appointed to review natural resource management recommended, in its Draft Report, the codifying a duty of care as follows: 'It is the duty of an owner of land to take all reasonable steps to: protect natural resources and sustainably manage the land; and avoid causing or contribution to land degradation which causes or may cause damage to land of another land owner.'

d) Development constraints

See part c above.

e) Management and grazing rules

Grazing activities are expected to maintain regional biodiversity. Tight restrictions apply only to leasehold land where permits are no longer issued for clearing vegetation in zones with conservation value, riparian land and areas of heritage value.

f) Mowing dates

Mowing dates are not regulated.

g) Input control

See Section 4.1

h) Buffer strips;

See Section 4.1

i) Controls of buildings

See Section 4.1

j) Water management

See Section 4.1

4.4.2 *GMOs*

a) Which definition of GMOs is applied in the legislative procedure?

A genetically modified organism (GMO) is an organism produced by genetic manipulation and whose resultant genetic make-up is unlikely to occur in nature. These do not include organisms obtained by conventional techniques and traditional breeding methods.

A food produced using gene technology is a food which has been derived from an organism which has been modified by gene technology, but does not include any substance regulated as a food additive or a processing aid (ANZFA, 1999b).

Gene technology refers to recombinant DNA techniques that alter the heritable genetic material of living cells or organisms (ANZFA, 1999b).

A new food standard for genetically modified food for Australia and New Zealand came into force on 13 May 1999. The Australia and New Zealand Food Standards Council agreed to this standard in July 1998. The standard requires that any genetically modified food must be assessed as safe by ANZFA before it is allowed on the market. If the food is a viable crop, it must also be approved by the Genetic Manipulation Advisory Committee in Australia or the Environmental Risk Management Authority in New Zealand.

The current standard requires genetically modified food to be labelled so that consumers know how it is different from its traditional counterpart. For example, rice that is genetically modified to contain more iron must be labelled as such.

b) Are they authorised, marketed and can you grow GMO crops?

There have been 112 field trials of genetically modified organisms in Australia, which ranks the country eighth among OECD countries and accounts for about 1 percent of OECD total trials (Foster, 1999). Australia has had 98 plant field trials, 12 micro-organisms trials (bacteria, rhizobium, virus, yeast), and 2 with an insect (the bollworm). Cotton has had 38 field trials; canola 8; potatoes 7; clover 6; field peas 5; and wheat and barley 3 each (Foster, 1999).

Australia has had three releases of commercial genetically modified crops: an insect resistant (Bt) cotton in 1996; a carnation in 1994 with improved vase life; and a carnation in 1996 with an altered colour (blue) (Foster, 1999). An estimated 85,000 ha were planted to Bt cotton in 1998, compared with 60,000 ha in 1997 and 30,000 ha in 1996.

The Wildlife Protection (Regulation of Exports and Imports) Act 1982 (WPA) meets Australia's obligation as a signatory to the international Convention on International Trade in Endangered Species (CITES) and furthers the protection and conservation of wild flora and fauna of Australia and other countries. No GMOs or GMO products have yet been imported or exported under the WPA. Species, organisms, groups of organisms or products covered by the Act would be regulated regardless of whether they were genetically modified or derived from GMOs.

Australia imports soybean seed from the United States for processing in vegetable oil and protein meal. As a result of the regulatory decision in the US, from late 1996 these imported soybean seeds contain a proportion of transgenic seeds.

c) Controls on buffer and GMO crops

Australia has established a Genetic Manipulation Advisory Committee (GMAC) as a non-statutory body to oversee the development and use of innovative genetic manipulation techniques in Australia so that any biosafety risk factors associated with the novel genetics of manipulated organisms are identified and can be managed. GMAC also advises ministers about matters affecting the regulation of innovative genetic manipulation technology.

The responsibilities of the Committee include concerns about public health and safety, agricultural production, and the quality of the environment. For the purpose of its overseeing activities, GMAC has prepared four sets of guidelines: *Guidelines for Small Scale Genetic Manipulation Work*; *Guidelines for Large Scale Genetic Manipulation Work*; *Guidelines for the Deliberate Release of Genetically Manipulated Organisms*; and *Guidelines for Activities with the*

Potential for Unintended Release of Genetically Manipulated Organisms. It is the responsibility of all persons engaged in research, development, trial or release of GMOs to familiarise themselves with and to comply with the relevant guidelines at each stage of their work.

- d) Refugia associated with GMO crops

See part a above

4.5 Animal welfare

4.5.1 Housing of animals

- a) Minimum cage size for poultry

The Agricultural and Resource Management Council of Australia and New Zealand agreed that minimum space allowances for the domestic fowl held in cage systems for egg production be installed in the statute law of all states and territories as of 1 January 1996. The standard provides a minimum space allowance of 450 sq cm per layer hen under 2.4 kg, with heavier birds receiving 600 sq cm, calculated to include the area under any egg baffle/manure deflector. Breaches of these legal requirements can be prosecuted (BAW, 1997a).

Table 4.3 Cage Size for Laying or Breeding Fowls Weighing up to 4.5kg Liveweight

Types of cage	Minimum cage floor area per bird(cm ²)
3 or more fowls(<2.4kg) per cage	450
3 or more fowls (>2.4kg) per cage	600
2 fowls per cage	675
single fowl cages	1000

Table 4.4: Cage Size for Laying or Breeding Fowls Weighing more than 4.5 kg Liveweight

Types of cage	Maximum liveweight per unit of floor area (kg/m ²)
3 or more fowls	460
2 fowls per cage	40
single fowl cages	26

b) Principal welfare related housing requirements for animals

For cattle: the stocking density of pens or yards must take into account age, size, behavioural needs, movement and feeding patterns of cattle. In any event, an absolute minimum space requirement of 9 m²/head must be provided. In the case of shedded animals, an absolute minimum of 2.5 m² must be provided for each animal.

Table 4.5 Maximum recommended stocking densities for housed pigs

<i>System</i>	Minimum space allowance (m² per pig)	Comments
Growing pigs up to 10 kg in groups.	0.11	Approximately 20 to 30 per cent of space allowance provides for a dunging area.
11-20 kg	0.18	
21-40 kg	0.32	
41-60 kg	0.44	
61-80 kg	0.56	
81-100 kg	0.65	
Adult pigs in groups	1.4	
Adult pigs in individual stalls	0.6 m x 2.0m	2.0m length means 2.0m clear space, not including feed and water facilities.
Sows in farrowing crates	0.5m width x 2.0m minimum length	
Boars in pens used for mating	6.25	Minimum length of shortest side 2 m
Lactating sows and litters:		
stalls	3.2	With piglets up to 4 weeks of age.
individual pens	5.6	With piglets up to 4 weeks of age.
suckling groups	5.6	For each sow and litter.

Source: BAW, 1997b

c) Welfare legislation on tethers

Tethering is an unacceptable practice.

d) Tail cutting, de-beaking, etc

The Code of Practice for Poultry advises that, when performed as a preventive measure, beak trimming should be carried out by a competent operator soon after hatching and preferably within three weeks. For chickens, the operator may remove not more than half of the upper beak and one-third of the lower beak (BAW, 1997a). This means:

- for day-old chickens, not more than 3 mm of the upper and 2.5 mm of the lower beak; for 10-day old chickens, not more than 4.5 mm of the upper and 4 mm of the lower beak; and

- further trimming of the beaks of growing birds may be necessary to prevent cannibalism during the laying period but not as a means of restricting or retarding body weight.

For poultry, castration ('surgical caponising'), devoicing, de-winging, pinioning, notching or tendon-severing to restrict flight in poultry are unwarranted practices and should not be performed.

e) Transport of animals

The stocking density for day-old chickens for transportation should not exceed 25 cm² per bird (standard containers are 60 cm by 45 cm for 100 chickens) (BAW, 1997).

For transportation, the recommended maximum liveweight densities for growing and adult fowls are: 55 kg/m² under hot and/or humid conditions; and 60 kg/m² for other times.

Transport guidelines exist for beef, sheep, poultry and other animals. These are not considered to cause cost constraints for producers.

4.5.2 Slaughter of animals

a) Rules on inspections and who pays for them

Abattoirs are inspected by independent auditors from quality assurance programs, HACCP, and from agencies appointed by the European Union, Japan and the United States. Costs are borne by the industry. Legislation mandates slaughterhouses to have HACCP-based quality assurance plans.

4.6 Human health

4.6.1 Hormones and animal feed requirements

a) Rules on BST

BST is not allowed in Australia.

b) Rules on growth promoting hormones

Growth hormones in beef are permitted. Record keeping is mandated so exports are allowed to countries banning imports of meat produced with growth hormones.

c) Rules on the use of antibiotics in animal feed

Registration of tylosin phosphate and spiramycin expires 30 June 1999. Bacracin zinc and virginiamycin are not registered for use in Australia.

4.6.2 Residues in food

a) Rules on nitrate and pesticide residues in food

See Chapter 3.

The Australian Quarantine and Inspection Service regulates most food exports (including beef, sheep, horticultural products, poultry, eggs, pork and grains) and facilitates trade. AQIS's export functions include inspecting and certifying products for export and assisting export of food products by providing information and services. Chemical-commodity combinations are selected for inspection on the basis of risk profiles. In developing risk profiles, the following factors are taken into consideration: international and/or domestic perceptions of the chemical-commodity combination as a possible public health hazard; the likelihood of residues occurring in the product (potential for misuse, persistence in the crop, animal or environment, extent of use and use patterns); the extent and results of previous monitoring for the chemical-commodity combination; the toxicity of the chemical or its break-down products; and other factors such as the availability of suitable sampling and analytical methods. In addition, AQIS monitors specific chemicals that may not be registered in Australia but are required by importing countries.

AQIS fees are paid by users and are deemed to be excessive by many exporters (FRRC, 1998).

4.6.3 Applicator safety

See Section 4.1.

4.6.4 Hygiene rules

The National Food Authority's food hygiene standard requires all food businesses to have a food safety plan based on HACCP principles. There is a phasing-in of this requirement for different sectors of the food industry.

Australia's rules are in line with those for European Union dairy activities.

4.6.5 Veterinary requirements and conditions to control animal diseases

The Australian Veterinary Emergency Plan (AUSVETPLAN) is a coordinated national response plan for the control and eradication of emergency diseases and certain emerging or endemic animal diseases. In most cases a 'stamping-out' policy will be employed, involving: (a) quarantine and movement controls; (b) the slaughter and disposal of infected and exposed animals; (c) decontamination of infected premises; (e) surveillance of susceptible animals; and (f) restriction of the activities of certain enterprises (DAFF, 1999).

These measures may be supplemented (or replaced) where necessary by vaccination, vector control campaigns, animal treatment and wild animal control. Infected and disease-free areas are established to contain the disease agent and to facilitate trade. In Australia, each state and territory has operational responsibility for the control and eradication of animal diseases, whether endemic or exotic, within its borders. Each state and territory therefore administers its own emergency disease control legislation. This legislation is further supported by emergency service arrangements. Commonwealth legislation includes powers under the Quarantine Act 1908 that are available to support the states and territories, where appropriate.

The purpose of AUSVETPLAN is to: provide a structure for the management of an animal disease emergency in which each element has an identifiable place; provide coherence of emergency disease plans; provide compatibility and uniformity of operation and procedures between Commonwealth/state/territory animal health authorities and emergency management organisations; improve the technical validity of underlying assumptions in the development of strategies to combat disease emergencies; identify deficiencies in technical knowledge required to combat a disease emergency and establish research priorities; and provide a focus for training of people in appropriate operational responses and procedures.

Under the cost-sharing agreement for the eradication of certain exotic animal diseases, the cost of eradication is borne by the Commonwealth (50 per cent) and the states/territories (50 per cent). Each state/territory pays a proportion fixed according to a formula established for each of the 12 diseases covered. The cost-sharing agreement applies only while CCEAD advises ARMCANZ that 'eradication is considered to be reasonably possible'. A cost-sharing agreement is in place for the following exotic diseases:

- African swine fever;
- bluetongue (in its classical virulent form);
- classical swine fever (hog cholera);
- foot-and-mouth disease;
- Newcastle disease (in its classical virulent form);
- rabies;
- rinderpest;
- screw-worm fly;
- swine vesicular disease;
- vesicular exanthema;
- vesicular stomatitis; and
- virulent avian influenza.

- a) Measures to control animal diseases, which are relevant to human health

See Chapter 3 on monitoring and testing.

- b) Measures to control the Newcastle disease

Australia's strategy is immediate stamping-out of Newcastle disease and the disposal of infected or exposed products to remove the most dangerous source of the virus. This is done in association with: strict quarantine and movement controls to contain the virus; decontamination to remove any remaining virus; tracing and surveillance to determine the extent of infection; and zoning to define infected and disease-free areas. Vaccination may be used in certain circumstances.

- c) Rules for the disposal and processing of animal waste

Guidelines and protocols are in place; see Chapter 3.

Chapter 5 THE ECONOMIC IMPLICATIONS OF COMPLIANCE WITH ENVIRONMENTAL REGULATIONS

5.1 Introduction

To date, the available literature evaluating the impact of environmental policies on agricultural activities suggests that on-farm compliance costs are not causing significant problems. Interviews with industry specialists, government departments of agriculture, and beef, sheep, grape, vegetable and orchard producers confirm this general consensus. For some commodities in some locations, increasingly stringent environmental policies may slow the rate of expansion, while for other commodities policies may accelerate their decline. However, the major factors influencing agricultural growth, expansion, productivity and location are much more related to output prices and both domestic and export market opportunities. Among the important explanations for this conviction include the following.

First, Australia's export-oriented agriculture has learnt over the generations to adapt quickly to evolving market conditions, including more stringent environmental, health and safety imposed on its exports. AS well, the country's public and private institutions have built up a range of signalling mechanisms to pass on key information to support producers. These signalling mechanisms include: relatively undistorted input and output prices; reliable product information on evolving consumer preferences; easy access to documentation on import requirements by commodity and by country; and research and extension networks that encourage resource conservation practices by commodity.

Second, Australia's producers market a great deal of their food production in designated premium markets (ie. those markets with the highest food safety and environmental standards, namely the EU, Japan, Korea and the US). Import requirements often vary significantly between these countries, so agricultural and food producers have developed procedures to react quickly to changes within and between markets.

Third, the predominant view of Australia's agribusiness community is that food safety is the country's most important agricultural issue (FRRC, 1998). The response of processors, marketers and exporters is to work up and down the food chain with quality assurance programs. Quality assurance serves the dual purpose of minimising the risk of 'tainted' produce, while the record keeping requirements allow tracing the problem to its source for quick resolution. Beef, dairy, horticulture and grains are all implementing quality control programs.

Fourth, while agricultural producers have become increasingly land and input intensive over the past two decades, dairy, beef, sheep, vegetable and fruit production is still based on relatively extensive production methods. For example, dairy and beef cows rely on pasture for most of their nutrients. In addition, Australia is one of the least densely populated countries in the world: the OECD average population density is eleven times Australia's level. This low population density combined with its highly urbanised population mean that a very high proportion of Australians live and work in

locations far removed from agricultural activities. The result is fewer conflicts between urban communities and rural industries.

Fifth, environmental policies do contribute to location shifts but they are unlikely to inhibit output expansion or dictate producer decisions except at the margin. In the longer run, environmental pressures and market forces are likely to impact on those rice and cotton producers who are pesticide intensive and rely on subsidised water.

Sixth, the trend in environmental policy is to use economic instruments, which allows individual producers to abate at least cost. Over time, this approach to environmental policy making leads to higher value uses of scarce natural resources, more efficient producers, and induces technological choices that minimise relatively expensive inputs. The level of waste and misuse of natural resources in Australia suggests that efficiency gains can offset production and productivity losses.

Environmental compliance costs related to water, air and chemical use are only a small proportion of total costs. For those cases where input costs are small yet this input is essential, producers tend to find new ways to offset increases eg, taxation options, corporate restructuring; leasing water rights instead of purchasing water (since payments to lease water is fully tax deductible).

One crude way to view the relative importance of water, fertilisers, and pesticides in total expenditures is presented in Table 5.1 for five industries at the national level. The costs associated with water use, pesticide use and fertilisers together make up 13 per cent of total expenses for fruit producers; 15 per cent for vegetable growers and around 24 per cent for grain crops. For beef and dairy, the proportion of water, fertiliser, pesticides and veterinary costs in total costs make up just 4 per cent and 14 per cent, respectively. At 1996/97 price levels, if compliance with environmental regulations had simultaneously doubled water costs, pesticide costs, fertiliser costs and veterinary expenses, net returns would still have been positive for every industry except vegetables.

This chapter focuses on the cost implications of water-related policies. Australia's water sector reforms have significant implications across sectors, commodities, and geographic regions. By contrast, each of the other five issues (soil, air, nature conservation, animal welfare and human health) are likely to have much smaller cost implications and apply to relatively few Australian producers.

**Table 5.1 Farm Business Expenses: Industry Averages 1996/97
Percentage of Total Expenses**

	Fruits	Vegetables	Grain	Beef	Dairy
(per cent).....				
Expenses					
Water	2.1	0.6	1.1	0.5	2.3
Fertiliser	5.1	8.1	12.9	2.6	7.3
Pesticides	5.0	6.4	10.5	0.7	0.6
Veterinary products	0.2	0.3	0.7	2.3	3.8
Livestock purchases	0.6	2.4	3.8	24.1	2.2
Seeds	1.9	6.4	1.9	0.6	1.2
Fodder	0.4	0.3	0.9	9.1	22.0
Marketing expenses	16.1	12.4	13.2	4.8	7.7
Electricity	2.6	2.7	0.9	0.8	2.5
Fuel	3.0	6.0	8.0	4.6	3.6
Contractors	6.6	3.6	6.6	2.3	2.4
Repairs	7.3	8.3	9.3	6.5	9.2
Leasing expenses	2.6	2.6	1.7	1.8	3.3
Rates and taxes	1.7	1.2	1.9	3.3	1.7
Insurance	2.3	1.7	2.6	1.8	1.4
Wages	24.3	18.6	5.9	9.6	8.1
Interest	5.7	5.5	8.4	10.1	9.1
Other expenses	12.5	12.9	9.8	14.6	11.6
Total Expenses	100.0	100.0	100.0	100.0	100.0
Ratio of total expenses to total revenue	0.87	0.96	0.72	0.92	0.80

Source ABS, 1998, Agricultural Industries Financial Statistics

5.2 Water

Australia's water policy reforms are likely to lead to higher water costs per unit of water used as the country moves to adopt the COAG water reforms. In the future, much higher unit costs should be expected as further reforms are enacted and as market forces influence the price for water. For example, public irrigation system fees are increasing not only to cover operating expenses and capital costs of storage and supply structures, but also to cover refurbishment and replacement of depreciating infrastructure. Many irrigation structures are now at or near the end of their useful lives (Crabb, 1997).

At the same time, the volume of water used per irrigated crop is likely to decline and, in many cases, so too will the total expenditure on water related expenses. This is because producers conserve water by using less, including through investing in new water saving technologies.

However, there is little evidence anywhere in Australia that these higher short-term unit costs are imposing an enterprise-threatening situation except for pasture. In many cases, pasture producers are simply taking advantage of the higher water prices and selling their unused allocation or selling their properties that are being transferred into higher value uses.

The evidence suggests that water entitlement transfers between irrigators have been from lower to higher value commodities, such as from 'sleeper' pasture entitlements in South Australia's Lower Murray to vegetable production in the Riverland (Crabb, 1997; WRMS, 1994). Dairy producers, rice producers and cotton producers may feel a greater cost squeeze in the future as overall subsidies to their industries are reduced.

There are a number of reasons why higher unit water costs are not imposing problems for non-pasture irrigators. These include:

- water costs are only a small proportion of total costs. For those cases where input costs are small yet critical, producers have flexibility to reduce costs in other areas, eg., taxation options, corporate structure, etc;
- alternatives are available to offset higher unit water costs and provide opportunities for cost saving improvements, eg., leasing water rights is tax deductible;
- a number of irrigation and water use studies suggest that much more water is used in production processes than necessary. Many irrigators are able to make management changes allowing them to greatly reduce their water consumption;
- all current on-farm irrigation investments are much more efficient in water saving technologies and they utilise management systems. Examples include under-canopy sprinklers, mini-sprinklers, drip systems, centre-pivot systems that produce 'soft rain', laser land forming, soil moisture measuring equipment, and efficient drainage;
- in South Australia, the use of furrow irrigation declined from 50 per cent of the total area in 1976 to 20 per cent by the mid 1990s. Along the Murray in the Sunraysia district 70 per cent is irrigated by furrow and flood methods while the figure in New South Wales 84 per cent (Crabb, 1997);
- changes to improve water use efficiency are also taking place in the livestock sectors. For example, piped reticulation systems for stock watering are being installed on many properties in place of farm dams; and
- over the past decade, higher water charges and opportunities offer by booming industries like wine grapes have encouraged water transfers out of low value uses. For example, water entitlements used on pasture in South Australia's Lower Murray have moved to vegetable production in the Riverland. (Crabb, 1997; WRMS, 1994).

Table 5.2 illustrates that water and drainage costs are one of the smallest expense categories incurred by agricultural producers in Australia's driest state (South Australia). The trend has been for increasing water-related costs. The share of water expenses increasing from 1 per cent in 1994-95 to 3 per cent in 1996-97.

**Table 5.2: South Australian Financial Expenses
For All Agricultural Industries**

Purchase Expenses	1994-95	1995-96	1996-97	1994-95	1995-96	1996-97
	<i>\$m</i>	<i>\$m</i>	<i>\$m</i>	%	%	%
Water and drainage charges	18.90	21.8	36.8	1	2	3
Payments for Veterinary supplies and services	22.20	30.1	28.9	2	2	2
Payments for fertiliser	158.90	179.3	179.7	12	13	12
Payments for crop and pasture chemicals	110.50	104.4	142.9	9	7	10
Payments for electricity	26.20	33.7	33.9	2	2	2
Payments for seed	33.10	30.4	47.9	3	2	3
Rent and leasing expenses	10.90	44.4	61.6	1	3	4
Purchases of livestock	90.00	123.3	86.5	7	9	6
Payments to contractors	86.00	76.0	86.0	7	5	6
Payments for fodder	81.60	72.1	110.1	6	5	8
Payments for fuel	120.90	110.5	112.8	9	8	8
Repairs and Maintenance	185.50	172.2	166.1	15	12	11
Other selected expenses	90.60	189.5	157.6	7	14	11
Marketing expenses	243.80	215.5	209.4	19	15	14
<i>Purchases and selected expenses</i>	<i>1,279.20</i>	<i>1,403.10</i>	<i>1,460.2</i>	<i>100</i>	<i>100</i>	<i>100</i>
Rates and Taxes	41.7	42.9	48.3	-	-	-
Insurance payments	48.2	52.5	48.2	-	-	-
Other expenses	70.6	68.0	68.4	-	-	-
Wages, salaries and supplements	189.6	194.0	212.3	-	-	-
Interest paid	151.1	178.0	184.0	-	-	-

Note: Percentages are not based on total expenses incurred, they are valid for purchases made by farms only (ie, they don't include expenditure on rates and taxes, insurance, wages or interest).

Source: ABS, Selected Financial Statistics, South Australia

Table 5.3 illustrates the cost and share of expenses for fruit and vegetable producers in South Australia. The average cost share of irrigation (between 1994-95 to 1996-97) for fruit and vegetable producers is considerably higher (10 and 3 per cent respectively) than the overall average for all agricultural industries (which was 2 per

cent).

Table 5.3: South Australian Financial Expenses for Fruit and Vegetable Industries

<i>Item</i> <i>Industry</i>	1994-95 <i>(\$'000)</i>	1995-96 <i>(\$'000)</i>	1996-97 <i>(\$'000)</i>	1994-95 %	1995-96 %	1996-97 %
<i>Payments for Crop and Pasture chemicals</i>						
Fruit	10,358	9,718	13,453	12.0	10.4	11.2
Vegetable	9,973	8,375	12,582	12.2	13.6	22.4
<i>Payments for fertiliser and soil conditioners</i>						
Fruit	5,349	8,034	12,964	6.2	8.6	10.8
Vegetable	11,975	12,316	10,939	14.7	20.0	19.5
<i>Payments for seed, seedlings and plants</i>						
Fruit	4,813	4,546	9,994	5.6	4.9	8.3
Vegetable	11,782	8,492	10,588	14.4	13.8	18.9
<i>Other crop and pasture expenses</i>						
Fruit	4,180	1,341	2,537	4.8	1.4	2.1
Vegetable	607	776	2,004	0.7	1.3	3.6
<i>Contract payments for work on crops and pastures</i>						
Fruit	11,730	20,542	22,350	13.6	21.9	18.6
Vegetable	6,534	1,365	2,773	8.0	2.2	4.9
<i>Rates paid to Vermin and weed authorities</i>						
Fruit	27	59	140	0.0	0.1	0.1
Vegetable	0	2	1	0.0	0.0	0.0
<i>Water rates and drainage charges</i>						
Fruit	6,540	10,894	14,760	7.6	11.6	12.3
Vegetable	1,827	1,069	2,317	2.2	1.7	4.1
<i>Land tax & land rates</i>						
Fruit	2,831	4,944	5,185	3.3	5.3	4.3
Vegetable	1,699	1,193	1,449	2.1	1.9	2.6
<i>Other rates taxes & licences</i>						
Fruit	824	1,440	1,748	1.0	1.5	1.5
Vegetable	265	383	346	0.3	0.6	0.6
<i>Electricity & gas charges</i>						
Fruit	5,611	6,232	8,380	6.5	6.7	7.0
Vegetable	3,425	3,664	3,059	4.2	6.0	5.5
<i>Payment fuels & lubricants</i>						
Fruit	9,117	6,700	9,267	10.5	7.2	7.7
Vegetable	7,999	7,755	3,638	9.8	12.6	6.5
<i>Marketing expenses</i>						
Fruit	25,102	19,224	19,274	29.0	20.5	16.1
Vegetable	25,465	16,058	6,372	31.2	26.1	11.4
<i>Total Expenses</i>						
Fruit	86,482	93,674	120,052	100.0	100.0	100.0
Vegetable	81,551	61,448	56,068	100.0	100.0	100.0

Source: ABS, Selected Financial Statistics, and South Australia

The 5 highest cost categories incurred by vegetable producers in 1996/97 is crop and pasture chemicals (22 per cent); fertiliser and soil conditioners (20 per cent); seed, seedlings and plants (19 per cent); marketing expenses (11 per cent); and fuel and lubricants (7 per cent). In comparison, water rates and drainage charges in 1996-97 represented just 4 per cent of total expenses for vegetables.

Table 5.4 illustrates the percentage share of costs by expense categories for premium and non-premium grapes and for field and glasshouse tomatoes. As a percentage of total expenses, water's share ranges up to 12 per cent for the premium wine grapes. However, on average, wine grape producers use less than one half the total volume of water required by tomato producers.

**Table 5.4 Production Expenses for Grapes and Tomatoes
(percentage of total expenses)**

<u>Expenses</u>	WINE GRAPES	FIELD TOMATOES	GLASS- HOUSE TOMATOES
per cent.....		
Water	12.0	0.7	1.2
Chemicals (weeds)	1.5	0.3	1.6
Chemicals (pests)	5.3	5.7	4.7
Fertilisers	10.5	12.4	2.2
Plants: depreciation at 3% p.a.	3.4	0.0	0.0
Electricity: irrigation pump	1.9	1.1	1.2
Labour: casual & permanent	18.9	25.7	62.0
Machinery operating costs	20.7	2.8	0.0
Pruning	3.2	0.0	0.0
Harvesting	22.6	43.7	15.5
Freight: to packing shed	0.0	1.3	0.0
Other costs	0.0	0.0	0.0
Packing	0.0	0.0	0.0
Seed & seedlings	0.0	6.3	11.6
Plants & soil preparation	0.0	0.0	0.0
Total expenses	100	100	100

Source: SACES (1995)

How would increasing water costs impact on gross margins? To help answer this question Table 5.5 illustrates the impact on gross margins and profitability under three alternatives for grape and vegetable production in South Australia. The base scenario represents crop returns in 1995. Scenario 1 is water costs doubling and scenario 2 represents a quadrupling of water costs.

The data indicate that if irrigators continued to use the same amount of water and made no other production or management adjustments, that returns to capital would be:

- 0.2 per cent less for tree and vine crops when water costs are doubled;
- 1 per cent less for tree and vines when water costs are increased by 4 times;
- 0.6 per cent less for field vegetables when water costs are doubled; and
- 1.7 per cent less for field vegetables when water costs are increased by 4 times.

Table 5.5: Sensitivity Analysis on the Effect of Water Costs on Profitability for Grapes and Vegetables in South Australia

Crop	Gross Income \$	Gross Margin			Return to Capital		
		\$			%		
		Base	Scenario 1 water costs double	Scenario 2 water costs quadruple	Base	Scenario 1 water costs double	Scenario 2 water costs quadruple
Vines							
Premium Grapes	18,700	16,062	15,742	15,102	18	17.7	16.9
Non-prem. Grapes	11,400	8,744	8,424	7,784	9	8.9	8.0
<i>Tree & Vine - average return to capital:</i>					13.5	13.3	12.5
Field Vegetables							
Cabbage	21,500	13,006	12,846	12,526	31	30.1	29.1
Cauliflower	20,090	9,851	9,691	9,371	22	21.1	20.2
Tomatoes	44,989	16,288	16,088	15,688	33	32.7	31.5
Onions	12,500	5,675	5,475	5,075	11	10.9	9.7
<i>Field Vegetables - average return to capital:</i>					24.3	23.7	22.6

Source: SACES (1995)

The scenarios used in Table 5.5 represent static analysis. When output and input price changes do occur, producers have the capacity to change their mix of inputs according to the incentives that induce them to do so. In NSW, Wall and Marshall (1995) found that farmers could economically recycle up to 15 per cent of the total water applied, because the private benefit of water saved justified the cost of such technologies.

A recent study of how irrigation reforms are impacting horticulture farms in the Murray Darling basin concludes that the rate of expansion is likely to slow but production is unlikely to fall as water becomes more scarce (ABARE, 1999). The study suggests that producers will purchase more water, invest in improved irrigation equipment, adopt new irrigation management practices, and change enterprise mix.

The ABARE study also concludes that increases in water charges are unlikely to lead to a fall in water use by horticulture in the Murray Darling Basin since water charges are only a small proportion of total costs, while the returns to water in horticulture are high. Water expenses ranged from 2 to 7 per cent of total cash costs. As water expenses increased from \$40/ML to \$100/ML (with other prices held constant), gross margins fell from around \$6,500 per ha to \$5,900 per ha for grapes and from \$3,500 per ha to \$2,800 per ha for citrus.

One of the most important indicators of the value of irrigation water is the price irrigators are willing to pay. In Australia, water licenses may be purchased or leased. Prices for permanent water licenses range from \$20/ML in parts of the water abundant Murray Darling Basin to \$10,000/ML in wine grape producing areas dependent on groundwater in South Australia. The 1999 ABARE study found that average prices in the Murray Darling had increased from around \$2.50/ML in 1992 to around \$20/ML in 1998. Irrigators are also leasing water in some parts of the Murray Darling Basin at prices up to \$155 per ML per year.

5.3 Wine and Export Regulations

Wine grape producers provide an important example of how Australia's export-oriented industries face relatively high compliance costs. In addition to an export license and meeting country specific labelling requirements, all Australian wine exports undergo chemical analysis to ensure the product meets Australian standards for exports as well as import requirements of the destination country.

Each wine in an export consignment of more than 100 litres needs an Australian Wine and Brandy Corporation "Certificate of Analysis" This analysis includes specific gravity, volatile acidity, alcoholic strength, total acidity, free and total sulphur dioxide, pH, and glucose and fructose. Some countries (eg Singapore and US) require only the Australian Certificate, while exports to the EU requires one more analysis, the VI Certificate of Analysis Report. A laboratory registered with the National Association of Testing Authorities must perform the VI Certificate. The level of analysis varies by the type of wine, table wine, bulk wine or late harvest botrytised wine. Exports to Japan can only be tested by a laboratory authorised by Japanese authorities. The differences in import requirements are one reason that the Australia recommends maximum residue limit at the lowest level for any country.

Once certificates are in place, the Australian Wine and Brandy Corporation subject exports to a sensory inspection. Wines are examined against prescribed criteria to determine whether the wine is sound and merchantable and is not likely to detract from Australia's reputation as a wine producer. (Weeks, 1999). The remaining procedures are paper work intensive. For the VI-1 wines to Europe, exporters must complete an application form for each wine type and package size; a declaration on company letterhead stating that the wine complies with all required winemaking practices and the Australian Food Standards code; a set of front and back export labels that are used on current shipment; a copy of the VI-1 Certificate of Analysis Report as prepared by the laboratory.

In total, the export license, laboratory costs, export fees and costs associated with processing applications can cost several thousand dollars per consignment. More importantly, while these export markets provide profitable opportunities for grape growers, the importing country requirements directly effect and constrain on farm management options. This grape production example also representative of how the export oriented Australian agricultural sector is so often dependent upon off shore environmental and health regulations.

Chapter 6 Conclusions

Australia is a highly urbanised, small economy with low population density, and low levels of protection for a largely export-oriented agricultural sector based on relatively low-intensive practices. Only 4 per cent of Australia's agricultural land is sown to improved pastures and less than 5 per cent of agricultural land is cropped. Stocking rates are low compared with other countries, while arid and rugged lands held under grazing licences account for 88 per cent of the agricultural land area, where livestock mainly graze on native grasses. Producers, processors and marketers not only recognise their comparative advantage in exporting to countries with high environmental and food safety standards, they continue to find ways in which to expand that advantage.

One of the aims of Australia's current agriculture policy strategy is to enhance the country's reputation as a 'clean' environment able to grow and process food in a sustainable manner. The country's 'clean and green' reputation is seen as a way to gain an edge in markets that are increasingly concerned about food quality and human health. Quality assurance systems on farms and along the supply chain are not only encouraged, they have become a widespread practice in almost every agricultural activity.

A principal policy strategy cutting across all agricultural activities is the promotion of ecologically sustainable development. The key agriculture-related environmental concerns currently receiving programme and/or policy attention are: biodiversity loss; dryland salinity; introduced pests and plants; soil acidification; soil structure decline; soil erosion; and water quality and scarcity issues.

The most common policy response to land and water degradation problems is the promotion of information, education, community participation, dissemination of research and the development of codes of practice. Research and extension on sustainable practices dominate Australia's policy response. Full cost resource pricing, overcoming market failures and addressing policy failures are increasingly encouraged.

Australian codes of practice are generally sector-based, providing guidance to specific industries on a range of environmental issues such as resource usage, emissions, waste generation and disposal, animal welfare, occupational or health hazards and regulatory standards. Codes of practice attempt to improve agriculture's environmental performance by providing: relevant information and suggesting management practices and production processes that individual producers can adopt; advice about how to implement environmental improvements; and a means by which regulatory bodies can work with smaller producers, firms and industries.

In addition to the greater community involvement in policy making and resource management, the regulatory approach has been complemented by or, in some cases even replaced with, economic incentives, market instruments and property rights systems. Market mechanisms are currently being introduced to meet strategic objectives, including implementing the polluter pays, beneficiary pays and user pays principles. This more market-oriented approach involves assessing total economic values for the costs and benefits attributed to environmental policies and government

regulations, as well as the positive and negative externalities generated by agricultural production activities.

Structural change in Australia's agricultural sector is primarily a function on the supply side of technological changes and on the demand side of international price movements, which in turn are affected in part by developments in the farm and trade policies of other countries. Hence unilateral, regional and global (ie WTO) trade policy reforms are important, as are policy reforms that are trade-related. The latter include the quarantine and food safety standards abroad, to which Australia's export focused producers, must comply (James and Anderson, 1999). That is, the quality assurance programs, designed to ensure Australia's reputation as a high-quality and safe supplier in foreign markets is maintained, are probable going to continue to have at least as much influence on costs of production in Australia agriculture as are domestic environmental and food safety regulations.

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Appendix A

COAG Water Sector Reforms

The *1994 COAG Water Reform Framework* (COAG 1994) includes the following key reforms in the area of rural water services:

Pricing reform: consumption-based pricing and full cost recovery (including positive rates of return on the written-down replacement cost of assets); the reduction or elimination of cross-subsidies; and making remaining subsidies transparent — for urban water services by 1998 and rural water supply by 2001;

Investment reform: investment in new rural water supply schemes or extension to existing schemes to proceed only if appraisal indicates it is economically viable and ecologically sustainable;

Water trading: implementation of comprehensive water allocation systems or entitlements, including allocations for the environment, with rights separated from land title, and with trading in allocations or entitlements by 1998 (including interstate trading where feasible);

Institutional reform: the adoption of an integrated water catchment approach, separating the roles of water resource management, standard setting and regulatory enforcement no later than 1998, and further development of interagency performance comparisons.

COAG Groundwater Reforms

In 1996, COAG endorsed the following key reforms for the management and use of groundwater:

Policy and Management

- achievement of efficient sustainable use of groundwater in accordance with a nationally agreed approach to sustainability;
- public identification of the sustainable yield, allocation and use of aquifers, with allocations limited to sustainable levels where appropriate;
- removing restrictions on groundwater use imposed by inefficiently designed or constructed wells;
- establishment of systems to support transferability of groundwater entitlements;
- improved integration of groundwater and surface water management;
- expansion of the National Driller's licensing system;

Data and Information

- provision of adequate funding for groundwater investigation in high priority areas;
- requirements for drillers to provide well construction data for all wells drilled;

- management and licensing of high yielding wells;

Pricing

- introduction of arrangements to provide for full recovery of direct costs of groundwater management with consideration being given to consequences of differential pricing between surface and groundwater where relevant;

Other Matters

- identification by the Federal Government of its full costs of groundwater related activities;
- elimination of conflict of interest situations within Government institutional arrangements; and
- assessment of opportunities for development of groundwater education program(s).

Currently, licences are required in all States prior to drilling. All new bores must be capped and water reticulated by piping. They must also meet prescribed construction standards and hydrological requirements. The licences are administered through the relevant State government departments. However, licence conditions and establishment fees vary between the States.

Appendix B

Government Assistance to Australian Agriculture

The agricultural sector receives assistance from a wide range of government programs and policies. Statutory marketing and regulatory arrangements provide the major component of assistance to agriculture, with budgetary assistance (including research and development, adjustment assistance and tax concessions) and tariffs on outputs being less important. Partly offsetting the assistance from these measures are tariffs and other taxes on the inputs used in agriculture.

However, by the standards of all other OECD countries except New Zealand, Australia provides relatively little assistance to farming. According to the OECD (1998b): PSE of 10 percent, compared with OECD average of 49 percent in 1997.

Trends in agricultural assistance

While the assistance afforded by various agricultural arrangements has declined over the past decade, estimated assistance has not fallen consistently across commodities. Assistance to agriculture is inherently more variable than assistance to manufacturing, with changes in estimated assistance reflecting not only changes in assistance policies, but also fluctuations in world commodity prices and the value of output, and the counter-cyclical nature of many agricultural assistance programs.

Nominal rates of assistance fell for wool, wine grapes, dried vine fruits, eggs and tobacco (figure 3.2). Offsetting these falls were increases for wheat, rice and the already highly assisted dairy industry. The average effective rate of assistance for agriculture remained largely unchanged in 1996-97 at 10 per cent. Increases in assistance to outputs and lower taxes on inputs were largely offset by decreases in assistance to value-adding factors. In dollar terms, the effective rate of assistance in 1996-97 represents a net subsidy to agriculture of \$997 million.

Effective rates of assistance fell for wool, wine grapes, dried vine fruits, poultry, eggs, cotton and tobacco. The most significant increase in effective rates of assistance was for fresh milk, already in receipt of effective assistance of more than 200 per cent. Smaller increases in effective rates were recorded for apples and pears, deciduous canning fruits, vegetables and most grains.

For many of the highly assisted agricultural commodities, previously implemented government reforms, designed to promote competition and reduce assistance, began to take effect in 1996-97. Falls in assistance for wine grapes and dried vine fruits in 1996-97 reflected a decline in tariff levels from 8 to 5 per cent for these commodities. Assistance to the sugar industry has been reduced through the removal of the tariff on sugar imports and reforms to domestic marketing arrangements.

The Commonwealth Government has committed to reducing assistance to the manufacturing milk sector over the next few years. Reforms have already been carried out in the market milk sector, but in most States these reforms have occurred only downstream from the farm gate. As part of the Competition Principles Agreement, however, most States have either concluded, or made commitments to review marketing arrangements at the farm gate level over the next few years.

Overall, the assistance provided to the dairy industry dominates the estimates for the agricultural sector. When the dairy industry is excluded, the 1996-97 effective rate of assistance for agriculture falls from 10 per cent to 6 per cent. Disparities in effective rates of assistance among agricultural activities are an important indicator of the potential for inefficiencies in resource use, while disparities in nominal rates provide an indication of the potential for distortions in production or consumption patterns. The Commission measures disparities in assistance using the standard deviation around the sectoral average effective and nominal rates. In 1996-97, the standard deviation of the effective rate of assistance increased to 42 percentage points, from 35 percentage points in 1995-96. The standard deviation in the nominal rate of assistance increased from 9 to 10 percentage points in 1996-97.

Although remaining a major component of sectoral assistance for agriculture, adjustment assistance fell by \$10 million to \$105 million in 1996-97. The beef, wool and wheat industries continue to be the main recipients of adjustment assistance. New South Wales and Queensland together received around 80 per cent of Commonwealth adjustment assistance in 1996-97. The rural adjustment scheme (RAS) forms the major component of adjustment assistance, accounting for over 90 per cent of total funding in 1996-97. In October 1997, the Government announced, as part of its *Agriculture — Advancing Australia* Statement, the discontinuation of the RAS with some of its components to be transferred to other programs. The Statement also included funding for the family restart scheme, farm management deposits scheme, exceptional circumstances (including drought), drought relief payment and retiring farmer assistance.

Income tax concessions to primary producers and research and development funding continued to represent major components of sectoral support in 1996-97. Revenue forgone from income tax concessions declined in 1996-97 to \$151 million from \$163 million in 1995-96. The wheat, beef and dairy industries were the largest recipients of this assistance, together receiving around \$69 million (45 per cent) in 1996-97. Research and development funding increased by around \$7 million to \$161 million in 1996-97.

The beef, wool and wheat industries together received around \$82 million (51 per cent) of total research and development funding for the sector in 1996-97. Government expenditure on export inspection services is another important component of agricultural assistance at the sectoral level.

The Australian Quarantine and Inspection Service (AQIS) is responsible for carrying out export inspection. AQIS is able to recover the costs of export inspection by charging for its services. For certain programs, however, revenues collected for services fell short of charges under-recovery, while over-recovery occurred for some other programs. Where over-recovery occurs, AQIS is required to rebate the amounts to exporters, while in cases of under-recovery no adjustment is made. Shortfalls are treated as assistance by the Commission. In 1996-97, shortfalls increased significantly to \$9 million but were confined to the meat industry. Previously announced changes to meat inspection charges took effect in 1997-98. Other reforms to the meat industry, including the establishment of Meat and Livestock Australia, were implemented on 1 July 1998.

In addition to inspection services, AQIS is also responsible for providing quarantine services in Australia. The purpose of Australian quarantine is to control the entry into Australia of disease, but quarantine requirements may also have the effect of reducing import competition and assisting local producers. See, for example, James and Anderson (1998).

Dairy

The dairy industry continues to receive assistance levels many times the average for the agricultural sector. The nominal rate of assistance to the dairy industry increased marginally in 1996-97 to 19 per cent, while the effective rate of assistance increased from 53 per cent in 1995-96 to 58 per cent in 1996-97. Different assistance arrangements apply to market milk (fresh or drinking milk) and manufacturing milk (used to produce dairy products such as cheese, butter and milk powders). Assistance to market milk is derived largely from State governments setting farm gate prices and rationing production through quotas, while assistance to manufacturing milk is derived largely from Commonwealth marketing arrangements. Typically, assistance to market milk has been much higher than that for manufacturing milk.

A more detailed discussion of the Commission's approach to measuring assistance to market and manufacturing milk is set out in the submission to the NSW Dairy Industry Review.

Market Milk

The estimated nominal rate of assistance for market milk production increased from 54 per cent in 1995-96 to 60 per cent in 1996-97, while the effective rate of assistance, already over 200 per cent, increased further in 1996-97. Marketing arrangements for market milk, from farm gate to final consumption, are administered by State statutory marketing authorities.

Under the Competition Principles Agreement, all States were required to review government regulation affecting competition. New South Wales has now joined Victoria, South Australia, Western Australia and Tasmania in abolishing most controls on marketing and pricing of milk beyond the farm gate. Post-farm gate deregulation in Queensland is scheduled to take effect from 1 January 1999. Because of the point at which assistance is measured, reforms to post-farm gate milk controls will not have a direct impact upon assistance estimates for the dairy industry.

In all States, farm gate prices and market milk production levels remain under the control of milk marketing authorities, however, most States have either concluded, or made commitments to review price and production controls at the farm gate level. Victoria, shortly to commence its review, is the most significant dairy producing region in Australia. Any decisions adopted in Victoria are likely to have a significant influence on decisions on future marketing arrangements at the farm gate level in other States.

Manufacturing Milk

The estimated nominal rate of assistance for manufacturing milk was 8 per cent in 1996-97, up from 7 per cent in the previous year. The effective rate of assistance increased from 20 per cent to 21 per cent. In 1996-97, manufacturing milk received most of its assistance from Commonwealth marketing arrangements — the Domestic Market Support Scheme. The scheme includes a levy applied to all milk (market and manufacturing milk) produced in Australia. Producers receive a full rebate of the levy on manufacturing milk used to produce dairy products that are sold on the export market.

For dairy products sold on the domestic market producers can pass the levy on to consumers. The funds raised by the levy are used to pay a subsidy to all manufacturing milk. This subsidy is treated as assistance by the Commission. The subsidy rates are being phased down, with the scheme due to expire on 30 June 2000.

Tobacco

The estimated nominal rate of assistance for the tobacco industry decreased from 40 per cent in 1995-96 to 30 per cent in 1996-97. The effective rate of assistance also fell substantially over the same period from 159 per cent to 100 per cent. Statutory marketing arrangements for tobacco are being phased out as part of a restructuring program, which commenced in

January 1995. Effective rates of assistance are expected to fall to around 2 per cent in 1999-2000 with the completion of the restructuring program.

Sugar

Assistance to the sugar industry in 1996-97 was derived from Queensland's statutory marketing arrangements for raw sugar and a specific tariff on raw sugar imports. These arrangements enable domestic prices to be raised above export parity prices. In 1996-97, the estimated nominal and effective rates of assistance for sugar remained constant at 4 and 16 per cent, respectively. Assistance to the sugar industry is expected to change significantly in 1997-98 following the removal of the sugar tariff on 1 July 1997 and implementation of the requirement for the Queensland Sugar Corporation to price at export parity on domestic sales. In 1996-97, the net subsidy equivalent for the sugar industry was \$70 million. Full implementation of the reforms to the sugar industry is expected to reduce the net subsidy equivalent by around \$50 million. This is equivalent to a reduction in the effective rate of assistance of around 12 percentage points. To offset this reduction in support, the Commonwealth Government is to provide a compensation package to the sugar industry.

Rice

The Australian rice industry, located primarily in New South Wales, is assisted through statutory marketing arrangements which allow the New South Wales Rice Growers Co-operative to vest and market all rice grown in the State. The nominal rate of assistance for the rice industry increased to 3 per cent in 1996-97 from 2 per cent in 1995-96, while the effective rate of assistance increased from 8 per cent to 11 per cent. In 1996, the Review of Legislation Establishing the New South Wales Rice Marketing Board recommended the removal of domestic marketing arrangements on the ground that such reform would provide a net community benefit.

The New South Wales Government rejected this recommendation. The National Competition Council (NCC) has stated that this decision was not consistent with the State's obligation under clause 5 of the Competition Principles Agreement (CPA). The New South Wales Government has indicated a willingness to resolve the matter in accordance with the CPA. In the event that appropriate reforms are not implemented by 31 January 1999, the NCC has recommended to the Federal Treasurer that \$10 million be deducted from the 1998-99 National Competition Policy payment to New South Wales (NCC 1998).

Wheat

The nominal rate of assistance for the wheat industry increased from 1 per cent in 1995-96 to 2 per cent in 1996-97. The effective rate of assistance increased from 4 per cent to 6 per cent over the same period, largely reflecting lower tax penalties following reductions in tariff levels on inputs. The wheat industry receives assistance mainly from the rural adjustment scheme, tax concessions, research assistance and the government guarantee on Australian Wheat Board (AWB) borrowings. The government guarantee on AWB borrowings accounts for around half of all assistance received by the wheat industry. The assistance afforded by the guarantee is equal to the interest savings resulting from the difference between the assessed 'market', and government-guaranteed, interest rates. The government guarantee is due to expire at the end of 1998-99. From 1 July 1999, the AWB is to be replaced by grower owned companies which will be responsible for wheat marketing.

Wool

The wool industry receives assistance mainly from research and development funding, the rural adjustment scheme and the government guarantee on borrowings by Wool International. The nominal rate of assistance for the wool industry decreased from 2 per cent in 1995-96 to

1 per cent in 1996-97. The effective rate of assistance decreased from 9 per cent to 7 per cent over the same period. The decrease in the effective rate of assistance largely reflects the decrease in output assistance. In August 1998, the Government announced plans to freeze all sales from the wool stockpile for the remainder of the 1998-99 season.

The introduction of the necessary legislation to change the existing wool marketing arrangements was delayed when Parliamentary sittings were suspended due to the calling of the 1998 Federal election. Wool International continued to make sales from the stockpile after the Government's announcement. The objective of the freeze was to provide price support to growers in light of poor market conditions for wool. The implications for support to the wool industry of any stockpile freeze would depend on the extent to which the freeze was successful in raising wool prices and therefore returns to growers.

Pigmeat

Assistance to the pigmeat industry is low relative to many other agricultural activities. The nominal rate of assistance for the pigmeat industry in 1996-97 remained at less than 0.5 per cent, while the effective rate of assistance was constant at around 5 per cent. The pigmeat industry receives assistance primarily from research and development funding, adjustment assistance and tax concessions. Research and development funding accounted for around half of all assistance received by the industry in 1996-97.

The Government recently announced \$18 million of additional funding for the pork industry to be provided through the National Pork Industry Development and Pigmeat Processing Grants Programs. The Commission has been asked to inquire and report on whether safeguard action, in accordance with the WTO Agreement, is warranted against imports of certain frozen pigmeat. The Commission has been asked also to report on the factors affecting the profitability and competitiveness of the domestic pig farming and pigmeat processing industries.

Source: PC 1998 Chapter 3

Appendix C

Part 2, Chapter 1 of the National Strategy for Ecologically Sustainable Development: Agriculture

Challenge

To facilitate the ecologically sustainable development of agricultural industries so that they contribute to long-term productivity and to Australia's economic well-being, and protect the biological and physical resource base on which agricultural industries depend, and improve human health and safety.

Strategic Approach

Governments will achieve this by promoting initiatives which support the sustainable use of Australia's land and water resources to improve the long term profitability of agriculture, contribute to the viability of other sectors such as freshwater fisheries and tourism, address areas affected by land degradation, and maintain ecological systems and protect biodiversity. Cooperative action by Commonwealth, State and Territory governments, the community and the agricultural sector has been the hallmark of resource management in agriculture. Many of the following actions build on this base, with State and Territory agencies having major responsibility for implementation.

Objective 1.1

to create a framework of integrated government policies and programs in which promote community-based self-reliant approaches to agricultural resource management

Governments will:

- continue to improve mechanisms for community participation in decision making on agricultural resource management issues such as the establishment of the National Landcare Advisory Committee and wider community representation on National Landcare Program State Assessment Panels;
- improve access to funding through simplification of application and assessment procedures for groups seeking assistance under resource management programs;
- review the consultation and approval procedures applying to commercial agricultural projects with the objective of improving the efficiency of the decision-making process;
- improve integration of the agricultural and natural resource policy management responsibilities of Ministerial Councils ;
- establish terms and conditions for leasehold land which encourage sustainable management ;
- enhance the role of integrated and total catchment management in policies and programs.

Objective 1.2

to promote integrated planning of agricultural resource management, in particular in areas affected by land degradation, and extend measures, particularly community based self-help approaches, which encourage information transfer and landholder adoption of sustainable management

Governments will:

- continue to promote collective or group approaches to sustainable resources management;
- continue to support the training of land managers in farm planning skills and provide direct support for the preparation of whole-farm plans through the National Landcare Program;
- promote both the development and adoption of whole-farm plans which encompass management of all physical and financial resources, and the integration of whole-farm plans with regional and catchment plans ;
- develop, in the context of the National Drought Policy, mechanisms for incorporating better business and climatic risk assessments into farm planning;
- improve extension services to raise the technical and advisory skills of those facilitating and coordinating collective or community-based groups;
- at the Commonwealth level, encourage research for sustainable land and water management with an emphasis on collaborative ventures with existing commodity-based rural Research and Development Corporations, including for integrated pest management and decision support systems;
- develop mechanisms for evaluating effectiveness of policies such as the three-yearly reviews of progress towards achieving Decade of Landcare goals.

Objective 1.3

to reduce and manage effectively the impacts of pest plant and animal species on Australia's agricultural areas

Governments will:

- give priority to rapid completion and implementation of national and regional strategic plans for the management of pests and weeds, in particular the National Strategy on the Management of Vertebrate Pests, and the National Weeds Strategy;
- continue to work through the IGAE to coordinate effectively a national approach to the control of introduced animals and plants which pose a threat to the natural environment and farming.

Objective 1.4

to improve kangaroo management at the national level, including the removal of impediments to a sustainable commercial kangaroo industry

Governments will:

- work towards an integrated, and coordinated kangaroo management strategy which is based on development of national guidelines for kangaroo management, the use of market mechanisms such as individual tradeable quotas and the early finalisation of National Game Meat Standards

Objective 1.5

to improve effective and safe management of agricultural and veterinary chemicals while improving levels of, and access to information on these chemicals

Governments will:

- implement the national scheme for the evaluation and registration of agricultural chemicals;
- at the Commonwealth level, ensure that coverage of the National Residues Survey and Australian Market Basket Survey meet necessary information requirements and that this information is widely disseminated;
- assess the merits of setting indicative national targets for the use of selected agricultural and veterinary chemicals;
- at the Commonwealth level, examine the possibility of commencing surveys to monitor agricultural chemical residues in wildlife and the wider environment.

Appendix D

Examples of Current Guidelines and Model Codes of Practice

- Report 18. Australian Code of Practice for Poultry Processing
- Report 19. Australian Code of Practice for Production and Inspection of Chilled and Frozen Pet Food**
- Report 20. Improving Nutritive Value of Forage
- Report 21. Soil Insect Pests in Australia: Control Alternatives to Persistent Organochlorine Insecticides**
- Report 22. Rapid Methods for Identifying Viruses in Perennial Fruit Tree Crops
- Report 23. Agricultural Co-operatives in Australia
- Report 24. Animal Importations into Australia
- Report 25. Feeding Standards for Australian Livestock Poultry
- Report 26. Feeding Standards for Australian Livestock: Pigs
- Report 27. Feeding Standards for Australian Livestock: Ruminants
- Report 28. Anthelmintic Resistance
- Report 29. Australian Model Code of Practice for the Welfare of Animals: The Sheep
- Report 30. Australian Model Code of Practice for the Welfare of Animals: The Farming of Deer**
- Report 31. Australian Model Code of Practice for the Welfare of Animals: Animals of Saleyards**
- Report 32. Australian Model Code of Practice for the Welfare of Animals: The Goat
- Report 33. Australian Model Code of Practice for the Welfare of Animals: Intensive Husbandry of Rabbits**
- Report 34. Australian Model Code of Practice for the Welfare of Animals: Feral Livestock Animals**
- Report 35. Farm Cattle Handling
- Report 36. Sustainable Agriculture
- Report 37. Guidelines for the Control of Exotic Vertebrate Animals
- Report 38. Register of Agents for Biological Control of Insect Pests and Weeds
- Report 39. Australian Model Code of Practice for the Welfare of Animals: Cattle
- Report 40. Australian Model Code of Practice for the Welfare of Animals: Domestic Poultry (3rd Edition)**
- Report 41. Australian Codes of Good Manufacturing Practice for Veterinary Preparations**
- Report 42. Australian Codes of Good Manufacturing Practice for Homemixed Feeds, Feed-Milling Industry and Stock-Feed Premixes**
- Report 47. National Guidelines for Beef Cattle Feedlots in Australia 2nd Edition
- Report 49. Review of Agricultural Chemical Spray Drift
- Report 50. Australian Standard Diagnostic Techniques for Animal Diseases
- Report 51. Sustainable Agriculture: Tracking the Indicators for Australia and New Zealand**
- Report 52. Australian Model Code of Practice for the Welfare of Animals: Farmed Buffalo**
- Report 53. Australian Standard for the Construction of Premises Processing Meat for Human Consumption**
- Report 54. Australian Standard for Hygienic Production of Meat for Human Consumption 2nd Edition**
- Report 55. Australian Standard for Construction of Premises Processing**

Animals for Human Consumption

Report 56. Australian Standard for Transportation of Meat for Human Consumption

Report 57. Australian Standard for Production of Game Meat for Human Consumption

Report 58. Australian Standard for Production of Poultry Meat for Human Consumption

Report 59. Australian Standard for Production of Rabbit Meat for Human Consumption

Report 60. A Guide to the Implementation and Auditing of HACCP

Report 61. Australian Model Code of Practice for the Welfare of Animals: The Camel

Report 62. Australian Model Code of Practice for the Welfare of Animals: Land Transport of Horses

Report 63. Australian Model Code of Practice for the Welfare of Animals: Land Transport of Pigs

Report 64. Bovine Semen Collection Centres

Report 65. Australian Model Code of Practice for the Welfare of Animals: Land Transport of Poultry

Report 66. Australian Model Code of Practice for the Welfare of Animals: The Pig (2nd Edition)

Report 67. Australian Standard for Hygienic Production of Crocodile Meat for Human Consumption

Report 68. Australian Standard for Hygienic Production of Natural Casings for Human Consumption

Report 69. Model Code of Practice for the Welfare of Animals: Husbandry of Captive Bred Emus

Report 70. Sustainable Agriculture: Assessing Australia's Recent Performance

Effluent Management Guidelines for Dairy Processing;

Effluent Management Guidelines for Dairy Sheds;

Effluent Management Guidelines for Intensive Piggeries;

Effluent Management Guidelines for Tanning and Related Industries;

Effluent Management Guidelines for Aqueous Wool Scouring

Effluent Management for Wineries.

Appendix E

Land Clearing Regulations and Legislation

<i>State</i>	Most recent changes	Overview
South Australia	1985 and 1991	Consent required to clear any native vegetation; heritage agreements with some financial assistance available for areas not approved. Agreements in place for 600 000 ha cost \$70 million in compensation for first six years. No broadacre clearing approved since the Act came into force.
Western Australia	1986 and 1995	Permission required for clearing of areas larger than one ha of native vegetation. No compensation provisions. More than 80 percent of requests approved and conditions tightened in 1995. Some funding available to maintain remnant vegetation for soil conservation. Technically, Conditional Purchase Lease system still applies to more than 800 properties, requiring them to be half cleared before they can be converted to freehold.
Victoria	1989	Clearing of blocks of native vegetation larger than 0.4 ha is subject to approval. No provision exists for compensation but heritage agreements may provide financial assistance.
Queensland	1995	The Government has released a preliminary policy for tree clearing on leasehold lands which will be proclaimed under the Lands Act, 1994 when local guidelines have been finalised. A satellite monitoring program has also been established. These restrictions are opposed by some land-owner groups. Many piecemeal measures are administered by State and local governments.
New South Wales	1995	A State environmental planning policy was introduced in August 1995 to control clearing on freehold land. Following community consultation, the Government will consider further amendments, options or alternatives to this policy. Previously existing controls include the Western Lands Act, provisions under the Soil Conservation Act and regional and local environmental plans.
Northern Territory	1992	Commercial activity involving the destruction of vegetation on Crown land or leasehold must be licensed. Some provisions exist under the Pastoral Land Act. Few measures are in place for private land.
Tasmania		Few measures exist, other than at local government level and some provision for private reserves.
ACT		There is no freehold land; vegetation protection is usually incorporated in lease provisions.

Source: SEAC, 1996

Appendix F

The National Residue Survey

(<http://www.brs.gov.au/residues/residues.html>)

The National Residue Survey (NRS) is part of the Bureau of Rural Sciences (BRS), an independent scientific bureau of the Commonwealth Department of Agriculture, Fisheries and Forestry - Australia (AFFA)

NRS Mission

To underpin export and domestic marketing initiatives, to enhance the value of Australian agricultural and associated commodities, and to safeguard the health of the general population by providing an independent, authoritative and scientifically rigorous audit of the chemical residue status of these commodities, providing scientific advice on residues, and the management of residue related issues.

Key Clients and Stakeholders

Ministers, Commonwealth, State, Territory and overseas Governments and agencies, agricultural industries, the general community and trading partners.

History

NRS was established in the early 1960s as the Commonwealth's response to growing concerns about pesticide residues in major meat export. NRS's residue monitoring programs now cover a wide range of food commodities including grains, fruit and vegetables, dairy products, eggs and honey, as well as meat destined for the domestic market.

NRS was fully government funded from appropriation from the early 1960s until partial cost recovery from industry was introduced in 1987. The rate of recovery was initially set at 50% from October 1987 and increased to 60% from October 1988. As part of the 1992-93 Budget, the Commonwealth Government announced the introduction of full cost recovery for NRS from 1 July 1993.

Role

NRS is a Commonwealth Government agency delivering residue monitoring services, on a full cost recovery basis, to industry clients. As such it must meet all Government requirements, operate essentially on a commercial fee-for-service basis with client industries and work cooperatively with State and government agencies with complementary responsibilities. NRS also negotiates the acceptance of proposed monitoring programs with trading partners.

NRS monitoring programs and the operational and administrative arrangements that support them, are driven primarily by the needs of participating industries to maintain access to key markets. In addition these programs establish a bank of objective and scientifically valid data to underpin quality assurance programs and assist in resolving

residue-related trade incidents. The data gathered by NRS surveys also contributes to the establishment of scientifically-based national and international standards for residues in food and thus, indirectly, to the improved functioning of the international agricultural trade system.

In meeting the objectives of industry, NRS also contributes to the achievement of the Government's goals of enhancing the value of Australian products and improving market access.

An Example: the 1997 Egg Program Results

The egg program is designed to meet the monitoring requirements of the European Union and the domestic market. The single organochlorine residue detected was for dieldrin at a level under a fifth of the MRL.

Appendix G

National Registration Authority

for Agricultural and Veterinary Chemicals

(<http://www.dpie.gov.au/nra/hgp.html>)

Review of agricultural and veterinary chemicals

The National Registration Authority for Agricultural and Veterinary Chemicals (NRA) conducts comprehensive reviews of registered agricultural and veterinary chemicals to ensure those chemicals meet current standards of registration and do not pose unacceptable risks to people, the environment or trade. Reviews are undertaken by the Chemical Review Section which plays a significant role in regulating chemicals used in agricultural and veterinary products.

Reassessment of older registered chemicals is important because regulatory standards have become more stringent over the years and more scientific data relating to the possible effects and longer term impacts of chemicals has become available. Older chemicals must, therefore, be re-evaluated to ensure they satisfy current registration standards of safety and performance.

History and legislation

When the National Registration Scheme started in March 1995, the NRA inherited over 5000 chemical registrations granted under earlier arrangements in Australia's States and Territories. Some of these were issued as far back as the 1950s.

Vast amounts of new data have been generated for chemicals that have been on the market for a number of years, some of it indicating that uses of a chemical should be reassessed. In addition, overseas regulatory agencies, including the US Environmental Protection Agency, have restricted or withdrawn some older chemicals due to concerns about health and environmental issues.

The NRA has the power, under the Agricultural and Veterinary Chemicals Code Act 1994 and the Agricultural and Veterinary Chemicals (Administration) Act 1992, to conduct reviews of registered chemicals.

In broad terms, these powers include the authority to reconsider the registration of active ingredients, products and labels, and to require relevant information to be provided. Relevant trial work can be requested to generate results needed for consideration, and additional information can be requested for delivery within specific timeframes. The NRA has the power to suspend or cancel the registration of active ingredients, products and labels.

Existing Chemical Review Program

The Existing Chemical Review Program (ERCP) is one of two major chemical review programs run by the NRA. It is a systematic and comprehensive review of older chemicals to ensure they meet contemporary standards of safety and performance, taking into account any new information and scientific data generated since their registration.

Reviews in the ECRP take up to 12 months to complete, as all chemicals in the program are assessed for possible harmful effects on human health, occupational health and safety, the environment, efficacy and implications for trade.

Consultation with the community, industry and farmers is a major feature of this program. Based on input from these groups, the NRA has formed a 'priority list' with about 80 chemicals. From this list between five and seven chemicals are selected to make up each review cycle within the program.

Steps in ECRP process

The NRA's Chemical Review Section invites the public, industry, government and academic institutions to nominate chemicals for review. Nominations are screened and the chemicals for each review cycle are chosen based on the strength of concerns relating to human health, occupational health and safety, the environment, trade and efficacy. Companies that have registered products containing chemicals chosen for review are notified and required to submit any data they have about the use of the chemicals. Through advertising, the NRA seeks public submissions which address the benefits of, or problems with, the chemicals under review.

Scientific data submitted is reviewed by the NRA and three external advisory Commonwealth agencies (Environment Australia, Worksafe Australia and Department of Health and Family Services). An evaluation of the chemical is released for public comment. Decisions on the future use of chemicals under review are made by the NRA Board as reviews are completed. All participants in the review are notified of the Board's decision and regulatory actions are implemented. Outcomes of reviews are published in the NRA's Agricultural and Veterinary Chemicals Gazette. The other major chemical review program undertaken by the NRA is the Special Review Program.

Special Review Program

The Special Review Program is one of two major chemical review programs run by the NRA. It allows the NRA to immediately review chemicals if issues arise which may alter the terms of their registration or cause them to be withdrawn. It addresses urgent or specific concerns about chemicals which may require a quick response. Special reviews can be triggered by, for example, the findings of new research, the availability of new scientific data, or concerns about the use or safety of the chemicals.

Special reviews, while thorough, are undertaken for specific reasons and take less time to complete, depending on the complexity of the issue and amount of data to be reviewed. Steps in the Special Review process The NRA is notified of concerns about a particular chemical, product or label and determines if a review is necessary. If a review is to be conducted, the NRA consults all parties affected by the nominations (applicants, commodity groups, State regulatory agencies) and gives them the opportunity to respond to the concerns raised and to take part in the review. All data and submissions are evaluated, including any evaluation reports from external Commonwealth agencies and other NRA assessment areas. Based on this information, appropriate regulatory action is recommended, and the NRA Board decides on the appropriate action to take. All participants in the review are notified of the Board's decision and regulatory actions are implemented. Outcomes of special reviews are published in the NRA's Agricultural and Veterinary Chemicals Gazette. The other major chemical review program undertaken by the NRA is the Existing Chemical Review Program. Chemicals currently under review.

Appendix H

The Food Regulation Review 1998 An abridged executive summary

(<http://www.anzfa.gov.au/FoodRegulationReview/ExecutiveSummary.htm>)

Background

The key objectives of the Review were stated as:

While protecting public health and safety, to reduce the regulatory burden on the food sector, and examine those regulations which restrict competition, impose costs or confer benefits on business; and to improve the clarity, certainty and efficiency of food regulatory arrangements.

The review combines two reform initiatives:

1. the 1996 Small Business Deregulation Task Force report, *Time for Business*, which proposed a comprehensive review of food regulation, and
2. the Commonwealth Government's legislative review program under the national competition principles agreement which referred to the *Australia New Zealand Food Authority Act 1991*

The Review investigated all food regulatory matters, focusing on regulations administered by agricultural and health agencies and involving the three spheres of government. It encompassed all types of government regulation-making, compliance and enforcement activities in relation to imported food and food produced for export and domestic consumption. It was also required to cover the whole of the food industry, including primary production, processing and retailing.

Context

The agrifood industry' is a term used to describe the food supply chain from the farm, fishing boat or orchard to the kitchen, restaurant or cafe in Australia or to our overseas customers. It is a source of employment, wealth generation and investment opportunity for many Australians. The benefits from an innovative and efficient food industry flow through to associated economic activities, such as tourism and entertainment.

There is currently a wide mix of regulatory approaches in Australia which vary from agency to agency and jurisdiction to jurisdiction. These approaches range from mandatory, and sometimes prescriptive, regulations through a variety of co-regulatory and quasi-regulatory arrangements to voluntary industry-driven schemes and total deregulation. Indeed, within a single agency the full spectrum of alternative approaches is sometimes used.

There is a need to ensure the benefits of government regulation outweigh the costs. All government activities (including developing and enforcing regulation/legislation) use public resources and these costs are borne by the community through the taxation system or directly by businesses in the form of government fees and charges. Regulatory activity also has indirect costs on industry in the form of the time and effort it takes to comply. While these latter costs are borne by businesses in the first instance, they are sometimes passed on to consumers in higher prices for goods and services.

Findings

The current regulatory framework for food in Australia is complex and fragmented and involves a large number of agencies and legislation spread across all three spheres of government. Approximately 150 Acts and associated regulations control food or agrifood businesses in Australia (including imported food and food produced for export and domestic consumption). This excludes levy Acts and local government by-laws as well as Acts which apply generally to businesses such as, for example, tax laws and occupational safety and health laws. In addition, there are over 90 separate national food product standards.

These laws and standards are developed, administered and/or enforced by numerous Commonwealth departments and statutory bodies, over 40 State and Territory agencies and departments and over 700 local governments. The current food regulatory system in Australia is undergoing a number of reforms, many of which are independent, others which are closely interrelated. Some of these involve review of legislation and others procedural and administrative reform.

Governments' primary role in food regulation is to protect public health and safety. The food industry as a whole relies on consumer confidence in a safe food supply to sell its products. To maintain consumer confidence in the food supply governments must continue to take a proactive rather than a reactive role in addressing public health and safety issues.

Consumers also need protecting from misleading and deceptive behaviour and access to appropriate information about food, diets and food-related illness and disease. It is widely accepted that when food safety failures occur the costs, both direct and indirect, to the community, industry, government and the economy as a whole can be considerable.

Figures on the economic costs of food safety failures are not readily available. However, the impact on individuals and business is readily apparent. In Australia in the 1990s reported outbreaks of food-borne illness from viral and bacterial causes resulted in illness to thousands of individuals and some examples can be given of the types of costs and losses involved:

- permanent health damage, including 23 cases of haemolytic-uraemic syndrome (HUS) in one outbreak incident alone;

- at least four deaths;
- significant product recall costs to companies including press advertisements (\$200 000 in one case) and product recovery and disposal; and
- loss of market share and profits, not limited to the companies involved. Examples include reduced sales for one company of almost \$6 million in the year following a product recall. In another example sales of a product category were still well below the level that existed prior to a food-borne illness outbreak for similar products. This situation can continue for considerable time after an incident occurs.

In Australia, the notification rates and case rates for diseases such as salmonellosis and campylobacteriosis, considered to be primarily food-borne, have been increasing since the 1980s . While Australia delivers safe food and food regulation has done much to reduce the costs of food-borne illness and diet-related disease, it has not removed it. However, the costs when there is a breakdown in the safety of the food supply provide incentive to ensure the effectiveness of the food regulatory system is maintained and efficiency improved. Any changes to the food regulatory system in Australia must not lead to a reduction in protecting public health or lessening of consumer protection.

Most agrifood businesses employ practices and equipment match or exceed the standards required by law. During the course of the Review, it was noted that many proprietors and managers have difficulty separating what they do as a natural part of good business practice from what they do solely to comply with food-specific or food-related regulations. Regardless of regulations, most food suppliers have strong incentives to produce safe food of the type consumers want and for which they will pay.

Despite extensive consultations with industry and systematic investigations of costs, it has not been possible for the Review Committee to identify the dollar cost of the regulatory burden on the food industry arising from food regulation.

The food regulatory system in Australia generally delivers safe food and Australia enjoys an enviable international reputation in this regard. Despite this, Australia continues to experience occasional significant lapses in food safety and there is growing concern within the community about the frequency and severity of food-borne illnesses. There is clearly scope for improving the effectiveness, and hence the public health outcome, of the food safety system. The concerns industry raised, however, focused more on the inefficiency of the regulatory system.

The Review undertook extensive consultation with all stakeholder groups — from industry, government and the general public; and from primary producers through to retailers. This process identified two major sources of complaint by industry about the food regulatory system in Australia. Firstly, that certain individual food laws and

regulations are inappropriate (for example, too prescriptive, requiring costly compliance activities, unenforceable, ambiguous, too restrictive); and secondly, that the food regulatory system is inefficient, and imposes significant and unwarranted costs on the food industry. Both types of complaint were made by all sectors of the agrifood industry.

The food regulatory system in Australia is considered to be complex, fragmented, inconsistent and wasteful. The food industry incurs costs due to duplication of effort between regulatory agencies, overlap of legislation and functional responsibilities, inconsistency of regulatory approaches between jurisdictions and difficulty in dealing with the large number of agencies and food laws involved.

Consumers and industry are also concerned about inconsistent and inadequate surveillance and enforcement. Within local government, in particular, there are significant problems stemming from inconsistent resourcing and widely divergent enforcement practices and priorities.

The main issues arising from consultations can be grouped into the categories of:

- lack of uniform legislation;
- inconsistent application of regulations by enforcement officers;
- inconsistent interpretation of legislation/regulations by enforcement officers;
- lack of clarity and consistency in agency roles and responsibilities;
- overlap and duplication of agency responsibility;
- lack of coordination between government agencies;
- inadequate and uncoordinated enforcement effort;
- multiple audits by industry and governments;
- inadequate training of auditors and inspectors;
- lack of training in hygiene by food handlers;
- insufficient consumer education on food safety;
- inefficient food standards setting processes;
- inappropriate food standards and regulations;
- insufficient small business consultation in government decision making; and
- inadequate access to information concerning food

Food safety is arguably the single most important challenge for the agrifood industry. Australia's reputation for safe food is well-earned. It is due largely to the efforts of the industry to implement and maintain high-quality systems and practices for producing safe food at all parts of the food supply chain.

Industry and government agree that, to further increase the agrifood industry's international competitiveness and reputation, there is a need for continuous improvement at all parts of the food supply chain to ensure food safety, as well as by taking every opportunity to reduce the current regulatory burden.

The system of food safety management in Australia is very effective. However, the issues identified in this Review point to the need for governments to fundamentally address the efficiency of the system. An improved national food regulatory system

will become more efficient through, amongst other things, a strong partnership approach to food regulation by all three spheres of government.

Efficiency will also be gained through improved coordination and interaction between the agrifood industry and government regulatory agencies working towards more strategic and effective integration of the existing arrangements. An improved system will need to combine a preventative, risk-based approach and an ongoing effort to minimise regulatory costs on industry, while ensuring food safety outcomes.

In parallel, there needs to be a movement towards increased industry self-regulation, but only where it can be used effectively to manage the food safety risk and where industry has the capability to manage self regulation. Complete self-regulation of the food industry may never be achieved because there will always be an expectation by consumers and industry of a minimum legislative framework, but there is considerable scope for a move in that direction through a co-regulatory approach.

The co-regulatory approach is based on the three spheres of government, industry and consumers working together as partners, with government setting minimum performance-based standards through consultation, and giving business greater flexibility in how it meets the standards, without reducing business' responsibility for meeting the standards.

The partnership model proposed for the national safe food system provides a good starting point, particularly for food safety objectives. However, it is necessary for governments to take this further to improve the efficiency of the system and to address duplication and overlap within the system.

There is an urgent need for governments to implement an integrated and coordinated national food regulatory system to replace the fragmented and piecemeal system of food regulation in place at the moment. To bring this about will require a strong partnership approach across all three spheres of government and with industry and consumers. The governments of Australia will need to work together with commitment and purpose to achieve the reforms proposed in this report.

The recommendations in this report are designed to:

- recognise the primacy of public health and safety;
- reduce inconsistencies, duplication and unnecessary costs;
- embrace and give effect to the principle of minimum effective regulation; and
- encourage individuals and businesses to accept more responsibility for ensuring improved food safety outcomes and regulatory compliance.

The Review proposes a package of structural, legislative and administrative rearrangements to reduce the costs of business compliance. The Review recommends centralising food regulatory policy within a single Commonwealth/State/Territory government agency, responsible to a single Ministerial Council; and a greater commitment to a government–industry partnership to ensure appropriate performance-based regulations are implemented efficiently, at least cost, and effectively across the whole agrifood industry. This should be supported by a rationalisation of legislation,

standards, regulatory agencies, registration systems, compliance requirements and streamlining of administrative procedures to improve effectiveness, efficiency and accountability.

In summary, the report suggests there is a need for governments to:

- implement an integrated and coordinated national food regulatory system, through:
- improved partnership arrangements; and
- adopting nationally consistent guiding principles.
- improve compliance and enforcement arrangements, through:
- service agreements;
- interpretation guidelines;
- contestable service delivery;
- a national auditor accreditation framework;
- amended food recall arrangements;
- improving cooperative arrangements between Trade Practices, Fair Trading and Food Acts; and
- rationalising enforcement agencies.
- improve legislation and national decision-making processes, through:
- nationally uniform food laws;
- centralising national decision making on food laws;
- rationalising national food regulatory agencies;
- improving the interface between regulation of food and drugs; and
- streamlining food standards-setting procedures.
- improve monitoring and surveillance systems, through:
- integrating systems from paddock to plate; and
- prioritising food safety research.
- improve communications to industry and consumers, through:
- better risk communication;
- single business entry point;
- rigorous consultations; and
- reviewing complaints handling.
- amend the *Australia New Zealand Food Authority Act 1991* by:
- developing objectives for the Act;
- amending the objectives used for developing standards; and
- updating ANZFA's functions.

The package of reform measures proposed in this report provide the potential for significant medium to long term cost savings to governments. These savings should be passed on to the agrifood industry, either directly, through reduced fees and charges, or indirectly by reduced compliance and paper work burden.

Appendix I

Expected Impacts of Food Regulation Legislation

The following table provides an analysis of the present status of food regulation in each State and the changes to that legislation contained in the Food Law.

Jurisdiction	Present Status of Legislation	Changes to Existing Legislation
New South Wales	Adequate but inadequate enforcement.	<p><u>Additions</u></p> <ul style="list-style-type: none"> • Extended scope • Notification • National performance standards for enforcement • Registration of laboratories not analysts • Register of auditors • Infringement notices • Review of administrative decisions <p><u>Deletions</u></p> <ul style="list-style-type: none"> • Hygiene provisions
Queensland	Adequate	<p><u>Additions</u></p> <ul style="list-style-type: none"> • Extended scope • Crown bound • National performance standards for enforcement • Registration of laboratories not analysts • Register of auditors • Infringement notices • Review of administrative decisions <p><u>Deletions</u></p> <ul style="list-style-type: none"> • Hygiene provisions • Licensing of food businesses
Jurisdiction	Present Status of Legislation	Changes to Existing Legislation
South Australia	Inadequate	<p><u>Additions</u></p> <ul style="list-style-type: none"> • Extended scope • Notification and registration • National performance standards for enforcement • Registration of laboratories (in addition to analysts) • Food safety programs • Auditing of food premises • Payment of compensation • Extended review of administrative decisions • Search warrant • Extended recall provisions • Protection from liability provisions • Publication of names of offenders • Provisions relating to advertising • Extended scope of provisions relating to authorised officers

Deletions

- Hygiene provisions
- Prescribed disease provisions
- Annual reporting to the Minister

Tasmania	Good	<u>Additions</u> <ul style="list-style-type: none">• National performance standards for enforcement• Review of administrative decisions• Approval of laboratories <u>Deletions</u> <ul style="list-style-type: none">• Registration of premises, vehicles and equipment except for registration of high-risk premises• Hygiene provisions
Victoria	Good [From 1 Jan 1999 will have notification of premises and food safety programs.]	<u>Additions</u> <ul style="list-style-type: none">• Extended scope• National performance standards for enforcement• Registration of laboratories not analysts• Infringement notices• Review of administrative decisions <u>Deletions</u> <ul style="list-style-type: none">• Registration of food premises and food vehicles except for high-risk businesses

Jurisdiction	Present Status of Legislation	Changes to Existing Legislation
Western Australia	Adequate [Has some registration processes already. Food and safety programs are being implemented]	<p><u>Additions</u></p> <ul style="list-style-type: none"> • Extended scope • National performance standards for enforcement • Registration of laboratories not analysts • Register of auditors • Notification • Infringement notices • Review of administrative decisions <p><u>Deletions</u></p> <ul style="list-style-type: none"> • Registration • Hygiene provisions
ACT	Good Has established licensing system for food premises.	<p><u>Additions</u></p> <ul style="list-style-type: none"> • Extended scope • National performance standards for enforcement • Notification • Registration of laboratories not analysts • Register of auditors • Infringement notices • Review of administrative decisions <p><u>Deletions</u></p> <ul style="list-style-type: none"> • Licensing of food businesses • Hygiene provisions
Northern Territory	Existing but outdated food hygiene regulations. Inadequate enforcement powers.	<p><u>Additions</u></p> <ul style="list-style-type: none"> • Extended scope • National performance standards for enforcement • Notification • Registration of laboratories not analysts • Register of auditors • Notification and registration • Infringement notices • Review of administrative decisions <p><u>Deletions</u></p> <ul style="list-style-type: none"> • Hygiene provisions

Source: **Regulatory Impact Analysis incorporating a National Competition Policy Review of the Food Law**

Appendix J

Funding arrangements for water bore rehabilitation programs

In New South Wales, the *Cap and Pipe the Bores Program* provides a non-repayable grant to landholders for them to undertake the works. The present cost sharing arrangements for bore rehabilitation is 80 percent State/Commonwealth and 20 percent landholder, and for property water planning and piping is 20 percent State/Commonwealth and 80 per cent landholder.

In Queensland, the *Bore Drain Replacement Program*, costed at more than \$40 million, is a joint Commonwealth and State initiative, funded by the Commonwealth, State and landholders. Negotiations with the Commonwealth and State governments have resulted in an initial subsidy of 40 percent Federal; 40 percent State and 20 percent landowner contribution for rehabilitating bores and piping water for both demonstration and economic analysis purposes.

In South Australia, the bore rehabilitation program has concentrated on the uncontrolled flowing bores in the Frome Embayment region. The program only covers the capping of the bores, with the funding being shared equally between the Commonwealth and State government.

Appendix K

Duty of care in resource and environmental regulation

Victoria

The *Catchment and Land Protection Act 1994* states that landowners must take all reasonable steps to:

- avoid causing or contributing to degradation to another's land;
- conserve soil;
- protect water resources;
- eradicate regionally prohibited weeds;
- prevent the growth and spread of regionally controlled weeds; and
- prevent the spread of, and as far as possible, eradicate established animal pests.

Queensland

The *Environmental Protection Act 1994* imposes a duty of care on everyone to take all reasonable and practicable measures to prevent or minimise environmental harm. There are no legal consequences for not fulfilling the duty. The legislation is intended to encourage industry self-regulation through codes of practice.

South Australia

The *Environmental Protection Act 1993* includes a general environmental duty of care. It requires that a person must not undertake an activity that pollutes or might pollute the environment unless that person takes all reasonable and practicable measures to prevent or minimise any resulting harm.

The *Soil and Landcare Act 1989* states 'It is the duty of an owner of land to take all reasonable steps to prevent degradation of the land'. The *Water Resources Act* is to be amended along similar lines.

Western Australia

In its Draft Report, the Task Force appointed to review natural resource management in Western Australia recommended codifying a duty of care as follows:

It is the duty of an owner of land to take all reasonable steps to: . protect natural resources and sustainably manage the land; and . avoid causing or contribution to land degradation which causes or may cause damage to land of another land owner.

Source: IC (1998).

Appendix L

National Water Quality Guidelines

Guidelines for Pesticides in raw water

Compound	Maximum concentration (µg/L)	Compound	Maximum concentration (µg/L)
Acephate	20	Fenvalerate	40
Alachlor	3	Flamprop-methyl	6
Aldrin	1	Fluometuron	100
Amitrol	1	Formothion	100
Asulam	100	Fosamine (ammonium salt)	3,000.00
Azinphos-methyl	10	Clyphosate	200
Barban	300	Heptachlor	3
Benomyl	200	Hexaflurate	60
Bentazone	400	Hexazinone	600
Bioresmethrin	60	Lindane	10
Bromazil	600	Maldision	100
Bromophos-ethyl	20	Methidathion	60
Bromoxynil	30	Methomyl	60
Carbaryl	60	Metolachlor	800
Carbendazim.	200	Metribuzin	5
Carbofuran	30	Mevinphos	6
Carbophenothion	1	Molinate	1
Chlordane	6	Monocrotophos	2
Chlordimeform	20	Nabam	30
Chlorfenvinphos	10	Nitralin	1,000.00
Chloroxuron	30	Omethoate	0.4
Chlorpyrifos	2	Oryzalin	60
Clopyralid	1,000.00	Paraquat	40
Cyhexatin	200	Parathion	30
2,4-D	100	Parathion-methyl	6
DDT	3	Pendimethalin	600
Demeton	30	Perfluidone	20
Diazinon	10	Permethrin	300
Dicamba	300	Picloram	30
Dichlobenil	20	Piperonyl butoxide	200
3,6-Dichloropicolinic acid	1,000.00	Pirimicarb '	100
Dichlorvos	20	Pirimiphos-ethyl	1
Diclofop-methyl	3	Pirimiphos-methyl	60
Dicofol	100	Profenofos	0.6
Dieldrin	1	Promecarb	60
Difenzoquat	200	Propanil	1,000.00
Dimethoate	100	Propargite	1,000.00
Diquat '	10	Propoxur	1,000.00
Disulfoton	6	Pyrazophos	.1,000.0
Diuron	40	Quintozene	6
DPA	500	Sulprofos	20
Endosulfan	40	2,4,5-T	2

Endothal	600	Temephos	30
Endrin	1	Thiobencarb	40
EPTC	60	Thiometon	20
Ethion	6	Thiophanate,	100
Ethoprophos	1	Thiram	30
Fenchlorphos	60	Trichlorofon	10
Fenitrothion	20	Triclopyr	20
Fenoprop	20	Trifluralin.	500
Fensulfothion	20	Vernolate	

Source: NHMRC/ARMCANZ, 1996

Summary guidelines for protection of aquatic ecosystems

Indicator	Units	Fresh waters	Marine waters
Biological		It is premature to recommend specific values for these indicators. The need for biological evaluation is recognised, and these indicators are identified as important characteristics of ecosystem function	
Physico-chemical			
Colour & clarity		< 10% change in euphotic	< 10% change in euphotic
Dissolved oxygen	mg/L	> 6 (> 80-90% saturation)	> 6 (> 80-90% saturation)
pH		6.5-9.0	< 0.2 pH unit change
Salinity	mg/L	< 1000 (about 1,500 µS/cm)	
Suspended particulate matter/ turbidity		< 10% change seasonal mean concentration	< 10% change seasonal mean concentration
Temperature		< 20C increase	< 20C increase
Toxicants			
Inorganic toxicants	all µg/L		
Aluminium		< 5.0 (if pH < 6.5) < 100.0 (if pH > 6.5)	NR
Ammonia		20.0-30.0	NR
Antimony		30	500
Arsenic		50	50
Beryllium		4	NR
Cadmium		0.2-2.05	2
Chromium		10	50
Copper		2.0-50	5
Cyanide		5	5
Iron		1,000.00	NR
Lead		1.0 -5.0	5
Mercury		0.1	0.1
Nickel		15.0-150.0	15
Selenium		5	70
Silver		0.1	1
Sulfide		2	2
Thallium		4	20
Tin (tributyltin)		0.008	0.002
Zinc		5.0_50.06	50
Organic toxicants			
Acrylonitrile		NR	NR
Benzidine		NR	NR
Dichlorobenzidine		NR	NR
Diphenylhydrazine		NR	NR
Halogenated aliphatic compounds			
Hexachlorobutacliene		0.1	0.3

Source: ANZECC, 1992

Summary Guidelines for irrigation water quality

Parameter	Guideline (mg/L, unless otherwise stated)	Comment
Biological parameters		
Plant pathogens		
Human and animal pathogens	1,000 faecal coliforms/100 mL	Tentative value. Geometric mean of not less than 5 water samples taken per month; no more than 20% should exceed 4,000 organisms/100 mL
Algae	Should not be visible	
BODs		No guideline recommended
Major ions		
Bicarbonate		No guideline recommended due to interaction with other factors
Chloride	30-700	Maximum concentration should be set according to sensitivity of crop.
Heavy metals and trace ions**		
Aluminium	5	High toxicity in acid soils
Arsenic	0.1	
Beryllium	0.1	
Boron	0.5-6.0	
Cadmium	0.01	Higher toxicity in acid soils
Chromium	1	Limit chromium (VI) concentration to 0.1 mg/L
Cobalt	0.05	
Copper	0.2	
Fluoride	1	
Iron	1	
Lead	0.2	
Lithium	2.5	Citrus: 0.075 mg/L
Manganese	2	If acid soils, limit to 0.2 mg/L
Mercury	0.002	
Molybdenum	0.01	
Nickel	0.2	
pH (CaCl ₂)	4.5-9.0	
Selenium	0.02	
Uranium	0.01	
Vanadium	0.1	
Zinc	2	1 mg/L is recommended for sandy soil below pH 6

Source: ANZECC, 1992

Herbicides registered for use in or near waters (mg/L)

Herbicide	Residue limits in irrigation water	Hazard to crops from residue in water**	Crop injury threshold in irrigation water (mg/L)
Acrolein	0.1	+	Flood or furrow: beans 60, com 60, cotton 80, soybeans 20, sugar-beets 60 Sprinkler: corn 60, soybeans 15, sugar-beets 15
AF 100	*	+	Beets (rutabag) > 3.5, corn 3.5
Amitrol	0.002	++	Lucerne 1,600, beans 1,200, carrots 1,600, corn 3,000, cotton 1,600, grains sorghum > 800, oats 2,400, potatoes 1,300, wheat 1,200
Aromatic solvents (Xylene)	*	+	
Asulam	*	++	
Atrazine	*	++	
Bromazil	*	+++	
Chlorthiamid	*	++	
Copper sulfate	*	+	Apparently above concentrations used for weed control (see irrigation criterion for copper)
2,4-D	*	++	Field beans 3.5-10, grapes 0.7-1.5, sugar-beets 1.0-10
Dicamba	*	++	Cotton 0.18
Dichlobenil	*	++	Lucerne 10, corn > 10, soybeans 1.0, sugar-beets 1.0-10, com 125, beans 5
Diquat	*	+	
Diuron	0.002	+++	
2,2-DPA (Dalapon)	0.004	++	Beets > 7.0, corn < 0.35
Fosamine	*	+++	
Fluometuron	*	++	Sugar-beets, alfalfa, tomatoes, squash > 2.2
Glyphosate	*	+	
Hexazinone	*	+++	
Karbutilate	*	+++	
Molinate	*	++	
Paraquat	*	+	Com > 10, field beans 0.1, sugar-beets < 1.0
Picloram	*	+++	
Propanil	*	++	Alfalfa 0.15, brome grass (eradicated) 0.15
Simazine	*	++	
2,4,5-T	*	++	Potatoes, alfalfa, garden peas, corn, sugar-beets, wheat, peaches, grapes, apples, tomatoes
TCA	+++	> 0.5	
Terbutryne	*	++	
Triclopyr	*	++	

Source: ANZECC, 1992.

Water quality guidelines for livestock watering

(mg/L, unless otherwise stated)

Parameter	Guidelines	Comment
<i>Biological parameter</i>		
Pathogens and parasites	1,000 faecal coliforms/100 mL	Geometric mean for not less than 5 water samples taken per month; no more than 20% should exceed 5,000 organisms per 10 mL
Algae	Up to 10,000 cells/mL may be tolerated, depending on the algal species present.	
<i>Major ions and nutrients</i>		
Calcium	1,000.00	
Nitrate-N	30	30 (horses), 40 (cattle), 60 (sheep)
Nitrite-N	10	
Sulfate	1,000.00	
Total dissolved solids	3,000.00	
<i>Trace elements</i>		
Aluminium	5	
Arsenic	0.5	
Beryllium	0.1	
Boron	5	
Cadmium	0.01	
Chromium	1	
Cobalt	1	
Copper	0.5	0.5 sheep, 1.0 pigs and poultry 5.0 cattle
Fluoride	2	
Iron	-	No guideline recommended
Lead	0.1	
Manganese	-	No guideline recommended
Mercury	0.002	
Molybdenum	0.01	
Nickel	1	
Selenium	0.02	
Uranium	0.2	
Vanadium	0.1	
Zinc	20	

Source: ANZECC, 1992

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