WESTERN AUSTRALIAN

salinity action plan

prepared by

AGRICULTURE WESTERN AUSTRALIA

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

DEPARTMENT OF ENVIRONMENTAL PROTECTION

WATER AND RIVERS COMMISSION

for the

GOVERNMENT OF WESTERN AUSTRALIA

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NOVEMBER 1996

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Executive summary

Salinity is one of the State's most critical environmental problems, threatening major economic and social consequences. It is preventable and, in the long term, reversible. Complete elimination is not realistic, but we can dramatically reduce its impact.

This requires coordinated action from agricultural land owners, the Government and the broader community. Catchment management and community participation are crucial to this Action Plan, which aims to:

- reduce further deterioration and wherever possible, recover existing salt-affected land;
- protect and restore key water resources and high value wetlands;
- maintain natural (biological and physical) diversity; and
- protect designated infrastructure affected by salinity.

These aims will be actively pursued over the next several decades.

Former woodland killed by rising salinity levels.

Cause

Salinity is caused by replacing deep-rooted native plants with shallow-rooted crops and pastures. More rainfall passes below the root zone and accumulates as groundwater so that watertables rise. The groundwater mobilises natural salts in the soil as it rises and carries them towards the surface, eventually degrading land and streams.

Successful salinity control requires management of saline groundwater. Deep-rooted perennials, especially trees and shrubs which can restore nature's balance, will be a fundamental part of all salinity management strategies.

Solutions

To achieve the Plan's aims the Government will ensure:

- another three million hectares of trees and shrubs are planted across the agricultural area;
- other commercially viable water management practices complement these plantings to maximise water use and economic benefits;
- remnant vegetation is protected and managed to maintain it in perpetuity.

The Action Plan will be applied on the basis of three rainfall zones:

- greater than 600 mm per annum, where farm forestry is largely proven and other perennial options exist;
- between 400 and 600 mm per annum, where the high water use capacity of woody perennials will be especially important because of the combination of high groundwater recharge and high salt storage; and
- less than 400 mm per annum, where extensive use of high water use cropping systems, complemented by strategically distributed revegetation with woody perennials, will be the major focus.

Implementation

The Action Plan will be implemented by creating an environment in which farmers and other investors can have confidence in their investment in restorative action by:

- ready access to information on commercially viable options by all farmers;
- Government support for land conservation and biodiversity plantings in return for implementation of other high water using practices;
- increasing effort in research and industry development of new commercial tree crops.

Implementation will also be achieved by the Government and the community establishing priority areas for on-the-ground action by:

- selecting focus catchments to concentrate action and Government advice and providing fully coordinated support teams (in return for agreements to implement); and
- establishing key "recovery" catchments where priority is given to restoration/protection of water resource, natural diversity and wetland values and rural infrastructure.

Investment and funding

The approach will require a major long-term investment of time, money and effort by landowners. An additional $3 billion is required to ensure the planting of sufficient woody perennials to sustain the natural resource base for current and future generations. This means an investment of about $100 million every year for 30 years (about two per cent of gross production from Western Australian agriculture). Much of this investment will have to come from landowners and private industry.

Private investment will be supported by Government spending, particularly where the public benefit is high.

The Action Plan will add to existing funding ($22.8 million per annum) by:

- redistributing $5.8 million per annum from existing agency budgets to salinity management;
- phasing in over three years an extra $10 million per annum of State Government money, to implement the plan and particularly to support the remnant vegetation, recovery catchments and rural towns rescue components;
- phasing in over four years $18 million per annum from CALM's budget by adjusting asset sales and debt reduction schedules, to implement a major commercial farm forestry program in the medium rainfall zone and on sandy soils on the Swan coastal plain;
- seeking $30 million per annum of Commonwealth money allocated as follows:
  - $13.5 million per annum for land conservation and biodiversity plantings
  - $11 million per annum for development of commercial woody plant crops and associated industries (to establish sufficient resource base to achieve commercial objectives)
  - $1.5 million for additional plantings to support commercial plantations on key water supply recovery catchments
  - $3 million for key natural diversity recovery catchments
  - $1 million for the rural towns rescue program; and
- renegotiating funding arrangements with the Commonwealth to implement the plan.

State and Commonwealth Government investment in controlling salinity will exceed $85 million per annum with much of the funds directed to on-farm activities, such as perennial crop establishment and fencing.

Whole of Government approach

The plan will be administered through a Ministerial Committee, chaired by the Premier and comprising the Deputy Premier and Ministers for Primary Industry and the Environment. The Committee will be advised by a State Salinity Council, made up of invited representatives of business, environmental interests and agricultural landholders, together with the chairpersons of the:

Rural Adjustment and Finance Corporation;
Farm Forestry Development Group;
Water and Rivers Commission;
National Parks and Nature Conservation Authority;
Lands and Forests Commission; and
Environmental Protection Authority.

The Council will draw on community and industry input and have the Chief Executive Officers of Agriculture Western Australia, Water and Rivers Commission, Department of Conservation and Land Management, and Department of Environmental Protection as advisers/observers.

The four CEOs will coordinate implementation and resourcing decisions.

1. Salinity - a long term problem that must be solved

Salinity is one of the State's most critical environmental problems. It has major economic and social consequences. Due to Western Australia's landforms and climate, both the extent and the rate of expansion of salinity are particularly severe compared to other parts of Australia. Decisive action is needed. The State Government believes that salinity is preventable and, in the long term, reversible. In the high rainfall south-west region, economically viable practices already exist. In lower rainfall regions, practices are available which will reduce the rate of development of salinity but additional practices will be required to achieve full control.

A coordinated plan of action to accelerate implementation of available practices and to develop additional cost effective practices will begin immediately.

This will require integrated action and support by the Government, agricultural land owners and the broader community. As solutions to salinity should generally be implemented through new approaches in agricultural production systems, land owners hold the key to fighting salinity successfully.

During the decade of Landcare, landowners have demonstrated a willingness to work, both in farmer groups and with the Government and the wider community, to tackle land and environmental degradation problems.

The Government is confident that a new era of partnership between farmers, Government agencies and the broader community can overcome the State's salinity problem, providing enormous future benefits for agriculture, the environment and all Western Australians.

Salinity is a large and complex problem and will take decades to bring under control. The magnitude of the task requires large financial and human resources which must be mobilised, organised and delivered according to priority. The salinisation process involves groundwater systems which respond slowly to changes in agricultural water management practices. It is inevitable that further deterioration will occur before improvements become apparent.

The nature of the salinity problem in Western Australia is such that the complete elimination of its effects is not realistic. However, concerted action can dramatically reduce the extent of salinity and its impacts on the State's environment, economy and social well-being.

This Salinity Action Plan provides a new blueprint for action by the Western Australian Government and its agencies to work effectively in partnership with land holders and the community to address the problems of salinity. The Plan shows how these groups can implement and further develop practical programs to combat salt encroachment so that future generations have sustainable agricultural production systems, protected potable water resources and sufficient protected habitats and wetlands to maintain the region's natural (biological and physical) diversity.

This Plan:

- describes the causes of salinity and its threat to natural resources (Section 2);
- sets objectives (Section 3);
- outlines solutions that are currently available and how they can be improved with further technological development and improved planning and management (Section 4);
- proposes the implementation of viable land management practices as quickly as possible (Section 5);
- outlines the overall approach to Government coordination, monitoring of the plan and proposed funding of the actions (Section 6,7,8 & 9).

Agriculture in the State's south-west is a $4.5 billion a year industry - if salinity worsens, we risk losing more than $60 million of productive farmland each year.

2 The threat to natural resources and infrastructure assets

Salinity has developed following the widespread clearing of deep-rooted native vegetation and its replacement by the annual crops and pastures of current agricultural systems. An additional proportion of rainfall is able to seep through the soil and reach levels below the shallow root zones of agricultural plants. Unable to be returned to the atmosphere by the vegetation, the additional water accumulates as groundwater. As the watertable rises it mobilises salts stored in the soil and transports them towards the soil surface. When saline groundwater reaches the surface, the concentration of salts reduces agricultural productivity and can render land unsuitable for any form of agriculture.

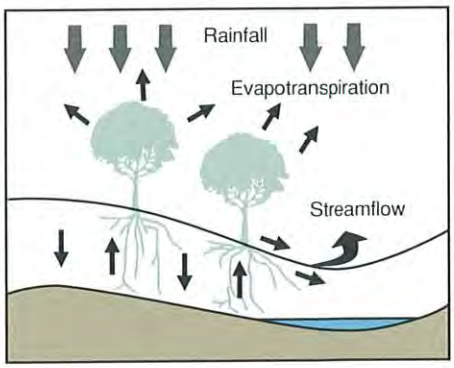
Salts are also washed down streams and river systems, affecting their value as potable water supplies and as environmental and recreational assets. The salinisation of land and water resources also kills native vegetation and causes degradation and loss of flora and fauna habitats, thereby reducing biological diversity both on land and in waterways.

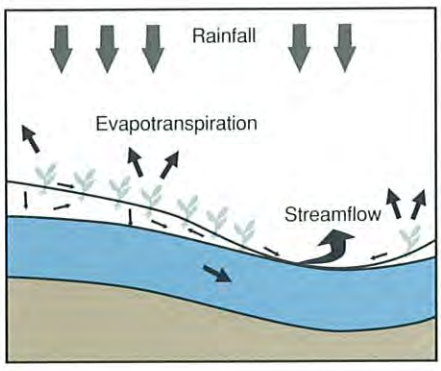
Rising saline groundwater levels can also cause considerable damage to buildings and roads in rural areas by weakening soil strength and affecting the structural foundations. Therefore, salinity poses a major threat, not only to the conservation of land, water and biological resources, but also physical infrastructure assets.

2.1 Land

The State's south-west agricultural region produces agricultural goods worth over $4.5 billion[1] annually for both local and export markets on around 18 million hectares of cleared land. Already 1.8 million hectares of formerly productive land, or about ten per cent of Western Australia's farmed areas, are affected by salinity. Production from this land has either been lost or reduced. It is estimated that the total value of this loss is in the order of $1445 million. This is an estimate of the capital value of the land and therefore includes an opportunity cost of production lost. If the current rate of salinity expansion continues there will be a resulting annual loss to agriculture of approximately $64 million each year. Currently over 70 per cent of Australia's reported salt-affected land occurs in Western Australia.

Figure 1: Typical changes in water and salt balances following clearing
(for a catchment with rainfall of approx 700 mm per annum)





	Before clearing	After clearing
Rainfall	650-750 mm	650-750 mm
Evapotranspiration	640-720 mm	580-660 mm
Streamflow	10-30 mm	70-90 mm
Salt input	0.01 kg/m²	0.01 kg/m²
Salt output	0.001-0.005 kg/m²	0.3-0.5 kg/m²

[1] The farm forestry industry and other regional developments may add another $1 billion.

If effective management is not developed and implemented quickly, the area affected is likely almost to double, to 17 per cent of the total farm area, in 15 to 25 years, and eventually double again (to over 30 per cent) as groundwater levels continue to rise.

In the past farmers largely adapted to the cost of salinity by increasing production on unaffected land with improved technology, farm rationalisation, higher yielding varieties and other agricultural system advances. This will be increasingly difficult in the future as the resource base continues to deteriorate.

2.2 Water resources

Western Australia has adequate surface and groundwater resources to meet water demand well into the middle of the next century. However, increased river and stream salinity have cost the community substantially. During the past eight years, over $40 million has been spent on replacement water supplies, and there will be major costs in the future as potential supplies become too saline to develop. More than a third (36 per cent) of the south-west's potentially divertible surface water resource is brackish or saline and no longer suitable to develop as drinking water. A further 16 per cent is of marginal quality. Key catchments with marginal or brackish water have been placed under clearing controls since the 1970s and restoration programs have begun in two catchment areas. While over $45 million has been spent on salinity management to date, expanded restoration programs are needed to return these catchments to drinking water standards.

2.3 Biological resources

Western Australia's flora and fauna have been greatly diminished by land clearing and the introduction of exotic plants and animals, and is further compromised by salinity. The worst hit areas are valley floors and wetlands where groundwaters approach or discharge at the surface. More than 80 per cent (by length) of stream riparian zones are seriously degraded by salinity. Salinity also poses a major threat to the remaining remnant vegetation, wetlands, unique species and ecosystems, and the tourism and recreational assets these comprise. Without corrective action over 80 per cent of remnant habitats on private land and as much as 50 per cent within public reserves could be lost over the next 30 to 50 years.

2.4 Rural infrastructure

Rising groundwater tables are affecting the infrastructure and transport systems of many rural towns. The cost of salinity is increasing through the need for frequent maintenance of roads, railways and their drainage systems, and of town buildings and services.

Rising watertables weaken the soil structure and cause waterlogging - both can undermine buildings and other structures in rural areas.

3 Strategic aims of the Action Plan

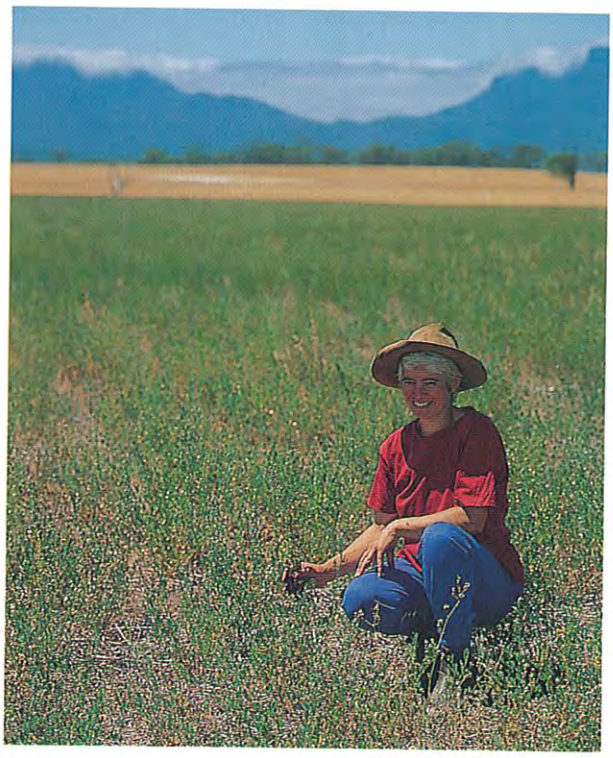
To address the threats to our resources the Action Plan aims to:

- Reduce further deterioration of agricultural land and where possible recover or rehabilitate existing salt-affected land.
- Protect and restore key water resources to ensure salinity levels are kept at a level that permits safe, potable water supplies in perpetuity.
- Protect and restore high value wetlands, and maintain natural (biological and physical) diversity within the agricultural areas of Western Australia.
- Protect designated infrastructure affected by salinity.

Each of these aims applies across the agricultural area of the State. However the degree to which each aim is pursued will depend on the relative importance of the assets under threat in particular catchments. Throughout most of the region the priority will be to minimise further deterioration of the land resource base and where possible, recover or rehabilitate existing salt-affected land. Where water supplies, biological diversity or infrastructure are threatened, and the community and Government decide that they must be protected, the priority will be to ensure their protection at minimum economic cost.

The proposed actions to achieve these aims and objectives are based on two fundamental principles:

- developing and implementing solutions that reduce net recharge and control saline groundwater; and
- taking an integrated approach to the planning and implementation of solutions at the catchment scale.



Lucerne, a perennial legume, is demonstrating its success in lowering watertables on south coast properties.

Bluegums in a belt planting integrating the tree crop with traditional farm production.

4 Solutions

There is a very large body of practical experience and scientific information about the salinity problem in south-west Western Australia. There is confidence that with a combination of the best management practices, economically viable solutions exist to control salinity over most areas in the high rainfall south-west region. In lower rainfall regions, practices are available which will reduce the rate of development of salinity, but additional practices will be required to achieve full salinity control.

The companion document entitled *Salinity: A Situation Statement for Western Australia* defines the approaches used for salinity control as "water management practices". These practices can be designed to decrease the amount of water able to enter and flow from groundwater systems. They are briefly discussed here to support the strategic direction of this Action Plan.

4.1 Water management practices

It is estimated that an additional five billion kilolitres per year of rainfall recharge now occurs on cleared land in the south-west agricultural region. This is of the same order as the annual streamflow of all the large river basins of the region and is an enormous quantity of water to be managed overall. Engineering approaches which seek to control (eg de-water and divert) large quantities of saline groundwater are rarely practical or financially viable at a regional scale. They can pose major environmental problems of disposal. However, groundwater recharge is distributed throughout the cleared land and is a small component of rainfall. The quantities of groundwater recharge involved at the local hillslope scale are much smaller and more manageable than on a regional scale. Approaches which seek to reduce recharge and control saline discharges at this local scale, through suitable water management practices, are generally much more effective, economic and environmentally manageable.

The water management practices to control salinity can be grouped into the following five categories:

- introducing perennial species, both native and exotic, to increase water use;
- improving water use of annual crops and pastures;
- collection, re-use and/or disposal of surface water;
- drainage or pumping, re-use and/or disposal of groundwater; and
- protection and management of remnant vegetation.

4.1.1 Increase water use by introducing deep-rooted perennial species

The deep roots of perennial plants, especially the longer-lived woody shrubs and trees, have the potential to use water from deep within the soil profile. By exploiting stored water, as well as rainfall, strategically placed trees can consume more than double the direct rainfall they receive. Thus they address the problems of salinity by directly controlling groundwater recharge and discharge. It is possible to use up and buffer against accumulating groundwater by manipulating the proportion and distribution of perennials, thereby controlling salinity.

> Deep-rooted perennials need to be a fundamental component of all salinity control measures. A further three million hectares of deep-rooted woody perennials are needed to manage the State's salinity problem successfully.[2]

Many landholders have begun planting deep-rooted perennial vegetation on their farms. The Government believes that the additional three million hectares can be achieved through a variety of planting types and situations. Indicative targets of how the three million hectares may be achieved are set out below.

Type of planting	Area (ha)	Funding
Commercial tree crops, eg *Eucalyptus globulus, Pinus pinaster*	0.75 million	Private*
Land conservation and biodiversity plantings, eg hardy species for salt prone areas, shelterbelts, plantings which add to existing remnant vegetation	1.25 million	Public/ Private
Forage crops, eg tagasaste	0.5 million	Private
New commercial tree crop development eg oil mallees	0.5 million	Private*

** Public funding to establish viable industries*

The target for perennial vegetation will be augmented with expanded introduction of lucerne into lower rainfall environments, particularly in the south of the State.

[2] This has been set as a preliminary target for deep-rooted woody perennials on the basis of current knowledge of their additional transpirative capacity equalling the current estimates of groundwater recharge.

As wide dispersal of perennials is essential to achieve high water use, it is also vital to integrate woody perennials into improved cropping and grazing production systems.

Such integrated perennial plantings can only be implemented on a large scale by individual landowners making substantial investment decisions in their long term future. An investment of some $100 million per annum will be required on average each year for 30 years to establish the additional three million hectares.

While this cost seems large, it must be viewed relative to the gross agricultural production of over $4.5 billion achieved annually from the agricultural region, and the large (but unquantifiable) economic benefit of the current and future use of the region's water resources. The investment of $100 million per year in salinity management represents only about two per cent of the gross agricultural production of the area. Most of the necessary plantings can be achieved by landowners or other investors, investing in farm forestry, land conservation and biodiversity plantings, forage cropping and development of new commercial tree crops.

Much of this can be achieved by commercial investment by landowners with returns to exceed the cost. Market forces alone, however, will not adequately address the whole problem.

The Government will invest funds to:

- create the climate and provide information to facilitate existing commercial solutions;
- support development of new tree crop species and industries;
- provide incentives for farmers where commercial options on their own will not adequately mitigate salinity;
- carry out works to "recover" catchments where protection of environmental values, water resources and infrastructure will provide significant public benefit.

The Government is committed to the promotion of farm forestry systems and sees the need for its further development and implementation. It also recognises a significant role for plantings to conserve land resources, including plantings to occupy difficult sites, give benefits from shelter and provide erosion control; and plantings to generate natural diversity and amenity benefits. These plantings are not directly commercial but have significant secondary benefits.

ACTION

The Government will seek $30 million per year from the Commonwealth Government's environment and sustainable agricultural initiatives under the Natural Heritage Trust to complement private investment in the establishment and protection of deep-rooted perennial vegetation throughout the agricultural areas of Western Australia. These funds will be used for:

- research and industry development for new commercial tree crop species and products;
- incentives for land conservation and biodiversity plantings;
- protection and remediation of "recovery" catchments for water supply and high conservation areas; and
- protection of rural town infrastructure threatened by salinity.

In addition, CALM will expend $18 million per annum principally on the implementation of a commercial farm forestry program in the medium rainfall zone. Tree crops will be established in partnership with farmers and integrated into farming systems.

4.1.2 Increase water use by crops and pastures

There is further potential to increase annual crop and pasture use while also achieving significant economic gains, in particular in the high performance cropping systems of the wheatbelt and south coast. In addition, it is possible to increase use of out-of-season rainfall in the south of the State with perennial pastures, particularly lucerne. Productivity of marginal and saline lands can be increased by use of new pasture varieties adapted to poor soils and waterlogging.

Water use will continue to improve through profitable farming systems. However, annual plants are not able to provide a complete solution, and will need to be complemented by extensive use of perennials to achieve salinity control.

ACTION

Agriculture WA will work with existing industry research and development corporations to further develop higher water using agricultural cropping and pasture systems.

(Funding from existing programs)

4.1.3 Collect, reuse and dispose of surface water

Water ponding on the soil surface and waterlogging within the soil profile inhibit plant growth and increase recharge. Shallow drainage can quickly and cheaply improve productivity in these circumstances. Retention of water along contour lines using drains, banks or cultivation rows can improve plant growth, increase plant water consumption, reduce erosion and recharge, and improve farm productivity. However, the disposal of water requires careful planning, and it only indirectly addresses groundwater control through the reduction of the amount of water available to recharge groundwater.

Shallow drainage can improve plant growth and water use on waterlogged sites. However it does not provide a solution alone and must be complemented by other strategies, such as the establishment of woody perennials, that directly control the recharge and discharge of saline groundwater.

4.1.4 Drain or pump, reuse and disposal of groundwater

Groundwater levels can be lowered with deep drains and ground-water pumping. The spacing and depth of drains can be designed to keep groundwater below a specific depth. Pumped water may be reused if the quality is suitable, or disposed of into evaporation basins. Most deep drainage to date has not been cost-effective. Discharge into streams and wetlands can adversely affect the environment, and the prospect of damage to other properties often makes off-site disposal unacceptable. This approach is only likely to be applicable to protecting or restoring valuable assets at a local scale such as conservation reserves, wetlands or infrastructure, where the land has suitable hydrologic properties and disposal is environmentally sound. Safe disposal by regional scale transport and reuse is rarely cost-effective. Recent studies of proposals to pump saline groundwater from Dumbleyung Lake to the eastern Goldfields have shown the costs outweigh the benefits.

Drainage and remedial plantings are being used to fight rising groundwater on this property.

Current drainage controls, under the Soil and Land Conservation Act, designed to protect downstream land holders and community assets, have proved difficult to implement effectively. Also, substantial drainage is already taking place, without any consideration of salinity control measures, so that it may be ineffective in addressing salinisation in the long term.

The Government will only support drainage proposals where the impact on downstream landowners and assets is minimal, and will not permit works without a commitment by those putting in drains to implement other water control measures, such as revegetation, at the same time.

ACTION

The Government acknowledges the limitations of the current drainage regulations, and commits its agencies (Agriculture WA, Water and Rivers Commission, Department of Environmental Protection and CALM) to:

- define more clearly the category of drainage schemes most likely to cause downstream impacts and environmental damage;
- establish an authorisation process for this category of drainage;
- provide the authorising bodies with powers to assess drainage on broad environmental criteria;
- ensure the protection of downstream landowners; and
- ensure that other essential water management practices are implemented with drainage proposals to reduce accessions to groundwater.

(Funding of an additional $0.09 m per annum to Agriculture WA and $0.05m per annum to DEP from State sources)

Wandoo woodland after sunset.

4.1.5 Improve protection and management of remnant native vegetation

Remnant vegetation occupies 2.8 million hectares out of the 20.8 million hectares of privately-owned land in the agricultural zone of Western Australia. It occurs mainly as small areas and is often degraded. A further 4.5 million hectares of State forest, national parks, nature reserves and other public lands occur mostly in large blocks with intact native vegetation. Remnant vegetation is particularly valued for salinity control where:

- individual remnants are large enough to affect recharge at a catchment or sub-catchment scale;
- smaller remnants occur on high recharge zones (eg deep sands and around rocky outcrops) or discharge zones (eg drainage lines, swamps and lakes).

All remnant native vegetation, if combined with appropriate revegetation, will contribute to the control of salinity and protect nature conservation values. However, current water use by remnants may be limited both by poor management and their degraded condition. Remnant vegetation is commonly exposed to grazing, has poor natural regeneration and may be subject to timber extraction without adequate regeneration. Nevertheless, remnant vegetation has a significant habitat value and is essential to the preservation of biological diversity. Protective fencing, rehabilitation of degraded remnants and on-going management will maintain or enhance water use.

Remnant vegetation protection and management, and its integration with other vegetation strategies, will be a significant component of salinity control systems.

The Government is committed to improving the protection and management of remnant vegetation. In 1995 it trebled funding for the Remnant Vegetation Protection Scheme (to $0.90m per annum) and established a new policy to reduce the expectation to clear land. Existing controls on clearing under the Soil and Land Conservation Act and the Country Areas Water Supply Act are to be augmented to ensure other natural resource conservation issues are considered before any further clearing occurs on private land.

ACTION

To this end the Government will:

- ensure that augmented clearing control procedures, including the consideration of natural resources conservation values, are in place by 1997;
- develop legislation which will enable individuals to place voluntary covenants on their land titles to protect nature conservation values including remnant vegetation in perpetuity;
- develop legislation to establish an independent fund-raising foundation to support nature conservation, including land acquisition for conservation reserves;
- ensure retention and better management of remnant vegetation on Crown land including conservation reserves.

(Funding of an additional $0.10m per annum to DEP for augmented clearing control procedures and $1.35m per annum for CALM for better remnant vegetation management - both from State sources)

CALM will:

- promote and support the conservation of remnant vegetation on farms in partnership with Agriculture WA, through collaboration with Commonwealth programs such as Save the Bush, through the establishment of a Land for Wildlife Scheme modelled on the highly successful Victorian scheme of the same name, and through its regional ecological and advisory services;
- promote remnant vegetation conservation along roadsides and other transport and utility corridors through the work of the Roadside Conservation Committee.

(Funding of an additional $0.25m per annum to CALM, $0.1m per annum from redistribution within the existing budget and $0.15m per annum from the State)

The Water and Rivers Commission will:

- through a new program, ensure that remnant vegetation on private land in the priority water resources catchments of Mundaring Weir, Wellington Reservoir, Warren, Kent and Denmark

Rivers is fenced by 2010 and managed to ensure its long term retention.

(Funding of an additional $0.6m per annum from State sources)

4.1.6 Regional application of water management practices

The range of water management practices which may be used will vary regionally. In the high rainfall region (>600 mm per annum), commercial farm forestry opportunities are readily available to farmers. Practices for integration need to be further developed to hasten farmer adoption. Given the high rainfall, waterlogging is widespread and surface water drainage is important to improve the conditions for plant production and water use. Perennial pasture is best suited to this region.

The intermediate rainfall region (400 to 600 mm) has high salt storage and active groundwater systems (due to the relatively high recharge), so land salinisation is severe. While expansion of high water use crop and more sustainable pasture systems will contribute to improved water use in this region, the most important means of salinity control will be to establish woody perennials to increase water use significantly. The development of more commercial tree crops for this region is essential.

For regions with less than 400 mm annual rainfall, small but extensive increases in water use can be achieved by continued improvement in cropping systems and the introduction of strategically dispersed high water use woody plant crops. While the technology now exists to use virtually all normal year rainfalls, woody perennials will be needed to use excess water from wet winters and out-of-season rainfall events. Commercial benefits from these woody plants need to be actively pursued. Until commercial options develop, plantings which generate land conservation, natural diversity and amenity benefits will be a high priority.

The Salinity Action Plan will focus on the implementation of appropriate solutions for these rainfall regions as illustrated in Figure 2.

4.2 Salinity management targets

An effective response to salinity at the catchment scale requires clear objectives and targets, that have been agreed and well understood by all the stakeholders, such as landholders, government and the broader community. Three key aspects need to be considered when setting objectives and target outcomes for particular catchments:

- sustaining the land and water resources base - reducing further deterioration, and where possible restoring land and water qualities;
- reducing the economic and financial losses to the individual and the State - reducing the costs associated with losses in agricultural production, water resources, environmental values, and infrastructure; and
- conserving natural diversity - protecting remaining natural areas and their flora and fauna, and restoring a representative range of natural environments on a regional scale.

Clear decisions are required on the degree to which each aspect is to be pursued and the relative importance of each when setting catchment objectives. Relative importance will vary depending on what is achievable in the individual catchments and districts, and priorities agreed between the Government and the community. While this ultimately needs to be done for every catchment, assistance will initially be centred on "focus" and "recovery" catchments (see Section 5.3 & 5.4) and extended to other areas as resources permit.

ACTION

Clear objectives and target outcomes for salinity management which specify the relative importance of protecting the land and water resource base, minimising financial losses to the individual and the State, and conserving natural diversity will be established for every catchment over time.

(Funding from existing sources)

4.2.1 Evaluating water management practices

While objectives should be specified in terms of land and water resources, finances and natural diversity, the strategies to achieve them may be assessed in terms of net economic benefit and degree of groundwater control (eg water use of crops in kg/ha/mm growing season rainfall).

Diagrams such as the one shown on page 13, for the medium rainfall zone, can then be used to rank alternative water management practices or farming systems at the property, catchment and regional scale. These will show those practices ready for adoption on a cost effective basis, and those which require further technology development.

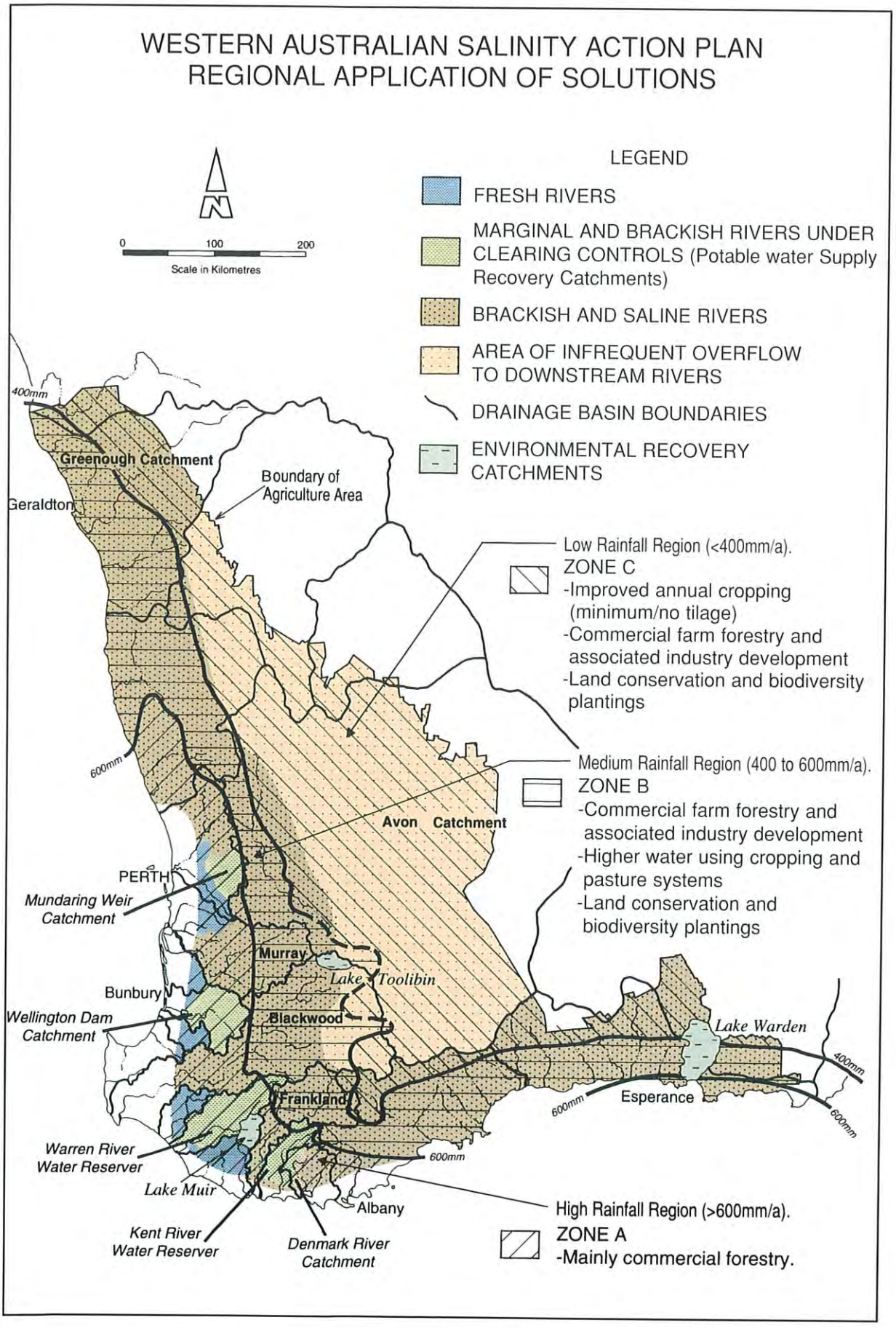
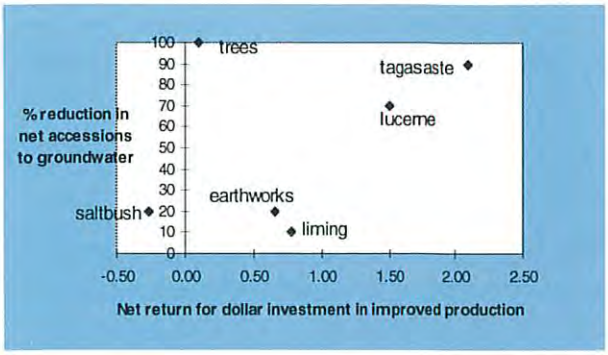

WESTERN AUSTRALIAN SALINITY ACTION PLAN
REGIONAL APPLICATION OF SOLUTIONS
LEGEND
FRESH RIVERS
MARGINAL AND BRACKISH RIVERS UNDER CLEARING CONTROLS (Potable water Supply Recovery Catchments)
BRACKISH AND SALINE RIVERS
AREA OF INFREQUENT OVERFLOW TO DOWNSTREAM RIVERS
DRAINAGE BASIN BOUNDARIES
ENVIRONMENTAL RECOVERY CATCHMENTS
0
100
200
Scale in Kilometres
400mm
Greenough Catchment
Geraldton
Boundary of Agriculture Area
Low Rainfall Region (<400mm/a).
ZONE C
-Improved annual cropping (minimum/no tilage)
-Commercial farm forestry and associated industry development
-Land conservation and biodiversity plantings
600mm
Avon Catchment
Medium Rainfall Region (400 to 600mm/a).
ZONE B
-Commercial farm forestry and associated industry development
-Higher water using cropping and pasture systems
-Land conservation and biodiversity plantings
PERTH
Mundaring Weir Catchment
Murray
Lake Toolibin
Bunbury
Wellington Dam Catchment
Blackwood
Lake Warden
400mm
600mm
Esperance
600mm
Frankland
Warren River Water Reserver
600mm
Lake Muir
Albany
High Rainfall Region (>600mm/a).
ZONE A
-Mainly commercial forestry.
Kent River Water Reserver
Denmark River Catchment

Figure 2



The diagram shows the effectiveness of each practice in controlling groundwater (vertical scale) and the financial benefit (or cost if negative) to the landowner for each dollar invested (horizontal scale).

4.2.2 Planning of salinity control strategies

Salinity control systems will require integration of a range of water management practices. The range of practices which will be appropriate at any location will vary with land and climate, and with the objectives and targets of the farmer, the catchment group and the Government. Each landholder must make decisions in the context of these objectives, such as site-specific choices of the most effective practices, and their optimum combination across land management units. Good biophysical information is needed for site identification, and economic decision tools are required to optimise the choice. This is a matter for careful farm and catchment planning.

4.3 Technology development

There is an urgent need to develop salinity control technologies further. If all current economically feasible water management practices and integration technologies were extensively adopted, a high degree of salinity control could be confidently achieved only in the high rainfall south-west region. While adoption of all currently feasible practices should be strongly promoted in all regions, it is imperative that this be complemented by the development of new technologies.

Revegetation with woody perennials offers the best potential for improved water management, complemented by the proposed expansion of improved cropping and grazing systems.

4.3.1 New vegetation systems and woody perennials

The large area of revegetation required to achieve sufficient extra water use (estimated to be an additional three million hectares), and the substantial cost of revegetation, mean that commercial returns are needed for most revegetation projects to be adopted by agriculturalists.

An indication of what is possible using commercial woody perennials is apparent from two recent projects. *Eucalyptus globulus* (bluegum) has become a competitive crop in much of the high rainfall south-west region and now provides farmers with the option of controlling salinity without any reduction in farm profitability. Tagasaste, a fodder shrub, is commercially viable on poor sandy soils in intermediate rainfall areas. Both crops have attracted strong farmer interest and their planting has expanded rapidly.

CALM has invested some $3 million over four years to develop a eucalyptus oil industry based on mallee eucalypts in the wheatbelt. Nearly 6000 hectares have been planted by 300 farmers, enough for the development of harvest and processing operations.

Pinus pinaster is a drought-tolerant, timber producing pine species which can grow on deep soils in areas with rainfall as low as 400 mm per annum. CALM has carried out a feasibility study and determined that 500,000 hectares are capable of supporting commercial *P. pinaster* in the medium rainfall zone (400-600 mm per annum). Research is continuing to define specific selection and yield potential.

The challenge for salinity control is not only to advance existing prospects rapidly, but to initiate the development of new ones. The objective should be to build a range of profitable woody perennial species and products so that all regions and soil types have attractive options.

Woody perennials such as bluegum, pines, tagasaste and oil mallee have each required some millions of dollars of capital to initiate their development as commercial crops.

Pinus pinaster, *or Maritime pine, thrives in soils too sandy for most other crops.*

There are major problems in funding the development of new commercial woody plant species, products and industries. The investment required is large and inherently risky. Any interest in a promising prospect will be based, at least partly, on the salinity control benefit, a return which is not readily available to help motivate private enterprise. Any new prospect will not have an established industry lobby, and will have to face the problem of building up a sufficient resource base before commercial development can emerge. Furthermore, many landcare and related funding programs explicitly exclude commercial development.

There is a compelling case for Government investment in the commercial development of woody perennial crops. There are several fundamental aspects of development, for example the identification of promising prospects; research and development and commercial feasibility investigation; building up an initial resource base; attracting the interest of markets and capital; and industry planning. Government needs to increase considerably its level of investment in this area.

ACTION

As part of its submission to the Commonwealth Government for an additional $30 million per year under the new sustainable agriculture and environmental initiatives (refer Section 4.1.1) the Government will seek $11 million per year over five years to conduct feasibility studies on a range of new woody perennial crops and industries.

Specifically CALM will continue developing the eucalyptus oil industry, in conjunction with the Oil Mallee Association.

(Funding existing budgets)

Any program to develop woody perennial species for agriculture or farm forestry should be designed to minimise the risk of weed introduction, and species native to the south-west region should be assessed for these purposes. Any State initiative to protect high value assets through revegetation could also provide an opportunity to establish a potentially valuable resource base for industry.

4.3.2 Improved information to support planting strategies

Strategic placement of woody perennials for maximum water use will achieve greater production as well as permit greater control of groundwater. New techniques using geology, geophysics and hydrogeology are emerging which should greatly improve the accuracy with which perennials can be placed to achieve maximum water use.

Salinity hazard mapping

World Geoscience Corporation has developed an integrated airborne geophysical mapping system called 'Saltmap'. While expensive on a Statewide basis, this system may be cost effective for farm-level decisions. It requires urgent evaluation, both as a stand-alone tool and when used in combination with other data sets. These could be used to improve predictions of areas of salt-affected land and as input to models which estimate the contributions of different water management practices in salinity reduction.

ACTION

Water and Rivers Commission and Agriculture WA will evaluate airborne geophysics and related data sets at three different sites, including Broomehill, to determine whether extensive application of this technology is warranted.

(Funding - additional $0.50m per annum to the Water and Rivers Commission for three years from State sources; Agriculture WA $0.10m per annum from redistribution of existing funds and $0.05m per annum additional from State sources)

Planting distribution

A profitable perennial species could justify extensive planting without the need for expensive biophysical investigation to determine accurate placement. The wide dispersal of perennials within traditional agricultural vegetation will reduce competition within the perennial stand and, therefore, enhance water use. Management systems accommodating wide dispersal, eg alley farming, may be as effective in terms of water use as strategic block planting, but be less dependent on the biophysical data necessary for optimal location of block plantations.

The cost and effective integration of perennials with other farm activities will also be a major factor influencing planting distribution. Perennials must not unduly suppress adjacent crops or pasture, nor compromise the large scale mechanisation of cropping or the low management input of extensive grazing. The technology for selection and design of perennial planting distributions (eg species, belt width, alley width and belt orientation) will be further developed.

ACTION

Agriculture WA and CALM will collaborate to develop knowledge of the major design variables of alley farming systems.

(Funding of additional $ 0.09m per annum to Agriculture WA from State sources)

4.4 Challenges to business management

The on-farm management response to salinity is going to be particularly challenging. There is a need for urgency in implementing salinity control measures which will mean taking decisions in a climate of uncertainty. New practices will be required with some risks attached. Also, integrating management options is a complex business. There is little past experience with deep-rooted perennials. Longer term budgeting will be required as there would be no financial returns for several years. In addition, siting perennials in the landscape will be a critical decision.

The area affected by salinity will continue to increase before any response to control measures is seen. Some farms may still have more than ten per cent of their land affected despite the best possible efforts at control, and this could threaten the viability of farming, especially as another 20 per cent of the farm land could well be trees and bush that do not directly provide financial returns. However, the greatest challenge will be coping with the differential impact of salinity across farms; some may suffer more than 50 per cent salt-affected land while others in the same catchment are largely unaffected. Major equity and rural adjustment issues can arise.

Some of the water management practices needed to control groundwater (eg strip or alley plantings, drainage or groundwater pumping where appropriate) will cross farm boundaries, distributing both benefits and costs, but not necessarily equally. Variations in land ownership (eg easements, boundary variations) need to be addressed.

The Salinity Action Plan needs to look closely at how to assist farmers more effectively in these areas. This can be done in several ways:

- farmers will be better informed of water use practices and the economic benefits of farming technologies, reducing the uncertainty in integrating them into current practice;
- under a property management planning initiative, continued learning will be available in areas such as business skills, risk management, strategic planning and information management;
- modelling and decision tools in the hands of Government development officers, consultants or the farmers themselves, can assist in integrating management options;
- strategic application of the Rural Adjustment Scheme on a catchment basis may assist farmers with inadequate resources to manage the impact of salinity, particularly capital intensive works.

To help farmers with the challenge of integrating new water management practices and with the uncertainties of time-critical land management changes, business skills development courses will be better supported. Agriculture WA's property management initiative, funded under a national business plan and drawing on the resources of the Rural Adjustment Scheme, will be adapted to do this.

ACTION

Grants are now available to contribute towards the cost of attending business management training courses and for professional preparation of farm business plans. Under the Rural Adjustment and Finance Corporation (RAFCOR), this program will be further adapted to meet the needs of salinity management.

(Funding from existing budgets)

There is some predictability in how salinity affects individual farms in a catchment. It is preferable to communicate that prediction as early as possible and give possible response scenarios to farmers. There will almost certainly be critical salinity control works in catchments which cannot be completely funded by individual farmers. RAFCOR has reviewed the scope for implementation grants to assist them, drawing on Rural Adjustment Scheme resources held in Western Australia.

ACTION

Agriculture WA, in partnership with RAFCOR, will monitor farm viability, the potential impact of salinity and constraints on adjustment (eg cropping and diversification). The Rural Adjustment Scheme will be adapted to assist implementation of critical control works and other actions where on-farm production options are limited.

(Funding - a re-allocation of $4.7m per annum from existing Rural Adjustment Scheme reserves - subject to decision by the Commonwealth Minister for Primary Industries and Energy)

Catchment planning and management must take into account the potential benefits, costs and impact of proposed water management practices across farm boundaries. Thus long-term protection of property rights and the environment require collaboration between neighbours. In some cases contracts between neighbours on the means of implementing water management practices that cross boundaries may be needed.

ACTION

The Soil and Land Conservation Council with Agriculture WA will be asked to review legal and other arrangements relevant to water management practices which need to cross property boundaries, and to recommend options for catchment management.

(Funding from existing budgets)

Water management practices are already being planned and implemented by farmers working in catchment groups.

5 Implementation

5.1 Introduction

The widespread adoption of high water using management practices by farmers, particularly the introduction of additional woody perennials as an integral part of agriculture, is a critical component of this Plan.

Western Australian farmers have an excellent record in introducing new farming practices. Over the past 50 years, agricultural production has recorded high growth rates. The development and adoption of higher yielding technologies, as well as improvements in the managerial capacity of farmers, have contributed to the increases in productivity. In recent times, crop establishment systems in the wheatbelt of Western Australia have improved to the point where yields have been rising at about five per cent per year; crop failures in dry years have become rare; soil condition has been improving; and water use within the cropping phase has become highly efficient. The challenge is to extend this culture of innovation to new levels by encouraging farmers to adopt woody perennials as an integral part of Western Australian agriculture.

The landcare movement, a uniquely Australian phenomenon, has grown rapidly, and Western Australian groups based on local sub-catchments and shires have proved to be effective in problem recognition, in learning about improved land conservation practices, in planning for farm and catchment scale adoption, and in bringing about a "commitment to act" by member farmers. However, recent reviews have shown that, while farmers in Landcare groups are more likely to adopt land conservation practices including salinity control measures, there is a high level of frustration in farming communities that site-specific advice on revegetation and farming systems, cash to pay for rehabilitation measures, and a wide enough choice of commercial high water use practices are not available to implement them quickly. Also the scale of salinity is such that voluntary individual adoption of control practices on a farm and catchment level would not provide the certainty of outcome required.

This Action Plan sets up the following levels of Government involvement in the implementation of salinity control practices:

Individual farmers - All land holders will have ready access to up-to-date, regionally specific information on best management practices and new land management systems.

Focus catchments - Selected sub-catchment groups will have guaranteed access to catchment support teams providing the technical and economic information needed for site-specific decisions on best management practices under a services agreement. In return, individual land holders will be asked to enter into a formal agreement to implement them.

"Recovery" catchments - Where major and high priority public resources are at risk, for example, water resources, wetlands, conservation reserves or towns, the Government will prepare a recovery plan in consultation with the catchment community to protect or restore the public asset. The Government will provide additional resources under cost-sharing arrangements, where necessary, to augment partnership agreements and voluntary adoption to achieve the protection goal. The degree of Government contribution in any cost-sharing arrangement will reflect the public benefit component. Compliance of land holders may need to be sought.

5.2 Individual farmers

A review of salinity control practices (see *Salinity: A Situation Statement for Western Australia)* shows a number of practices that can be adopted now and more that are being researched and developed. However, there is an urgent need for farming systems that will have an even higher water use than at present. Farmers must be able to assess all current and potential farming practices, technologies and systems with their capacity to control groundwater and to reduce economic impact in order to achieve rapid adoption levels.

It is important that the benefits and costs of salinity practices, and their probability of success, are accurately estimated. Ideally, all practices should be profitable in their own right. However, this may not always be the case; farmers have shown they will adopt minimum cost practices that are relatively certain of protecting their land resource base in the longer term. Demonstrations on a farm scale, and access to site-specific advice, can take away much of the guesswork. Government agencies will actively provide information

and advice on "best salinity control practices". Accessibility and coordination will be improved. The advice itself will have estimated economic and water use impacts, known probability of success and regional, catchment or farm specificity.

As noted previously, the development and promotion of woody perennial options will be increased. Most importantly, farming systems development will focus on the integration of deep-rooted perennials, with a greater role for woody perennials. This will be a major focus of technology transfer programs. Improving crop yields and pasture productivity to increase water use will continue and be promoted in an integrated context of overall water usage from the landscape.

ACTION

Agriculture WA and CALM will adopt a "water use evaluation" approach. Each technology they promote must improve or maintain water use in the landscape, and each farming system will be rated according to its water use potential.

(Funding of an additional $ 0.08m per annum for Agriculture WA from State sources)

New communication technologies now available to farmers such as AgFax, a dial up fax-back service, and REX, a revegetation expert system, make regional information much more readily accessible. All farmers and catchment groups can have improved access to the best technical and economic information.

Joint extension activities between Agriculture WA, CALM and Water and Rivers Commission will promote consistent messages to farmers on salinity issues.

ACTION

Farmers will be able to access information on best management practices through new communication technologies such as AgFax and REX.

(Funding of $0.06m per annum for Agriculture WA from redistribution of existing budgets and an additional $0.16m per annum from State sources)

To support this information, a better distribution of technical expertise and extra resourcing by Government agencies is required, in particular for the key areas of hydrology, farm forestry, revegetation and nature conservation. This should be done through interdisciplinary teams that include farming systems development officers, economists, soil scientists and land conservation officers.

The Government has agreed to establish a joint Farm Forestry Advisory Service by Agriculture WA and CALM in the south-west and south coast to promote high rainfall farm forestry.

ACTION

CALM and Agriculture WA will complement the high rainfall Farm Forestry Advisory Service by providing an integrated advisory service on revegetation in medium to low rainfall areas, with an initial focus on centres where CALM and Agriculture WA have a presence, eg Narrogin, Katanning, Merredin and Moora.

(Funding of an additional $0.3m per annum in Agriculture WA; $0.225m per annum new funds from State sources and $0.075m per annum by redistribution)

CALM will appoint Land for Wildlife officers and ecologists in key centres to support this activity.

(Funding included under Section 4.1.5)

Attention needs to be given to other salinity control measures such as surface water control, deep drainage, ground water pumping and management of remnant vegetation.

Woylies are still found in the wheatbelt, but rising salinity will affect many remaining habitats.

ACTION

Agriculture WA, Water and Rivers Commission and the Department of Environmental Protection will review the technical and environmental suitability of deep drainage, providing standards to guide the assessment of farmer proposals and producing best practice information for wide distribution.

(Funding from existing budgets)

While salinity problems continue to worsen in Western Australia, concerted effort and particular landscape treatments appear to be having some positive impacts. Catchment research sites, (eg Mundaring and east Collie), towns such as Merredin, farms and individual sites (eg bluegum plantings on the south coast), have seen their water tables lowered.

Land holder and catchment group decisions would benefit greatly from evaluations of these sites and from feedback on trends from widespread groundwater level observations.

ACTION

Agriculture WA will carry out a detailed assessment of farms and catchments that have implemented components of high water use systems with apparent success.

Water and Rivers Commission will review its groundwater salinity investigative program to increase its extension efforts through promoting the use of groundwater mapping and the related data base with farmer and catchment groups.

(Funding of $0.20m per annum from redistribution of existing Water and Rivers Commission sources and $0.30m per annum from new State sources)

A Salt Watch network will be established where land users will have on-line computer or faxback access to monitoring data on water use, ground-water use and salinity for their catchment or region.

(Funding of $0.09m per annum redistributed from existing Agriculture WA sources)

5.3 Focus catchments

A catchment-by-catchment approach, with all land holders fully understanding the contribution their farms are making to the overall catchment plan, is required in order to tackle salinity effectively. It also requires a high level of planning and technical support to optimise the adoption of land use practices for catchment objectives. However, with more than 300 groups in total, support services are spread too thinly to be fully effective.

On the other hand, the best approach to catchment management in Western Australia can now be defined. Implementation is best handled on a local scale, under a catchment or regional strategy. Typically, action-oriented groups comprise 15-30 farms in a sub-catchment of 30,000-100,000 hectares. The National Landcare Program, the State Government and Alcoa of Australia have supported six Avon sub-catchment groups in an accelerated program of planning and action. These six groups have demonstrated the benefits of planning and implementation at this scale.

There are promising signs that this approach promotes the adoption of the best land management practices, where:

- the local neighbourhood group organises planning and educational activities;
- specific land management problems are studied and the group, with technical experts, decides on the best farming systems for each part of the catchment area;
- all farmers are expected to adapt these systems to their own farms, using the best available information;
- amounts and distribution of any external funding are decided by the group as an incentive to individual farmers; and
- collaborative projects such as surface water harvesting and control, drainage and managing bush areas for nature conservation can happen at the group level.

ACTION

Using these pilot projects as a base, Agriculture WA will:

- define a common methodology for local scale management of catchments; and
- fund monitoring and evaluation work to increase community confidence in this more disciplined, integrated approach.

(Funding of $0.08m per annum redistributed from existing Agriculture WA sources)

It is proposed to use the framework of Agriculture WA's Sustainable Rural Development Program to coordinate regional strategies and catchment management planning. All strategies and plans will explicitly include water resources, environmental values and built infrastructure as key elements. The community network of Agriculture WA and other catchment co-ordinating groups (eg Blackwood, Swan-Avon) are important to establishing links between communities sharing catchments.

The Regional Partnerships Groups for the Sustainable Development Program will oversee the regional strategies which will guide this integration.

5.3.1 Priority catchments

It is planned to identify a number of priority catchments through an assessment of the benefits and costs of achieving salinity control, and through a negotiated cost-sharing system. Overall regional strategies will also be taken into account. These priority catchment groups will include:

- sub-catchment groups entering into these arrangements on a voluntary basis, with farmers prepared to commit themselves to implementation, and where the Government is prepared to provide intensive decision support advice on a site-specific basis using catchment support teams. These will be called focus catchments; and
- catchments where the public assets at risk from salinity are high enough in value to justify more binding controls (eg strong clearing restrictions), and strongly promoted rural reconstruction programs. These will be called recovery catchments.

The initial priority for selection as focus catchments will go to:

- existing sub-catchment groups that have completed their planning process and are committed to implementation; and
- sub-catchment groups with community coordinators appointed and locally supported.

ACTION

Agriculture WA will support up to 30 initial focus catchments under the new arrangements, including the services-for-implementation agreement.

(No new funding required - see support teams below)

5.3.2 Catchment support teams

All the necessary professional expertise to support land holders in focus catchments will be brought together into catchment support teams. They are to provide an integrated advisory service to help landowners to set objectives, targets and criteria for their catchment, to develop management plans and to facilitate their implementation. The teams will involve Agriculture WA staff with experience in farming systems, hydrology, economics, soil management, water control works and re-vegetation. The teams will be able to draw on expertise of staff from DEP, CALM and Water and Rivers Commission in the areas of environmental and natural diversity criteria, woody perennial vegetation management, hydrogeological and catchment modelling advice. These teams will recommend management options on a site specific basis and will ensure they comply with existing land management and environmental regulations.

ACTION

Agriculture WA will set up 12 catchment support teams with responsibility for providing best management practice information and advice on a farm scale, integrated to catchment outcomes.

(Funding of an additional $ 0.54m per annum in Agriculture WA; $0.32m per annum from redistribution and $0.22m per annum new funds from State sources)

5.3.3 Partnership agreements

Landcare and catchment management issues in the 1980s were built around community participation, but far more binding partnership agreements are now required. In NSW, farmers enter into agreements under planning framework and partnership principles that share responsibilities. These may be in the form of a memorandum of understanding between land holders and Government.

For Western Australia, a "services-for-implementation" agreement is proposed, where the Government will share contract responsibilities with catchment groups. The partners would establish the ground rules, while the Government would provide technical and economic services to a level at which farmers could have confidence in the proposed land management options for different land management units, within their resource constraints, and would be able to implement these options.

ACTION

Priority catchment groups will have a services agreement for the provision of the technical and economic information needed for decisions. In return, individual land holders will be asked to enter into a formal agreement to implement the best practices developed in the partnership. The term of the agreement, to be no longer than three years, will also be defined.

(No new funding required)

The prospect for more binding agreements under statute will be reported by the Taskforce on Natural Resource Management and Viability of Agriculture by the end of 1996. The Taskforce is examining the potential for modern sustainability legislation applied to agricultural industries and land use.

5.3.4 Environmental objectives

Clear objectives are required to guide the development of catchment management plans in priority catchments. These will be developed jointly between the catchment community and the catchment support teams. In addition, specific environmental objectives and criteria are needed and can be used for planning and evaluating the success of implementation.

ACTION

DEP, in consultation with other Government agencies and the community, will develop broad environmental objectives and criteria suitable for selecting and monitoring priority catchments. The same objectives will provide guidance for planning by individual farmers and catchment groups outside the focus and recovery catchments.

(Funding of an additional $0.05m per annum to DEP from new State sources)

This action will complement DEP's role in establishing environmental policy for protecting and managing high conservation wetlands and their catchments throughout the south-west agricultural areas.

The criteria may vary throughout the region, and are to be considered for adoption in particular catchment plans by the catchment group. They would form a component of the service-for-implementation agreement.

As support in establishing integrated catchment action plans will be concentrated on focus and recovery catchments, new funding for on-the-ground works can be expected to concentrate in these areas. However, well planned and integrated projects proposed outside these priority areas, will be considered on their merits. New focus catchments will be established as resources become available.

5.4 "Recovery" catchments

The need to protect high value public and private assets (eg water resources, natural diversity, towns and roads) justifies targeting more intensive and potentially costly management systems. Higher proportions of deep-rooted perennial species relative to current agricultural crops and pastures could be used in such cases, with a consequent impact on conventional agricultural production in the area. Consequently, the selective use of public resources to increase the rate of implementation of catchment solutions, and, where necessary, to implement short-term emergency actions to control salinisation until long-term solutions become effective and/or commercially attractive to the landowner, is likely to be an important part of actions to protect key public assets.

Where the protection and/or restoration of a key public asset has been recognised as a priority, the Government, in consultation with affected communities, will develop a recovery plan to protect the asset in perpetuity. These plans will define what is required of the community and of Government, include joint action programs and feature cost-sharing arrangements reflecting the degree of public benefit/ private cost involved. The plan will define the management objective for the catchment, the impact of individual strategies towards the objective and an agreed time frame for action.

The responsibility for the coordination of the preparation and implementation of recovery plans to protect the particular types of public assets is set out below.

As noted previously DEP will have a key role in establishing environmental policies and criteria to be achieved in recovery catchments.

Coordinating agencies will work together with communities and other supporting agencies by establishing recovery teams to help formulate and implement each plan. These recovery teams will establish links with existing LCDCs and other

Public assets to be protected - type of recovery plan	Coordinating agency
1. Potable water resource catchments	Water and Rivers Commission
2. Key catchments to protect wetlands and natural diversity	CALM
3. General town infrastructure	Agriculture WA
4. Major individual public infrastructure assets	Asset owner - eg Main Roads, Water Corporation

community groups. The Government will help establish objectives and criteria to be met for recovery catchments. The Toolibin Lake recovery team is a current example of the proposed model.

As individual catchments within the recovery program are rehabilitated to a point where the Government can no longer justify further assistance, they could be replaced by others which become high priority.

5.4.1 Potable water resource catchments

There are adequate water resources in the south-west of the State to meet water supply demands into the middle of the next century. However, as demands grow, there will be an increasing need to keep water resources to salinity levels suitable for the region's drinking water supply needs.

Action has already been taken to prevent salinisation and restore water quality in the five key water resource catchments of the Mundaring Weir (Helena River), Wellington Reservoir (Collie River), and the Warren, Kent and Denmark Rivers.

These catchments have the potential to yield almost 440 gigalitres per annum in total. This is equivalent to about twice Perth's current water supply. The Salinity Action Plan will focus on restoring or maintaining salinity levels in these catchments to levels suitable for drinking (potable levels).

Future management will concentrate on improved remnant vegetation protection and promotion of farm forestry on private land, integrated with improved annual cropping and pasture management and less-commercial plantings in lower landscape positions adjacent to saline discharge areas. This will be done through clearly established targets, time frames and catchment management plans, developed with input from the community and adopted by Government. Any incentives and/or cost sharing arrangements for implementation would be based on the public benefits involved and would require the recipient to implement fully the adopted plan.

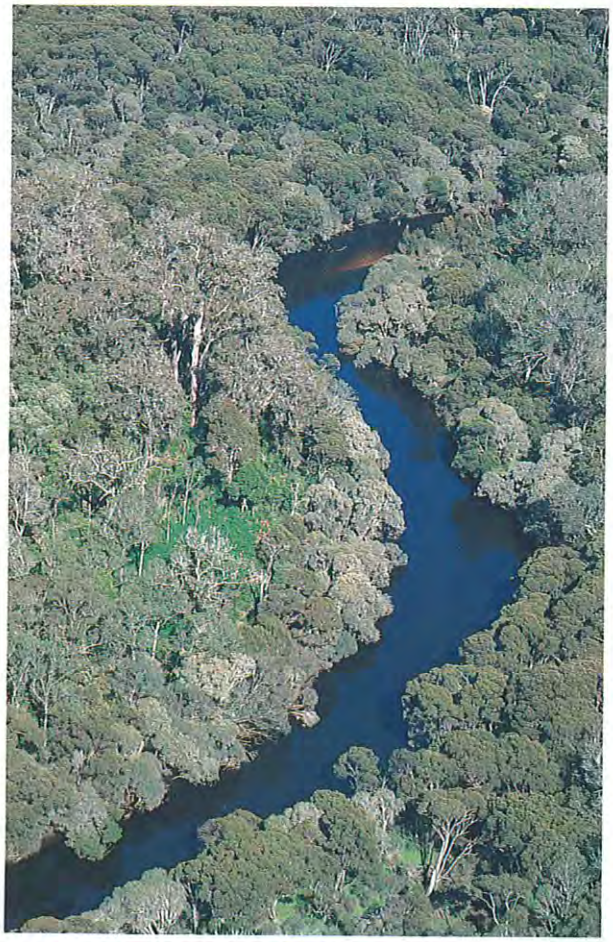
The reforestation program in the Wellington Reservoir Catchment area has established about 7000 hectares (about 11 per cent of the cleared land in the catchment) over a 15-year period. A further 20,000 hectares of plantings are likely to be required, depending on the distribution used, to achieve potable water levels.

The other catchments are likely to need more than 30 per cent of their cleared land replanted with perennials. Commercially-driven farm forestry is expected to make a major contribution to this target. However, the efficient integration of commercial plantings with high water using agricultural systems and with land conservation plantations will also be necessary and will be incorporated at the detailed planning stage.

ACTION

The Water and Rivers Commission will:

- review reforestation activities in the Wellington Reservoir catchment area and implement a plan with the community to reduce salinity to potable water supply levels by the year 2015. The public and private benefits of establishing trees on farms will be investigated to see if specific incentives are necessary to promote their adoption;
- evaluate private reforestation in the Denmark catchment to ensure that it is sufficient to achieve potable water supply levels by the year 2020;
- evaluate options to reduce the salinity of Mundaring Reservoir and establish target salinities and catchment plans, including programs to implement them;
- prepare and implement catchment plans on the Kent (Agriculture WA as lead agency) and Warren Water



The Warren River, shown here flowing through karri forest, is affected by rising groundwater under the agricultural land in its catchment.

Reserves, in cooperation with the community, with the objective of achieving potable water supply levels by 2030.

(Funding of $2.5m per annum - $1m per annum from State sources and $1.5 m per annum from the Commonwealth to establish land conservation plantings integrated with commercial plantations to control stream salinity)

To support the above actions and to assist with input to other recovery catchments and focus catchment groups, the Water and Rivers Commission will:

- increase its resources committed to salinity management through the provision of additional regional support, particularly to service the planning and implementation of catchment restoration programs;
- maintain existing and establish new research/ demonstration sites to improve the understanding of salinity treatment processes.

(Funding of an additional $0.5m per annum to the Water and Rivers Commission from State sources)

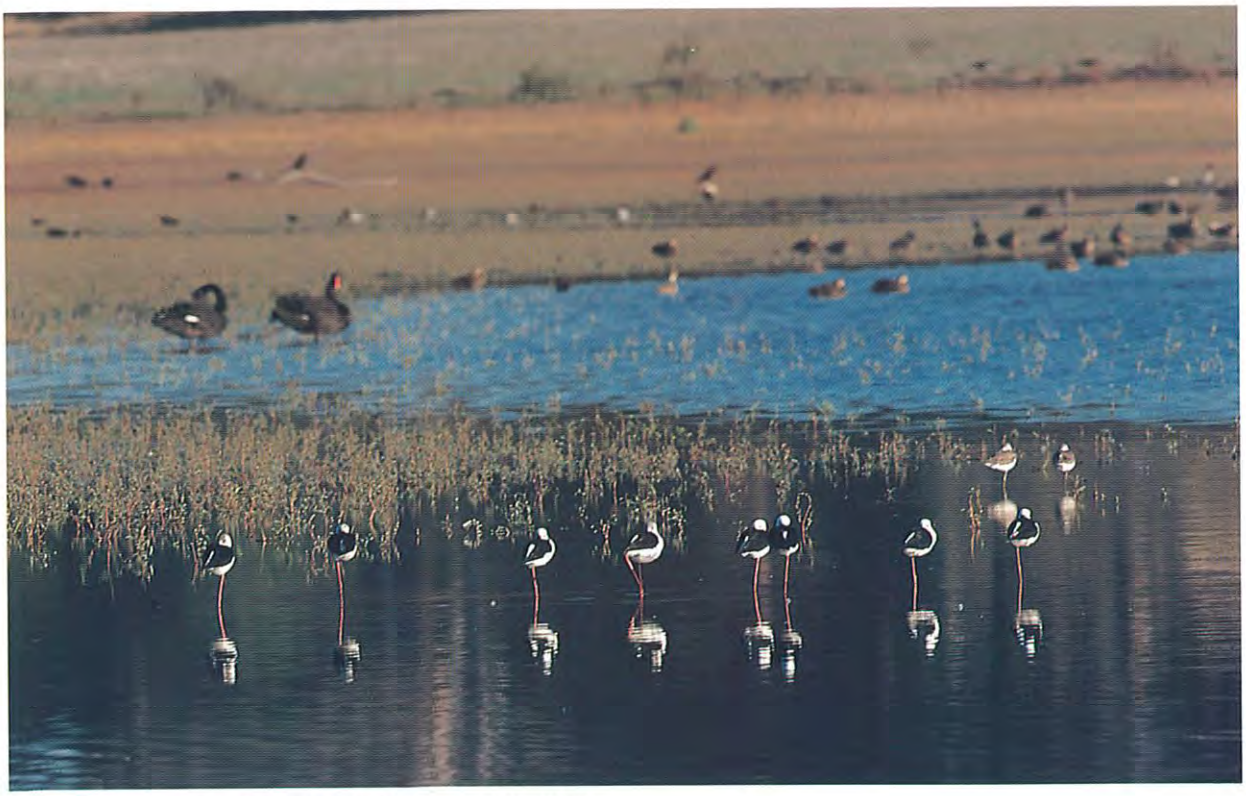
5.4.2 Key catchments to protect wetlands and natural diversity

Protection of key wetlands and natural diversity in agricultural areas is dependent on catchment scale solutions. The adoption of salinity control measures to protect land and water resources will have a positive, complementary effect on natural diversity, provided they do not involve the use of weedy species or detrimentally affect the water regimes and quality of natural bush areas. While the catchments of key wetlands will be a priority, approaches which improve flora, fauna and habitat protection throughout the landscapes of the region will be an integral part of the program.

Therefore, the major thrust for protecting and recovering areas of key wetlands and natural diversity will be to ensure that salinity is controlled at a catchment scale in a manner that is sympathetic to natural diversity. Nonetheless, without urgent protection and recovery programs specifically aimed at conserving environmental values, valuable natural assets may disappear, or their condition will considerably worsen before more general action to combat salinisation becomes effective.

ACTION

The Government will develop and implement a co-ordinated Wetlands and Natural Diversity Recovery Program targeting at least six key catchments over the next ten years to ensure that critical and regionally significant natural areas, particularly wetlands, are protected in perpetuity. This will be funded in part from additional State Government funds and from funds sought from the Commonwealth Government as part of the request for $30 million per annum from the new sustainable agriculture and environment initiative.



A colony of pied stilts with other waterbirds on an inland lake.

(Funding of an additional $5.5m per annum to CALM phased in over three years with $2.5m per annum from State sources and $3m per annum from the Commonwealth, as part of the $30 million overall Commonwealth request)

Under this program, recovery plans will be developed through catchment or sub-catchment approaches and, where necessary, short-term emergency actions will be identified.

Three wetland and associated catchment systems have already been selected as high priority areas: Toolibin Lake, the Lake Muir-Unicup system of wetlands, and the Lake Warden wetland systems near Esperance.

ACTION

As coordinating agency for the Wetlands and Natural Diversity Program, CALM will:

- implement the Toolibin Lake Recovery Plan;
- complete its management plan for the Muir-Unicup wetland reserves by 1997 and work with the local community to coordinate action in the whole catchment area;
- complete its management plan for the Lake Warden wetland reserves by 1997 and work with the existing catchment groups to coordinate action over their catchment areas;
- give priority to locating commercial woody perennial plantings in areas which also generate significant nature conservation benefits, such as Toolibin Lake;
- complete its Wheatbelt Regional Management Plan by the end of 1998. For much of the State's agricultural region, this plan will describe CALM's policies for management of conservation reserves, conservation of natural diversity across the landscape and commercial production from woody plants.

(Funding requirements included in the above $5.5m per annum)

Additional effort and resources will be required to fully implement the Natural Diversity Program and to complete the planning and implement action on additional priority areas.

Similarly to focus catchments, DEP will develop clear objectives and environmental criteria for recovery catchments. These should be based on sound technical knowledge and adopted by Government following input from the community.

Much better biological data are required to:

- select further recovery catchments, and provide ecological advice for catchment management;
- understand and develop the resource base of species for use in land conservation and for commercial development.

Given that insufficient is known of the flora and fauna of valley flats and associated wetlands of the wheatbelt and that they are seriously threatened by salinity, these areas need to be surveyed as a matter of priority.

ACTION

CALM will:

- conduct a biological survey, in the agricultural zone, with an emphasis on low-lying areas that are vulnerable to salinity, to identify nature conservation priorities and to identify plant species that are likely to be of value in revegetation for both commercial production and land conservation;
- using the results of the biological survey, and following discussion with peak advisory bodies and affected community groups, the Government will select an additional three or four key recovery catchments and establish recovery plans by the end of 2000; and
- commence the implementation of an initial ten-year recovery program in 1996/97.

(Funding of an additional $0.50m per annum to CALM for the biological survey from State sources)

5.4.3 Rural infrastructure assets

Many rural towns in Western Australia are located in valleys and are facing current or future challenges from rising saline groundwater. Wheatbelt towns where some action is being taken or considered include Merredin, Brookton, Morawa, Corrigin and Dowerin.

ACTION

Agriculture WA will:

- consult with local government authorities in rural catchments to assess salinity risks and plan action to deal with rising groundwater;
- investigate funding options for implementation of the resulting plan with local government, regional development commissions and relevant Government agencies (eg Main Roads).

(Funding of an additional $2m per annum - $1m from the State and $1m from the Commonwealth)

Painted featherflower.

Blue leschenaultia.

6 Monitoring and evaluation

Monitoring is required to determine the effectiveness of this Action Plan. The monitoring program will determine:

- progress towards achieving defined agricultural, water resource and natural diversity objectives;
- natural bio-physical trends and the likely impact of land management changes on trends over time;
- performance of land owners, community groups and Government agencies in meeting their responsibilities.

For example, progress in establishing the additional three million hectares of woody perennials throughout the region will be monitored at three year intervals (see below). The results of the monitoring programs will be evaluated and used to refine the Action Plan over time. Targets of re-establishing a set percentage of deep-rooted perennial vegetation throughout particular catchments may be refined upwards (or downwards) in response to changes in the local groundwater table response.

Regular evaluation of the effectiveness of the overall Action Plan will be a key responsibility of the State Salinity Council (see Section 8).

Salinity is also a key issue being addressed in the State of Environment (SoE) reporting process. Environmental indicators, including ones for salinity, are being developed as part of the SoE exercise. Their development, measurement and analysis of their trends will be an important aspect of the first review of the Action Plan by the State Council.

6.1 Land resources

Accurate long term data are required on the condition of the land resource to evaluate adequately the success of Action Plan over time. However, reliable estimates of areas of salt-affected land have been difficult to assemble in the past.

ACTION

The Government will:

- establish a regular program of satellite imagery (Landsat TM) evaluation, or similar systematic and technically sound technique, to provide the most reliable and consistent recording of the area of salt-affected land, remnant vegetation extent and condition, and the rate of establishment of deep-rooted perennial vegetation throughout the agricultural areas of the south-west. This program would be conducted every three years and would be supported by the Australian Bureau of Statistics Agricultural Census in the intervening years;

(Funding of an additional $0.18m per annum for Landsat TM and ABS survey evaluations to Agriculture WA; $0.095m per annum from redistribution of existing Agriculture WA funds and $0.085m per annum new funds from State sources)

- through Agriculture WA and supported by the Water and Rivers Commission and CALM, maintain long-term groundwater monitoring stations to document trends in groundwater levels throughout the region;
- through Agriculture WA and in association with other agencies, develop and maintain the most up-to-date models for estimating the future likely extent of salt-affected land.

(From existing budgets)

6.2 Water resources

The Water and Rivers Commission has established an extensive network of gauged catchments to monitor the flows and salinity levels of the State's river systems. The year-by-year fluctuations of stream salinities and saltloads make it difficult to determine reliable trends from limited, short-term records. It is critical that the current levels of intensive water quality monitoring continue to ensure that long-term trends in the salinity of water resources can be reliably determined.

ACTION

Water and Rivers Commission will:

- maintain, and where necessary upgrade, its stream gauging and salinity monitoring program to ensure that long-term trends can be reliably determined ; and
- evaluate the results of its stream gauging and salinity monitoring program and regularly report on the effectiveness of actions to prevent further stream salinity deterioration and to lower salinity levels in recovery catchments.

(Funding of an additional $0.25m per annum from State sources. Also to be used to support the land and vegetation inventory work above)

6.3 Natural diversity

Ongoing monitoring of the region's biological resources and natural diversity is required to assess the progress and success of this strategy. The rate of establishment of deep-rooted perennial vegetation will be a key measure.

A program to re-establish systematic monitoring of wetlands as an indicator of catchment health is also required. Wetlands provide an important measure of the dynamic changes in salt water loads moving through catchments. Furthermore, changes in flora and fauna due to salinisation will be most pronounced, in the short-term, in valley flats and their wetlands.

Wetland monitoring will provide a basis for evaluating achievement of biodiversity conservation goals and will focus on both physical and biotic characteristics.

ACTION

CALM will monitor a sample of wetlands, and their associated flora and fauna, throughout the south-west to determine long term trends in natural diversity and provide a sound basis for corrective action.

(Funding of an additional $0.2m per annum to CALM from State sources)

Round fruit banksia.

Blue squill.

7 Incentives, funding and compliance

7.1 Incentives and funding options

The salinity problem is such that every dollar spent by the Government and by land holders must achieve the maximum return in terms of increased water use. The State and Federal Governments are already contributing significant funding and other incentives to natural resource management in Western Australia. Further substantial funding and incentives are proposed in this Action Plan. To maximise their impact on salinity, these resources must be integrated and focused on the priority issues.

Grants direct to land holders, under cost-sharing principles, have proved to be effective (eg the Remnant Vegetation Protection Scheme). The concept of cost sharing to cover aspects of private and public good is being evaluated nationally. As a general principle, the higher the public interest or potential benefit, the higher the proportion of Government investment, and it is increasingly accepted that there should be a compliance requirement on land holders. Such Government investment should be guided by strategic plans or catchment management strategies.

The Landcare Review (1995) identified that current funding comes from a number of sources, each with different objectives, guidelines and criteria. Land holder frustration is complicated by an emphasis on gaining funds rather than on developing good projects.

7.2 Proposed approach

The emphasis of this strategy is on the selection and development of incentives and cost sharing arrangements that are capable of harnessing community participation and delivering tangible outcomes at the local level.

Combinations of incentives and cost sharing arrangements will be assembled in "packages" for individual catchments, or parts of catchments. The composition of the assembled package will vary according to management objectives for the catchment and the extent to which public resources are invested.

Packages for recovery catchments will include binding agreements between private landowners and the Government. These agreements will state the expectations and obligations on all parties including financial contributions, work priorities, time frames and the process for dispute resolution.

Catchment project development needs to focus on the merits of an integrated approach to managing salinity and pursuing joint investment or commissioning of appropriate funds to larger projects. Under the whole of Government framework outlined in this Action Plan there will be a clear decision on a coordinating Government agency for each catchment, who accepts the responsibility for coordinating delivery of cross-agency assistance, including the matching of project needs to funding sources.

The allocation of Government resources will be according to known principles:

- for each catchment there will be a different investment framework, a different public:private good ratio, and a different time frame for implementation depending on the relative importance of specific economic, environmental and social objectives adopted for the catchment;
- there will be a process for community negotiation and a strategy for community support;
- the Government will identify the public interest, and what it will fund or do; and
- the use of the money will be backed by the partnership agreement.

In recognition of the poor rate of implementation of catchment and farm planning, the Commonwealth Government is prepared to see National Landcare Program funds directed towards works on farms under limited conditions. Western Australia has successfully argued that this can be safely done under regional assessment provided a strategy is in place. NLP funds for implementing works with a high public good component or demonstration value will be available through regional initiatives. This will occur under regional strategies which will give confidence to the funders and regulators of Government, with formal agreements across funding sources.

ACTION

The State Government will consult immediately with the Federal Government and peak councils in Western Australia to establish a more effective delivery system for State and Federal programs. A coordinating agency will be identified and widely known for each catchment and will facilitate the development of integrated salinity management projects, and joint investment by external funders.

There will be an agreed level of investment and Government support for each focus and recovery catchment.

National Landcare Program funding will be available for high public benefit works within regional initiatives, with the coordinating group having discretion in applying the funds under an agreed strategy.

The Government will continue to promote the case for a tax rebate for approved salinity management actions and support the Commonwealth in making Income Equalisation Deposits and Farm Management Bonds more attractive and better used.

7.3 Regulatory support

The aims of this strategy will be largely achieved through the voluntary and cooperative work of landholders and landcare groups, supported by the Government. The Government will continue to review and revise existing statutes and regulations, seeking to ensure that they are consistently and equitably applied in a manner that complements the work of landholders and groups.

Actions by individuals that threaten to accelerate the current rate of degradation, and reverse or impede the good work of others, will be controlled by legislation and regulation. A number of controls already exist, and these will be both rationalised and strengthened.

Clearing controls under the provisions of the Soil and Land Conservation Act will be augmented by a memorandum of understanding between the relevant agencies and statutory authorities. This memorandum will establish a joint approach to assessment of clearing proposals.

The rights of both downstream landholders and the environment will be protected. Salinity management can involve changes to existing water flow, through the construction of drains and banks, and other changes to existing watercourses and flows. Existing controls have proved difficult to administer.

Agriculture WA will also seek a memorandum of understanding between the Commissioner for Soil and Land Conservation and the Environmental Protection Authority to control the potential impact of drainage proposals with an authorisation procedure taking broad environmental factors into account (see Action Items under Section 4.1.4).

Water and Rivers Commission will conduct a review of riparian and water-related legislation.

The Minister for Primary Industry has commissioned a Task Force to report on the legislation needed to apply ecologically sustainable principles to agricultural industries and land use. Such legislation could clearly establish directions for sustainability in agriculture, specify the rights and responsibilities of all parties, and provide for a program of community involvement, planning and implementation.

8 Whole of Government approach

The Government is committed to ensuring that the salinity management program for Western Australia is implemented quickly and efficiently. A Cabinet Committee chaired by the Premier and comprising the Deputy Premier and Ministers for Primary Industry and the Environment will be established with overall accountability for the Action Plan's achievements.

However, the Government fully acknowledges the key roles of the six peak statutory bodies in developing policies and providing advice to their Ministers, on the basis of wide community and industry input. They are the:

Soil and Land Conservation Council
Rural Adjustment and Finance Corporation
National Parks and Nature Conservation Authority
Lands and Forests Commission
Water and Rivers Commission
Environmental Protection Authority

A new State Salinity Council will report to the Cabinet Committee on matters of policy and performance of the Salinity Action Plan. The Council will comprise the chairpersons of the agencies above and the Farm Forestry Development Group, together with invited representatives of business, environmental interests and agricultural landholders.

It will coordinate advice and recommendations to the Cabinet Committee on policy and priorities in salinity management. The Council will draw on community and industry input and have the Chief Executive Officers of Agriculture WA, Water and Rivers Commission, Department of Conservation and Land Management and Department of Environmental Protection as advisers/ observers.

The four CEOs are responsible for carrying out their respective agency actions and will need to approve expenditures of the major activities. To ensure co-ordinated implementation of the Action Plan across their agencies, the CEOs will meet jointly as necessary. They will ensure effective executive support to the State Salinity Council and initiate, where necessary, joint Cabinet submissions to specify the whole of Government approach and integrate budget allocations to activities.

This proposed whole of Government approach to salinity management will be reviewed after three years and a report prepared for the Cabinet Committee's consideration.

Meanwhile the coordinating structure may change according to the outcomes of the legislative review process (Review of Natural Resource Management and Viability of Agriculture in WA) initiated by the Minister for Primary Industry.

9 Budget implications

Estimates of expenditure contributing to current salinity management by WA Government agencies	State money for salinity programs [1] $ millions	Contribution from the Federal Govt $ millions
Water and Rivers Commission	1.83	0.72
Research, development, investigation and planning	(1.16)	(0.22)
Land management and implementation	(0.46)	(0.5)
Monitoring	(0.21)	
Conservation and Land Management	3.92	0.55
Commercial development of tree crops (inc. oil mallees)	(1.42)	(0.25)
Natural diversity	(2.5)	(0.3)
Agriculture WA	9.0	6.3
Catchment management	(5.9)	(4.5)
Property management planning	(1.2)	(0.5)
Remnant vegetation protection scheme	(0.90)	
Revegetation and landcare grants	(1.0)	(1.3)
Department of Environmental Protection	0.35	0.15
Policy and planning	(0.15)	
Support for ICM	(0.2)	(0.15)
Total	15.1	7.7

[1] *Many programs are not directly related to salinity but contribute to its overall management. Estimates of the proportion of expenditure that can be related to salinity have been made so that an overall estimate can be established and used to compare the cost of new initiatives with current expenditure.*

9.1 Current expenditure

The current expenditure by the key agencies involved in managing salinity is summarised in the table above.

Overall the State is currently investing approximately $22.8m per annum in salinity research, development, investigation, management and advice services distributed under the sub-headings shown. These programs and expenditures will be maintained.

9.2 Budget summary of proposed new actions

Each of the action items of the strategy is listed in the Appendix, together with whether the action is to be funded from redistribution of priorities within existing agency funding, or whether new Government funding is proposed.

A summary of the new budgets and how they are to be sourced is tabulated on the following page.

Western Australian Salinity Action Plan
Investment and funding summary

SALINITY ACTION PLAN ITEM	NEW MONEY REQUIRED	GOVERNMENT SOURCES		
		Redist. existing agency	New from State	New from Common-wealth
SOLUTION ACTIONS				
• Deep rooted perennials				
• Commercial farm forestry	$18.0m	$18.0m		
• Land conservation and biodiversity plantings	$13.5m			$13.5m
• Forage crops				
• Commercial industry development	$11.0m			$11.0m
• Remnant vegetation	$2.3m	$0.1m	$2.2m	
•. Salinity hazard investigation and mapping (including airborne geophysics evaluation)	$1.1m	$0.3m	$0.8m	
• Rural adjustment and critical control works	$4.7m	$4.7m		
IMPLEMENTATION				
• Promotion and advice to individual farmers	)$1.5m	$0.6m	$0.9m	
• Service agreements to focus catchments	)			
• Recovery catchments planning and restoration				
• Water supply	$3.0m		$1.5m	$1.5m
• Wetland and natural diversity	$6.0m		$3.0m	$3.0m
• Rural towns rescue program	$2.0m		$1.0m	$1.0m
MONITORING AND EVALUATION				
• Land resources	)	)	)	
• Water resources	)$0.7m	)$0.1m	)$0.6m	
• Biological resources	)	)	)	
TOTAL	**$63.8m phased in**	**$23.8m phased in**	**$10.0m phased in**	**$30.0m**

This strategy is proposing that the four key agencies contribute an additional $23.8 million per annum by redistributing their existing budgets to focus on salinity management. This will be complemented by a further $10 million per annum from the Consolidated Fund and an additional $30 million per annum from the Commonwealth. The additional Government funds are to address areas where private investment is unlikely to occur without incentives. This is primarily in the areas of development of new commercial tree or shrub crops and their associated industries and plantings for environmental, amenity and public asset benefits that are not directly commercial.

9.2.1 State funding

Eighteen million dollars of the $23.8 million per annum of re-allocation of existing agency funds are to establish a commercial timber industry based on *Pinus pinaster* in the 400 to 600 mm/rainfall zone. Another key item of redistribution is $4.7 million per annum (phased in) of Rural Adjustment Scheme reserves which is proposed for targeted assistance of critical works on farms within a farm business and catchment management context. The Rural Adjustment and Finance Corporation, which has a statutory responsibility for advising governments on the use of these funds, has approved this initiative in principle. It is now subject to Commonwealth approval.

Both redistributed and additional funds are allocated to Agriculture WA to provide for catchment support teams and the development and evaluation of new farming systems, including the integration of farm forestry and revegetation with agriculture.

The majority of the additional $10 million per annum sought from the consolidated fund is targeted to investments in remnant vegetation protection and plantings for wetland protection and natural diversity benefits. This additional State funding also supports the request for the additional Commonwealth funding as discussed on the following page.

9.2.2 Future Federal funding

The Commonwealth Government is planning an additional $1.15 billion over the next five years for environmental and sustainable agricultural initiatives, including a National Vegetation Initiative ($318m), a National Land and Water Resources Audit ($32m), the National Rivercare Initiative ($85m) and the Natural Wetlands Program ($8m). Western Australia will actively seek an appropriate share of this additional funding to help implement its salinity plan.
All the proposed new actions would fit under these broad programs. The request for $30 million per annum of Commonwealth funds is a moderate one in the context of the seriousness of Western Australia's salinity problem and the scale and overall intent of the Commonwealth's environmental initiative. As noted previously the additional funding is targeted to encourage the development of new commercial tree and shrub crops to become and integral part of agriculture, establish plantings in priority areas for wetland and natural diversity recovery where the public benefit is high and to encourage farm forestry in other focus catchment areas.

Appendix

Summary of salinity action items and their proposed source of funds

EXPLANATORY NOTES

Rainfall zones for salinity management:	A	High rainfall, greater than 600 mm/a
	B	Medium rainfall, between 400 and 600 mm/a
	C	Low rainfall, less than 400 mm/a
Federal funding programs:		
	NVI	National Vegetation Initiative
	NRC	National RiverCare
	FFP	Farm Forestry Program
	NLP	National Landcare Program
	RAS	Rural Adjustment Scheme
	BRS	Bureau of Resource Sciences
	NCPISA	National Collaborative Project on Indicators for Sustainable Agriculture
	NWP	National Wetlands Program

Western Australian Salinity Action Plan Items 1	Report section reference	Rainfall zones for salinity mgmt.	Additional recurrent funding need ($ millions/a)	Lead agency	Source of new recurrent funding ($ millions/a)		
					Redistrib. of existing agency resources	New funds from State Govt	Possible Comm funds
Solution activities							
Woody perennials							
• Deep-rooted perennials will be a fundamental component of all salinity control systems. Three million hectares of deep-rooted trees and shrubs will need to be established throughout the agricultural area, to improve the soil and water resource base significantly.	4.1.1	All	Included below	CALM			
• Implement a commercial tree crop program in the intermediate rainfall zone involving the establishment of 15,000 ha of *Pinus pinaster* and 1,000 ha of woodlot species per year (with an ultimate objective of achieving 500,000 ha of commercial tree crops) in the medium rainfall zone.	4.1.1	Medium	18	CALM	18		
• The Government will seek $30 million/year from the Commonwealth Government's environment and sustainable agricultural initiatives under the Natural Heritage Trust to complement private investment in the establishment and protection of deep-rooted perennial vegetation throughout the State's agricultural areas. These funds will be used for: • research and industry development for new commercial tree crops and products; • incentives for land conservation and biodiversity plantings; • protection and remediation of "recovery" catchments for water supply and high conservation areas; and • protection of rural town infrastructure threatened by salinity.	4.1.1	All	30.0 (13.5 million for land conservation and biodiversity plantings - other costs included below)	GOVT			Yes (NVI)
Increased water use by crops and pastures							
• Agriculture WA will work with existing industry research and development corporations to develop further higher water using agricultural cropping and pasture systems.	4.1.2	All	Industry R&D Corporations	AgWA			
Drainage							
The Government acknowledges the limitations of the current drainage regulations, and commits its agencies (Agriculture WA, Water and Rivers Commission, DEP and CALM) to: • define more clearly the category of drainage schemes most likely to cause downstream impacts and environmental damage; • establish an authorisation process for this category of drainage; • provide the authorising bodies with powers to assess drainage on broad environmental criteria; • ensure the protection of downstream landowners; and • ensure that other essential water management practices are implemented with drainage proposals to reduce accessions to groundwater.	4.1.4	All	0.09 0.05	AgWA DEP		0.09 0.05	
Remnant vegetation protection and management							
The Government will: • ensure that augmented clearing control procedures, including the consideration of natural resources	4.1.5	All	Nil	AgWA			

Western Australian Salinity Action Plan Items 2	Report section reference	Rainfall zones for salinity mgmt.	Additional recurrent funding need ($ millions/a)	Lead agency	Source of new recurrent funding ($ millions/a)		
					Redistrib. of existing agency resources	New funds from State Govt	Possible Comm funds
conservation values, are in place by 1997;			0.1	DEP		0.1	
• develop legislation which will enable individuals to place voluntary covenants on their land titles to protect nature conservation values including remnant vegetation in perpetuity;		All	Nil	CALM			
• develop legislation to establish an independent fund-raising foundation to support nature conservation, including land acquisition for conservation reserves;		All	Nil	CALM			
• ensure retention and better management of remnant vegetation on Crown land including conservation reserves.		All	1.25	CALM		1.25	
CALM will:							
• promote and support the conservation of remnant vegetation on farms in partnership with Agriculture WA, through collaboration with Commonwealth programs such as Save the Bush, through the establishment of a Land for Wildlife Scheme modelled on the highly successful Victorian scheme of the same name, and through its regional ecological and advisory services;	4.1.5	All	0.25(LFW) Nil (other)	CALM	0.1	0.15	
• promote remnant vegetation conservation along roadsides and other transport and utility corridors through the work of the Roadside Conservation Committee.		mainly B&C	Nil	CALM			Yes
The Water and Rivers Commission will:							
• through a new program, ensure that remnant vegetation on private land in the priority water resources catchments of Mundaring Weir, Wellington Reservoir, Warren, Kent and Denmark Rivers is fenced by 2010 and managed to ensure its long term retention.	4.1.5	A	0.6	W&RC		0.6	
Salinity management targets							
• Clear objectives and target outcomes for salinity management which specify the relative importance of protecting the land and water resource base, minimising financial losses to the individual and the State, and conserving natural diversity will be established for every catchment, over time.	4.2	All	Nil	varies with catchment			

Western Australian Salinity Action Plan Items 3	Report section reference	Rainfall zones for salinity mgmt.	Additional recurrent funding need ($ millions/a)	Lead agency	Source of new recurrent funding ($ millions/a)		
					Redistrib. of existing agency resources	New funds from State Govt	Possible Comm funds
Technology development							
• As part of its submission to the Commonwealth Government for an additional $30million per year under the new sustainable agriculture and environmental initiatives (refer Section 4.1.1) the Government will seek $11 million per year over five years to conduct feasibility studies on a range of new woody perennial crops and industries. Specifically CALM continue developing the eucalyptus oil industry, in conjunction with the Oil Mallee Association.	4.3.1 4.3.1	All B&C	11.0 (included in the $30m above)	GOVT CALM			Yes (NVI & FFP)
• Water and Rivers Commission and Agriculture WA will evaluate airborne geophysics and related data sets at three different sites, including Broomehill, to determine whether extensive application of this technology is warranted.	4.3.2	All	0.5 0.15	W&RC AgWA	0.1	0.5 0.05	Yes (NLP) Yes (NLP)
• Agriculture WA and CALM will collaborate to develop knowledge of the major design variables of alley farming systems.	4.3.2	All	0.09	AgWA		0.09	
Challenges to business management							
• Grants are now available to contribute towards the cost of attending business management training courses and for professional preparation of farm business plans. Under RAFCOR, this program will be further adapted to meet the needs of salinity management.	4.4	All	Nil	AgWA			
• Agriculture WA, in partnership with RAFCOR, will monitor farm viability, the potential impact of salinity and constraints on adjustment (eg cropping and diversification). The Rural Adjustment Scheme will be adapted to assist implementation of critical control works and other actions where on-farm production options are limited.	4.4	All	4.7	AgWA	4.7		Yes (RAS)
• The Soil and Land Conservation Council, with Agriculture WA, will be asked to review legal and other arrangements relevant to water management practices which need to cross property boundaries, and to recommend options for catchment management.	4.4	All	Nil	AgWA			

Western Australian Salinity Action Plan Items 4	Report section reference	Rainfall zones for salinity mgmt.	Additional recurrent funding need ($ millions/a)	Lead agency	Source of new recurrent funding ($ millions/a)		
					Redistrib. of existing agency resources	New funds from State Govt	Possible Comm funds
Implementation							
Individual farmers							
• Agriculture WA and CALM will adopt a water use evaluation approach. Each technology they promote must improve or maintain water use in the landscape, and each farming system will be rated according to its water use potential.	5.2	All	0.08	AgWA CALM		0.08	
• Farmers will be able to access information on best management practices through new communication technologies such as AgFax and REX.	5.2	All	0.22	AgWA CALM	0.06	0.16	
• CALM and Agriculture WA will complement the high rainfall Farm Forestry Advisory Service by providing an integrated advisory service on revegetation in medium to low rainfall areas, with an initial focus on centres where CALM and Agriculture WA have a presence, eg Narrogin, Katanning, Merredin and Moora.	5.2	B&C	0.30	CALM AgWA	0.075	0.225	
• CALM will appoint Land for Wildlife officers and ecologists in key centres.	5.2	All	Included above	CALM			
• Agriculture WA and Water and Rivers Commission will give priority to reviewing the technical and environmental suitability of deep drainage, providing standards to guide the assessment of farmer proposals and producing best practice information for wide distribution.	5.2	B&C	Nil	AgWA W&RC			
• Agriculture WA will carry out a detailed assessment of farms and catchments that have implemented components of high water use systems with apparent success.	5.2	All	Nil	AgWA			
• Water and Rivers Commission will review its groundwater salinity investigative program to increase its extension efforts through promoting the use of groundwater mapping and the related data base with farmer and catchment groups.	5.2	All	0.5	W&RC	0.2	0.3	Yes (NLP)
• A Salt Watch network will be established where land users will have on-line computer or faxback access to monitoring data on water use, ground-water use and salinity for their catchment or region.	5.2	B&C	0.09	AgWA	0.09		
Catchment groups							
Using these pilot projects as a base, the Government will: • define a common methodology for local scale management of catchments; • fund monitoring and evaluation work to increase community confidence in this more disciplined, integrated approach.	5.3	mainly B&C	0.08	AgWA	0.08		

Western Australian Salinity Action Plan Items 5	Report section reference	Rainfall zones for salinity mgmt.	Additional recurrent funding need ($ millions/a)	Lead agency	Source of new recurrent funding ($ millions/a)		
					Redistrib. of existing agency resources	New funds from State Govt	Possible Comm funds
Focus catchments							
• Focus catchment groups will have a services agreement for the provision of the technical and economic information needed for decisions. In return, individual land holders will be asked to enter into a formal agreement to implement the best practices developed in the partnership.	5.3.2	mainly B&C	Nil	AgWA			
• Agriculture WA will support up to 30 sub-catchment groups under the new arrangements, including the services-for-implementation agreement.	5.3.2	mainly B&C	Nil	AgWA			
• Agriculture WA will set up 12 catchment support teams with a responsibility for providing best management practice information and advice on a farm scale, integrated to catchment outcomes.	5.3.2	mainly B&C	0.54	AgWA	0.32	0.22	Yes (NLP)
• DEP, in consultation other government agencies and the community, will develop broad environmental objectives and criteria suitable for focus catchments. The same objectives will provide guidance for planning by individual farmers and catchment groups outside the focus and recovery catchments.	5.3.2	All	0.05	DEP		0.05	
Potable water resource catchments							
The Water and Rivers Commission will: • review reforestation activities in the Wellington Reservoir catchment area and implement a plan with the community to reduce salinity to potable water supply levels by the year 2015. The public and private benefits of establishing trees on farms will be investigated and specific programs adopted to generate necessary commercial and other plantings; • evaluate private reforestation plantations in the Denmark catchment to ensure that it is sufficient to achieve potable water supply levels by the year 2020; • evaluate options to reduce the salinity of Mundaring Reservoir and establish target salinities and catchment plans, including programs to implement them; • prepare and implement catchment plans on the Kent (Agriculture WA as lead agency) and Warren Water Reserves, in cooperation with the community, with the objective of achieving potable water supply levels by 2030.	5.4.1	A A A A	2.5 (1.5 million included in the $30 million above)	W&RC W&RC W&RC W&RC		1.0	Yes (NVI)
The Water and Rivers Commission will: • increase its resources committed to salinity management through the provision of additional regional support, particularly to service the planning and implementation of catchment restoration programs; • maintain existing and establish new research/demonstration sites to improve the understanding of salinity treatment processes.	5.4.1	mainly A&B	0.5	W&RC		0.5	

Western Australian Salinity Action Plan Items 6	Report section reference	Rainfall zones for salinity mgmt.	Additional recurrent funding need ($ millions/a)	Lead agency	Source of new recurrent funding ($ millions/a)		
					Redistrib. of existing agency resources	New funds from State Govt	Possible Comm funds
Key wetlands and natural diversity catchments							
• The Government will develop and implement a coordinated Key Wetlands and Natural Diversity Recovery Program targeting at least six key catchments over the next ten years to ensure that critical and regionally significant natural areas, particularly wetlands, are protected in perpetuity. This will be funded in part from additional State Government funds and from funds sought from the Commonwealth Government as part of the request for $30 million/a from the new sustainable agriculture and environment initiative. (Refer section 4.1.1)	5.4.2	All	5.5 (3.0 million included in 30 above)	CALM		2.5	Yes (NVI)
As the coordinating agency for the Wetlands and Natural Diversity Program, CALM will:							
• implement the Toolibin Lake Recovery Plan;	5.4.2	C	Included above	CALM			Yes
• complete its management plan for the Muir-Unicup wetland reserves by 1997 and work with the local community to coordinate action in the whole catchment area;		A	Included above	CALM			Yes
• complete its management plan for the Lake Warden wetland reserves by 1997 and work with the existing catchment groups to coordinate action over their catchment areas;		B	Included above	CALM			Yes
• give priority to locating commercial woody perennial plantings in areas which also generate significant nature conservation benefits, such as Toolibin Lake;		All	Nil	CALM			
• complete its Wheatbelt Regional Management Plan by the end of 1998. For much of the State's agricultural region this plan will describe CALM's policies management of conservation reserves, conservation of natural diversity across the landscape and commercial production from woody plants.		B&C	Nil	CALM			
CALM will:							
• conduct a biological survey, in the agricultural zone, with an emphasis on low-lying areas that are vulnerable to salinity, to identify nature conservation priorities and to identify plant species that are likely to be of value in revegetation for both commercial production and land conservation;	5.4.2	B&C	0.5	CALM		0.5	Yes
• using the results of the biological survey, and following discussion with peak advisory bodies and affected community groups, the Government will select an additional three or four key recovery catchments and establish recovery plans by the end of 2000;		B&C	Included above	CALM			
• commence the implementation of an initial ten-year recovery program in 1996/97.		B&C	Included above	CALM			

Western Australian Salinity Action Plan Items 7	Report section reference	Rainfall zones for salinity mgmt.	Additional recurrent funding need ($ millions/a)	Lead agency	Source of new recurrent funding ($ millions/a)		
					Redistrib. of existing agency resources	New funds from State Govt	Possible Comm funds
Rural infrastructure assets							
• Agriculture WA will consult with local government authorities in rural catchments to assess salinity risks and plan action to deal with rising ground-water.	5.4.3	B&C		AgWA			
• Agriculture WA will lead implementation of a major Rural Towns Rescues Program to protect infrastructure such as buildings and roads which are threatened by salinity.	5.4.3	B&C	2.0 ($1.0 million included in $30 million above)	AgWA		1.0	Yes (NVI) (NLP)
Monitoring and evaluation							
The Government will: • establish a regular program of satellite imagery (Landsat TM) evaluation, or similar systematic and technically sound technique, to provide the most reliable and consistent recording of the area of salt-affected land, remnant vegetation extent and condition, and the rate of establishment of deep-rooted perennial vegetation throughout the agricultural areas of the south-west. This program would be conducted every three years and would be supported by the ABS Ag Census in the intervening years; • through Agriculture WA and supported by the Water and Rivers Commission and CALM, maintain long term groundwater monitoring stations to document trends in groundwater levels throughout the region; • through Agriculture WA and in association with other agencies, develop and maintain the most up-to-date models for estimating the future likely extent of salt affected land.	6.1	All All All	0.15 0.03 Nil Nil	AgWA AgWA AgWA AgWA	0.095	0.055 0.03	Yes (BRS) Yes (NCPISA)
Water and Rivers Commission will: • maintain, and where necessary upgrade, its stream gauging and salinity monitoring program to ensure that long-term trends can be reliably determined; • evaluate the results of its stream gauging and salinity monitoring program and regularly report on the effectiveness of actions to prevent further stream salinity deterioration and to lower salinity levels in recovery catchments.	6.2	mainly A&B	0.25	W&RC		0.25	
CALM will: • monitor a sample of wetlands, and their associated flora and fauna throughout the south-west to determine long term trends in natural diversity and provide a sound basis for corrective action.	6.3	All	0.25	CALM		0.25	Yes (NWP)

Western Australian Salinity Action Plan Items 8	Report section reference	Rainfall zones for salinity mgmt.	Additional recurrent funding need ($ millions/a)	Lead agency	Source of new recurrent funding ($ millions/a)		
					Redistrib. of existing agency resources	New funds from State Govt	Possible Comm funds
Incentives and funding							
• The State Government will consult immediately with the Federal Government and peak councils in Western Australia to establish a more effective delivery system for State and Federal programs.		All	Nil	GOVT			
• A coordinating agency will be identified and widely known for each catchment and will facilitate the development of integrated salinity management projects and joint investment by external funders.		All	Nil	AgWA			
• There will be an agreed level of investment and Government support for each focus and recovery catchment.		All					Yes (NLP)
• National Landcare Program funding will be available for high public benefit works within regional initiatives, with the coordinating group having discretion in applying the funds under an agreed strategy.		All					
• The Government will continue to promote the case for increasing the level of tax credits and rebates for approved salinity management actions and support the Commonwealth in making Income Equalisation Deposits and Farm Management Bonds more attractive and better used.							

SUMMARY OF COSTS

Western Australian Salinity Action Plan Items 9	Report section reference	Rainfall zones for salinity mgmt.	Additional recurrent funding need ($ millions/a)	Lead agency	Source of new recurrent funding ($ millions/a)		
					Redistrib. of existing agency resources	New funds from State Govt.	Possible. Comm funds
Sub-totals							
Agriculture WA			**7.5**		**5.5**	**2.0**	
Water and Rivers Commission			**3.35**		**0.2**	**3.15**	
CALM			**22.75**		**18.1**	**4.65**	
DEP			**0.20**			**0.2**	
COMMONWEALTH • Commercial industry development • Land conservation and biodiversity plantings • Recovery catchments - water supply - natural diversity • Rural Towns Rescue Program			**30.0**				**11.0** **13.5** **1.5** **3.0** **1.0**
Totals			**63.8** **(phased in)**		**23.8** **(phased in)**	**10.0** **(phased in)**	**30.0**