Western Australian
Auditor General's Report

Management of Salinity

Report 8: May 2018

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WESTERN AUSTRALIAN AUDITOR GENERAL'S REPORT

Management of Salinity

Report 8
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WESTERN AUSTRALIA

THE PRESIDENT
LEGISLATIVE COUNCIL

THE SPEAKER
LEGISLATIVE ASSEMBLY

MANAGEMENT OF SALINITY

This report has been prepared for submission to Parliament under the provisions of section 25 of the *Auditor General Act 2006*.

Performance audits are an integral part of the overall audit program. They seek to provide Parliament with assessments of the effectiveness and efficiency of public sector programs and activities, and identify opportunities for improved performance.

The audit assessed the management of salinity in the agricultural regions of the South West of WA.

I wish to acknowledge the staff at the Department of Primary Industries and Regional Development, the Department of Biodiversity Conservation and Attractions and Department of Water and Environmental Regulation for their cooperation with this report.

Labuschagne

SANDRA LABUSCHAGNE
ACTING AUDITOR GENERAL
16 May 2018

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Auditor General's overview

Salinity has been developing since large scale clearing in the South West agricultural regions began, and is forecast to continue to expand for another 50 years or more. Estimates are that it affects between 1 and 2 million hectares, potentially rising to 5 million, and costs over half a billion dollars a year in lost agricultural production alone.

The scale of the problem is daunting, but so is the scale of the action that would be needed to eliminate salinity. It would require re-planting 80% of the Wheatbelt, a huge task, requiring significant investment that would make broad scale agriculture, as it currently exists, impossible.

The State Salinity Strategy, which stopped 10 years ago, reflected the fact that salinity is a shared problem. It is not spread evenly through the landscape and managing it often relies on action by landholders whose land is not salt affected.

Recovering the landscape completely would take decades and comes with its own significant impacts. But agencies, landholders and communities can adapt to salinity and mitigate its spread and impact through well informed, well targeted, collaborative local action. For agencies to play an effective role in this, they need good information on the extent and impact of salinity, to understand the best options in tackling it, and they need to build effective partnerships to get things done.

Executive summary

Introduction

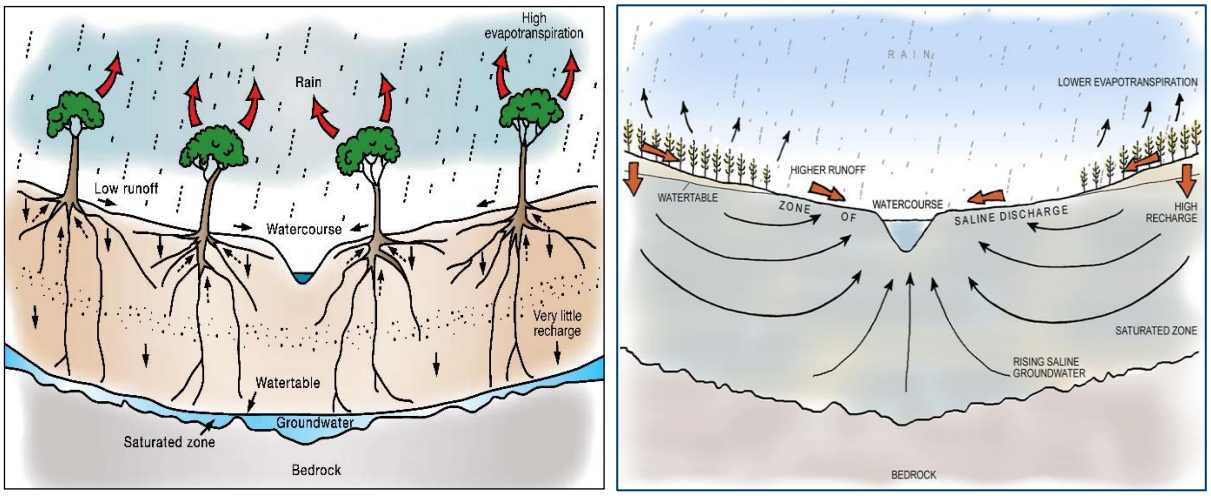
This audit assessed the management of salinity in the agricultural regions of the South West of Western Australia (WA). This is defined by the area roughly west of a line from Kalbarri to Esperance. We focused on the following lines of inquiry:

1. Do agencies know the extent and impact of dryland salinity in the South West agricultural regions?
2. Are efforts to reduce the impacts of dryland salinity in the South West agricultural regions working?

Background

Dryland salinity is a major issue in the agricultural regions of the South West of WA. It adds significant costs to agriculture, causes damage to road, rail and building infrastructure and affects water resources and biodiversity.

It is caused by the clearing of deep rooted native vegetation for shallow rooted annual crops and pasture, which changes the water balance. As water tables rise, salt stored deep in the sub-soil is carried up to the surface and eventually discharged into waterways (Figure 1).



Source: Smith R., 2007, *Salinity- a story of water and salt* (poster), Department of Water, Government of Western Australia

Figure 1: Depiction of how dryland salinity occurs – a healthy balanced system on the left, removing trees on the right shows a high water table, bringing salt to the surface

By the 1990s dryland salinity was considered the greatest economic and environmental threat to the State[1]. The Department of Primary Industries and Regional Development (DPIRD) estimates that since 2009-10 the opportunity cost of lost agricultural production from dryland salinity has been over $500 million a year and that 25% of cleared agricultural land will be at risk of salinity in the long term. It was also predicted by DPIRD that the cost of protecting water supplies and maintaining infrastructure could be even higher.

Clearing over 18 million of the 21 million hectares of native vegetation in the agricultural regions has occurred in an area that is internationally recognised as a biodiversity hotspot. Salinity has had a significant and long lasting impact on the region's natural biodiversity and land systems. The threat to the biodiversity is not limited to individual species. The

[1] Western Australian Salinity Action Plan, November 1996
Appreciating and Creating Our History, By Frost and Burnside, page 9

Department of Biodiversity Conservation and Attractions (DBCA) advises that all the remaining remnants of many valley-floor communities (wetlands, shrublands and woodlands) along with their soils could disappear because of salinisation.

In response to community concern the Government released the Salinity Action Plan in 1996 and the State Salinity Strategy in 2000. A Cabinet Standing Committee, chaired by the Deputy Premier, was established with overall accountability for the Salinity Action Plan. A Salinity Council was also appointed by Government to report to the Committee on matters of policy and performance of the Salinity Action Plan. A timeline of government initiatives is detailed in Appendix 1.

In May 2001, a Salinity Taskforce was established by Government to review salinity management in WA. In June 2002, the Government provided a response to the Taskforce report and committed to taking the lead, building on the action plan and the strategy. Between 2003 and 2008, $560 million of Federal and State funds was invested in a range of land management initiatives which included salinity management and water quality programs.

The *Soil and Land Conservation Act 1945* is the principal legislation relating to the conservation of soil and land resources, and to the mitigation of the effects of erosion, salinity and flooding. Government agencies and individual landholders have a responsibility to manage dryland salinity as per below:

Managing salinity – general responsibilities:

Government responsibilities to manage dryland salinity:	
Department of Primary Industries and Regional Development (DPIRD)	• Administers legislation that is related to food production, environmental conservation and sound agricultural management in WA
Department of Water and Environmental Regulation (DWER)	• Manages water resources; its availability, quality and sustainability
Department of Biodiversity, Conservation and Attractions (DBCA)	• Has responsibilities for the State's biodiverse environment, which includes areas outside its reserve system

Other responsibilities:	
Landholders (includes government agencies local government, and private landowners)	• Have a responsibility to manage their land • Require approval to clear native vegetation • Require approval to construct drainage systems

***Soil and Land Conservation Act 1945* (Administered by DPIRD):**

Under the Act:	
Commissioner of Soil and Land Conservation (within DPIRD)	General functions include the prevention and mitigation of land degradation, promotion of soil conservation, and education of landholders and the public

Under the Act:	
Soil and Land Conservation Council (a statutory body)	Functions for the Minister for Agriculture: • advise on the condition of soils and land resources • make recommendations on land use, soil and land conservation policy • coordinate, monitor, and review soil and land conservation programs and activities

Under the Act:	
Land Conservation District Committees	The Committees promote sustainable land management, manage projects, follow direction from and provide asistance to the Soil and Land Commissioner

Figure 2: Dryland salinity management framework

The Commissioner of Soil and Land Conservation can issue a notice to a landholder to take specific action if degradation is occurring or likely to occur. If the land is within a gazetted water catchment or has important biodiversity values, there may be restrictions as to its use under legislation managed by the Department of Water and Environmental Regulation (DWER) and DBCA.

Audit conclusion

Dryland salinity has been developing since large scale clearing began. It is estimated to affect between 1 and 2 million hectares (up to 10% of total land) in the agricultural regions of the South West, and cost $519 million per annum in lost agricultural production. Salinity also damages infrastructure, adding further costs, impacts on water resources and reduces biodiversity.

Predictions are that, without some level of intervention, the area of land affected by salinity could more than double over the next 50 to 100 years. Intervention on such a scale is a huge task and needs to be balanced against the possible cost, which could also be large.

Government has to decide how much intervention is both feasible and economically sound, but is currently in no position to make an informed decision. Since 2008, there has been a lack of strategic direction and agencies have reduced monitoring the extent and impact of salinity.

Managing dryland salinity is a shared responsibility, with shared benefits, and experience to date indicates that effectiveness relies on coordinated local action. It also relies on all landholders taking appropriate action to protect their land. But, in the absence of strategic direction, agencies have focused on protecting individual assets, and there has been little coordination of efforts between agencies, landholders and stakeholders.

Key findings

Dryland salinity is a significant cost to agriculture and infrastructure, and a major risk to water resources and biodiversity

- It is estimated that between 1 and 2 million hectares (up to 10% of total land) in the agricultural regions of the South West are salt affected. DPIRD calculates that the opportunity cost of lost agricultural production as a result of dryland salinity since 2009-10 is $519 million per annum. Without some level of intervention, dryland salinity will continue to be a significant cost and major risk to the State. The extent of salinity affected land in the South West is expected to more than double over the next 50 to 100 years to around 5.4 million hectares. Of this, 4.5 million hectares is agricultural land.

- Salinity also has a significant impact on water resources, biodiversity and infrastructure. DWER estimates that almost every stream and river in the South West is affected to some extent by salinity. In 2010, the then Department of Environment and Conservation estimated that 850 endemic flora and fauna species were at threat of extinction as a result of dryland salinity. Cost and impacts on infrastructure assets such as roads, railways and buildings are not accurately known, but local governments estimate salinity can halve the life of roads.

The scale and cost of intervention could be very large, and government needs to decide what is feasible and economically viable

- For large scale improvements, DPIRD estimates that over 80% of the Wheatbelt would need to be replanted with deep rooted trees and shrubs to stabilise and lower water tables. Water tables would take decades to fall and the current extent of broad scale agriculture would no longer be possible.

- Agencies advise that recovery from dryland salinity is only feasible in discrete catchments and they have focused efforts on individual assets that warrant protection. On a landscape scale, more achievable and feasible management goals are to contain the area impacted or adapt to the saline conditions. Options include revegetation, drainage systems, planting salt tolerant plant species or adopting alternative land uses. The choice for government is to decide how much intervention is feasible and economically sound.

The State does not have all the information it needs to effectively manage salinity

- Agencies do not have good information about the current extent, impact and cost of dryland salinity and are therefore not well positioned to manage the risks and provide direction and advice. In large part, this is because since 2008 agencies have reduced monitoring and evaluation, and the Soil and Land Conservation Council, the key independent advisor to Government, has not met since 2003. This impacts on the State's ability to manage salinity effectively and efficiently, and increases the risk that poor decisions will be made.

- DPIRD conducts limited monitoring and reporting, and its estimates of the extent of dryland salinity are out of date. The last satellite imagery analysis that mapped salinity was in 2000. At that time, DPIRD calculated that severely salt affected land was increasing by 14,000 hectares per year. The Department does not know if this rate of increase has continued, decreased or accelerated.

- DPIRD monitors water tables throughout the South West. Because there is a link between water table height and salinity this does provide an indication of areas at risk. DPIRD reported water table data in 2013, however, there are gaps in the data and DPIRD has advised that its monitoring effort has reduced since 2010.

- Recently, Government has recognised the need to develop a greater understanding of how to manage WA soils and has taken some steps to address this. In December 2017 it announced the formation of a Ministerial Advisory Committee to guide the re-establishment of the Soil and Land Conservation Council.

There has been little coordination of efforts between agencies, landholders and stakeholders

- There is currently little coordinated management across government agencies, landholders and stakeholders. As a result, efforts to manage dryland salinity are unlikely to achieve any landscape wide improvement.

- The management of dryland salinity lacks strategic direction. Neither the State Salinity Action Plan nor the State Salinity Strategy were completed. Since 2008, both have been dormant and are now outdated. The absence of clearly defined outcomes, and good information on what works, increases the risk that limited funding is not spent efficiently. For example, it is not clear how effective the $560 million investment of state and federal funds between 2003 and 2008 was because agencies have not continued to monitor and evaluate outcomes.

- Salinity is spread unevenly across the landscape, resulting in varying impacts. Addressing it is a shared responsibility and experience to date indicates that effectiveness relies on coordinated local action. It also relies on all landholders taking appropriate action to protect their land, even those who are not affected and stand to gain relatively little.

- There are currently no goals and targets for reducing water tables or planting deep-rooted species and decisions to protect land are left to individual landholders. Relying purely on private benefit can result in landholders either acting alone, or not at all.

- Mechanisms exist to help more collaborative approaches, such as the functions of the Commissioner of Soil and Land Conservation, the Soil and Land Conservation Council, and Land Conservation District Committees. But these are not used, which increases the risk that some landowners will take appropriate actions while others will not. Inaction by a landowner can have a significant impact on their neighbours.
- DPIRD measures to prevent land degradation are mostly reactive and reliant on applications for drainage or complaints from the public. It is not effectively using its legislative powers to prevent land degradation. With up 2 million hectares affected by salinity, and the problem predicted to get worse, we would expect a more proactive approach to the prevention and mitigation of land degradation.
- DPIRD advised that since 2008, it had investigated 303 land degradation complaints and only 2 were directly related to dryland salinity. A further 39 complaints were related to unapproved drainage which the Commissioner for Soil and Land Conservation stated may have been about salinity.

Agencies have protected individual assets but overall are not meeting legislated responsibilities

- Agencies have focused on protecting individual, high value assets in local areas. This has resulted in some success for those assets. However, agencies are not meeting wider legislated responsibilities to prevent and mitigate land degradation, and protect water resources and biodiversity throughout the South West.
- DPIRD has responsibilities under the *Soil and Land Conservation Act 1945* (the Act) to prevent and mitigate land degradation, promote soil conservation and encourage and educate landholders. DPIRD does not own or manage agricultural land apart from a few research stations. It works to ensure a profitable and sustainable agricultural industry by conducting research and providing advice on a range of agricultural issues. It can also investigate complaints about land degradation but does little to directly manage salinity.
- DBCA and DWER have wide responsibilities to protect the environment and manage water resources. They advised that given the widespread scale of dryland salinity and limited resources they have prioritised which assets they protect. These were originally identified in the Salinity Action Plan. They acknowledge that while they have had success with some of those assets, other water resources have become more saline and native flora and fauna remain at significant risk.
- In the early 1990s, DBCA started recovery works to protect biodiversity in 6 South West wetland catchments. In 2002, the Government committed to increasing the number of recovery catchments to 25, however this was never done. Work in the recovery catchments has since been reduced based on available resources and changed priorities. DBCA currently provides a direct staff resource and funding to implement recovery actions for 2 wetland catchments; Toolibin Lake and Lake Bryde. They also conduct broader wetland projects and research at other sites that includes monitoring water depth and salinity levels.
- The Salinity Action Plan identified 5 key water resource catchments in the South West for DWER to manage. These catchments are declared under the *Country Areas Water Supply Act 1947*. Interventions by DWER in the Kent and Denmark River catchments were successful in reducing salinity levels, especially the Denmark River where the salt levels are now within Australian Drinking Water Guidelines. DWER remains active in the Collie River (Wellington Dam) and Denmark River catchments. For many other rivers in the South West such as the Avon, Blackwood, Warren/Tone, Pallinup, Gairdner and Lort, salinity levels continue to increase.

Recommendations

1. **To improve the effectiveness and efficiency of the management of dryland salinity DPIRD (in consultation with DBCA and DWER) should by December 2018:**

    a. **set the strategic direction for the management of salinity**

    b. **establish regular monitoring and reporting of the spread, impact and cost of dryland salinity**

    c. **make better use of established mechanisms to ensure there is better cooperation and coordination at the government and local level**

    d. **consider whether there should be targets to reduce water tables and re-plant deep rooted trees on a catchment wide or localised level**

    e. **continue to promote soil conservation, and educate landholders and the public**

    f. **where necessary, make greater use of compliance and enforcement mechanisms under the *Soil and Land Conservation Act 1945* to ensure that landholders prevent and/or mitigate land degradation.**

Agency responses

Department of Primary Industries and Regional Development

The Department of Primary Industries and Regional Development (DPIRD) accepts the findings of the audit of the Management of Salinity in the agricultural regions of Western Australia.

The requirement to establish a new strategic direction for the management of salinity is acknowledged and DPIRD generally accepts the recommendations outlined to improve the effectiveness of the management of salinity in Western Australia.

DPIRD will work with DBCA and DWER through existing consultative mechanisms to ensure effective cooperation and coordination of future activities to manage salinity.

With the available estimates of salinity now nearly 20 years old, finalising a strategic direction will require establishing the current extent, impacts and rate of change in salinity. This will take approximately two years to complete, is unfunded and could not be achieved by December 2018 as recommended.

Department of Water and Environmental Regulation

The Department of Water and Environmental Regulation (DWER) accepts the key findings contained in the report and notes that the benefits of the previous investment into salinity management are often intangible.

The Department supports all but one of the recommendations proposed. While the setting of targets to reduce water tables and re-plant deep-rooted trees may appear attractive, the Department is of the view that the scale of intervention required for even small reductions in salinity levels place unreasonable and unobtainable expectations on land managers. It may also impose significant costs without realisation of benefits commensurate with the scale of investment required.

The Department believes that the current targeted approach to salinity mitigation whereby activity is focussed in areas where there is a high chance of success is a much more efficient use of limited resources and provides a far greater return on investment than spreading the effort across large geographical areas.

Overall, DWER recognises the scale, complexity and importance of the management of salinity in the state's agricultural regions. The Department also acknowledges the work of its predecessor agencies and other agencies and their contributions to the significant body of work on salinity management in Western Australia since the early 1900s.

This research has directly informed the Department's policy with respect to waterways management and has resulted in success. Maintaining or improving salinity levels has been achieved in key water resource catchments including the Denmark River, which is now being used for drinking water for the town of Denmark, and the stabilization of salinity in the Wellington Reservoir enabling it to continue to be used for agriculture on the coastal plain and is the subject of renewed efforts to improve water quality.

Audit focus and scope

The audit assessed the management of salinity in the agricultural regions of the South West of WA. This is defined by the area roughly west of a line from Kalbarri to Esperance. The audit focused on 2 lines of inquiry:

1. Do agencies know the extent and impact of dryland salinity in the South West agricultural regions?
2. Are efforts to reduce the impacts of dryland salinity in the South West agricultural regions working?

We focused on the management of dryland salinity by DPIRD, DBCA and DWER. In conducting the audit, we:

- reviewed plans and policies and key documents for managing dryland salinity
- interviewed staff at DPIRD, DBCA, and DWER
- visited the South West agricultural area and met with 7 local governments and a number of landholders to discuss dryland salinity, observe different salinity management options and dryland salinity impacts
- met with key stakeholders and industry groups.

This was a broad scope performance audit, conducted under section 18 of the *Auditor General Act 2006* and in accordance with Australian Auditing and Assurance Standards. Performance audits focus primarily on the effective management and operation of agency programs and activities. The approximate cost of tabling this audit was $269,000.

Audit findings

Dryland salinity is a significant cost and major risk to the State

Dryland salinity is a significant cost to agriculture and infrastructure, and a major risk to water resources and biodiversity. It is estimated that between 1 and 2 million hectares of land within the agricultural regions is salt affected and that the opportunity cost of lost agricultural production alone is $519 million a year. Salinity also damages infrastructure, adding further costs, impacts water resources and reduces biodiversity. Without some level of intervention, dryland salinity will continue to be a significant cost and major risk to the State.

Agencies expect the extent of salinity affected land in the South West to more than double over the next 50 to 100 years to around 5.4 million hectares. Of this, 4.5 million hectares is agricultural land.

There are approximately 18 million hectares of agricultural land in the South West. If the upper estimate of 4.5 million hectares became salinity affected that would equate to 25% of agricultural land and could potentially cost around $1 billion a year in lost production (2016 estimated opportunity cost x2).

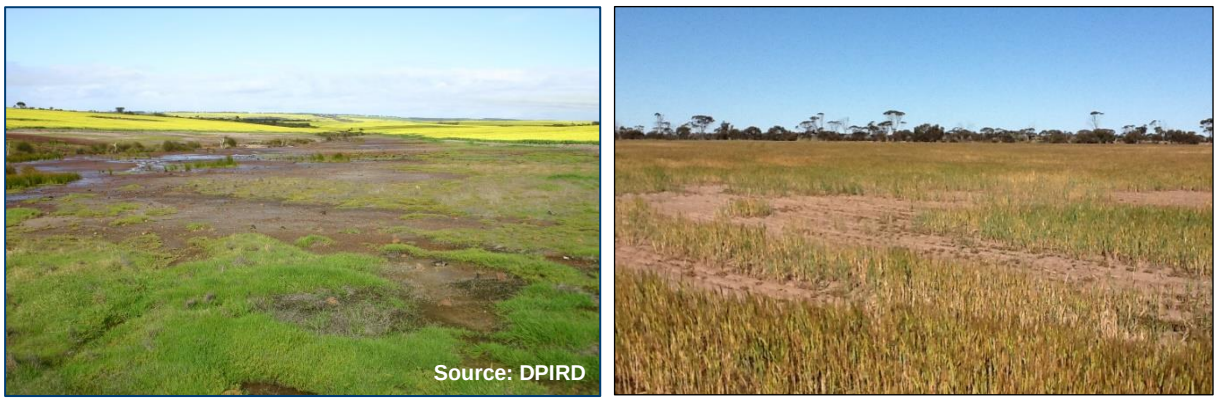


Figure 3. Impact of dryland salinity on agricultural land in the South West – left photo: bare earth salt scalds; right photo: impact of salinity on a cereal crop

DWER estimates that almost every stream and river in the South West is affected by salinity. When salt levels exceed Australian Drinking Water Guidelines of 500mg per litre it can be harmful to health. As salt concentrations increase the potential uses for the water diminish.

High concentrations of salt are harmful to most plants and animals. In 2010, the then Department of Environment and Conservation estimated that 850 endemic flora and fauna species were at threat of extinction as a result of dryland salinity. The threat to the State's biodiversity is not limited to individual species. DBCA advise that all the remaining remnants of many valley-floor communities (wetlands, shrublands and woodlands), along with their soils could disappear because of salinisation.

Under the Natural Diversity Recovery Catchment Program, DBCA manages 2 key catchments so they are protected for the long term. Expenditure for activities related to overall dryland salinity management are not separated and reported.

Source: DPIRD and DWER

Figure 4. Impact of dryland salinity on biodiversity within the South West – left photo: bare earth and accumulated surface salt and lack of, or dead vegetation; right photo: natural lake with increased inundation and salt levels resulting in dead trees

Salt also damages infrastructure owned by State, local government and the private sector which can increase maintenance costs and reduce the life of an asset. Infrastructure includes roads (main, regional and local) and railways, local government assets, private houses and buildings.

Source: DWER

Figure 5. Examples of damage to infrastructure caused by salinity

The cost and impact on infrastructure assets is not accurately known, but local governments estimate salinity can halve the life of roads. In 2006, the Salinity Investment Framework

Phase II[2] report stated that about 252 kilometres of highways and main roads, and 3,850 kilometres of local roads were affected by salinity. The annual costs of repairs were approximately $175 million a year. It was estimated that 210 kilometres of rail line and potentially another 1,050 kilometres could be affected by salinity with an annual repair cost of $2 million and $7 million respectively.

Local governments that we spoke to said salinity did impact their roads and assets such as parks, reserves and buildings but were not able to separately identify the financial impacts. Where the local governments operated town site bores to lower water tables, they were able to provide ballpark calculations of operational costs for the pumps. All other expenditure is included within operational costs.

There is no practical way of calculating the cost of salinity on private assets such as houses and buildings. Anecdotally we were told of extensive repairs needed to some houses in Narrogin, Wagin and Katanning.

Source: DPIRD

Figure 6: A local road in the eastern Wheatbelt showing damage; waterlogging and surface salt

The scale and costs of intervention could be very large, and government needs to decide what is feasible and economically viable

The South West agricultural area is poorly drained, is particularly flat in the eastern parts and has wide valley floors. For large scale improvements, DPIRD estimates that over 80% of the Wheatbelt would need to be replanted with deep rooted trees and shrubs to stabilise and lower water tables. Water tables would take decades to fall and the current extent of broad scale agriculture would no longer be possible.

Agencies advise that recovery from dryland salinity is only feasible in discrete catchments and they have focused efforts on individual assets that warrant protection. On a landscape scale, more achievable and feasible management goals are to contain the area impacted or adapt to the saline conditions. Options include revegetation, drainage systems, planting salt

[2] Salinity Investment Framework, Phase II, Natural Resource Management, December 2006

tolerant plant species or adoption of alternative land uses. The choice for government is to decide how much intervention is feasible and economically sound.

Figure 7: Examples of intervention (drainage at a farm, Dumbleyung) and adaption (fodder plant suitable for livestock)

The State does not have all the information it needs to effectively manage salinity

There is a lack of complete and current knowledge about the extent, impact and cost of dryland salinity. In large part, this is because agencies have reduced monitoring and evaluation, and the Soil and Land Conservation Council, the key independent advisor to Government, has not met since 2003. This impacts on the State's ability to manage salinity effectively and efficiently, and increases the risk that poor decisions will be made.

Recently, however, Government has recognised the need to develop a greater understanding of how to manage WA soils and has taken limited steps to address this. In December 2017, it announced the formation of a Ministerial Advisory Committee to guide the re-establishment of the Soil and Land Conservation Council. The Council is a statutory body with members appointed by the Governor. It functions to provide advice to the Minister for Regional Development; Agriculture and Food, and to coordinate, supervise, and promote land conservation activities.

The current extent, impact and full cost of dryland salinity is not known

There is no regular, on-going monitoring and reporting of dryland salinity. As a result, no one accurately knows the extent, impact, cost and potential spread of dryland salinity. In June 2002, the Government committed to implementing an evaluation framework to monitor the extent, potential spread and impacts of salinity. This has not been done.

Agencies estimate the extent of dryland salinity using various analytical methods, some more than 15 years old. Estimates are extrapolated from satellite images, groundwater, stream, river and wetland monitoring.

The last satellite imagery analysis that mapped salinity was in 2000. The Land Monitor project (1988-2000) used satellite imagery over 2 periods (1988-92 and 1996-2000) from which areas of low productivity (little ground cover and bare soil) were mapped and used to calculate that about 1 million hectares was severely saline affected land.

At that time, DPIRD calculated that this was increasing by 14,000 hectares per year. The Department does not know if this rate of increase has continued, decreased or accelerated.

The 2010 Western Australian Salinity Review[3] recommended that the Land Monitor project should be continued every 5 years so that results could be reported in the WA State of the Environment reports.

In 2013, DPIRD reported that 1 million hectares of agricultural land was severely salt affected. The basis for this estimate was DPIRD's groundwater bore monitoring network, from which the status of the water table (depth, rising, stable or falling) is monitored for trends. The network has 1,500 bores but not all are monitored. DPIRD has advised their monitoring effort has decreased since 2010 and is now part strategic and part opportunistic. Without seeking independent specialist advice, we were unable to report whether the number, distribution and monitoring frequency is scientifically valid for results to be reliable and representative.

Previously, in 2009, the then Department of Agriculture and Food WA (DAFWA) reported that salinity affected 2 million hectares of agricultural land in the South West[4]. DWER currently reports on its website that 1.8 million hectares is salt affected.

DBCA under the South West Wetlands Monitoring Program collects data each year on water level, salinity and pH data for 105 wetlands, most within national parks and nature reserves. Started in 1977 the program initially monitored 119 South West wetlands but in 1992 the focus changed to a smaller number of near coastal freshwater wetlands.

A report published in 2016 showed the results on water depth and rainfall monitoring of 105 South West wetlands for the period 1977 to 2015. The Depths and Salinities of Wetlands in South Western Australia 1977-2000, published in 2004, did report water depth and salinity data for 151 wetlands plus long term trend data for 41 of these wetlands which were monitored for more than 20 years. The 2010 report (trends in Wetlands from 1981-2010) made minimal mention of salinity and was more focused on water depth and rainfall. DBCA advised that monitoring capability is severely impacted by available resources.

The Natural Diversity Recovery Catchment program was DBCA's key salinity management program established under the WA State Salinity Action Plan 1996. Originally, there were 6 recovery catchments that were closely managed.

As a result of reduced resources DBCA now only actively manages 2 of the recovery wetland catchments, Toolibin Lake and Lake Bryde and monitors another 2 wetlands across the South West at risk from rising water tables and increased surface flows.

Under the Salinity Action Plan, DWER managed 5 key Water Resource Recovery Catchments. DWER currently maintains a watching brief over South West river catchments and publishes limited information about water quality. Trends and status data is reported via an on-line map however the data is now out of date and changes in sites monitored mean trend data is not always valid. DWER has a network of gauging stations to measure stream flow and water levels. Data is available online but difficult to access and interpret.

There is little coordination of efforts to manage dryland salinity

Salinity is spread unevenly across the landscape, resulting in varying impacts. Addressing it is a shared responsibility and experience to date indicates that effectiveness relies on coordinated action. It also relies on all landholders taking appropriate action to protect their land, even those who aren't directly affected by salinity but are contributing to altered hydrology and/or salinity on another property.

[3] The Western Australian Salinity Review – Roy Green and Colin Creighton 2010
[4] National Action Plan for Salinity and Water Quality and Natural Heritage Trust Program 2003-2009 final report – State Natural Resource Management Office, DAFWA

There is currently little coordinated management across government agencies, industry, land holders and the community. As a result, efforts to manage dryland salinity are unlikely to achieve any landscape wide improvement.

The management of dryland salinity lacks strategic direction

The strategic management and planning framework established in the late 1990s and early 2000s has not been completed. The Salinity Action Plan and the State Salinity Strategy are both dormant and are now outdated. The absence of clearly defined outcomes increases the risk that limited funding is not spent efficiently.

For example, it is not clear how effective the salinity initiatives that were part of the $560 million investment of state and federal funds between 2003 and 2008 were, because agencies have not continued to monitor and evaluate outcomes.

There are currently no goals and targets for reducing water tables or replanting deep-rooted species. Decisions to protect land are left to individual landholders without any level of government regulation or enforcement. Relying on landholders to make choices about addressing salinity based on their own private benefit can result in landholders either acting alone, or not at all.

This is a significant change to the management approach adopted in the 1990s and 2000s which considered that Government had a fundamental responsibility to protect public assets, assist in the protection of private assets and provide on-going funding.

Mechanisms exist to help more collaborative approaches, such as the functions of the Commissioner of Soil and Land Conservation, the Soil and Land Conservation Council, and Land Conservation District Committees. But these are not used, which increases the risk that some landowners will take appropriate actions while others will not. Inaction by a landowner can have a significant impact on their neighbours. Although DPIRD advises that it does investigate complaints, the risk of inaction remains because it is not effectively using its legislative powers to prevent land degradation.

We would have expected a framework and strategic plan that is up to date and that incorporates a state approach to the management of dryland salinity. The plan should define the role of Government, agencies, stakeholder, landholder and community in addressing dryland salinity. Elements of this were in place in the early 2000s but are no longer in operation. At the ground level, government support for community groups has been reducing. Much of the Natural Resource Management funding tends to be federal funding, often tied to federal priorities that differ from State and local land care priorities.

Agencies have protected some individual assets but overall are not meeting wider legislated responsibilities

In the absence of a coordinated statewide strategy, DBCA and DWER have focused on protecting individual, high value assets in local areas. This has resulted in some success for those assets. However, they are not meeting wider legislated responsibilities to prevent and mitigate land degradation, and protect water resources and biodiversity throughout the South West.

Agencies advise that they direct investment to priority assets. The Salinity Investment Framework reports (Phase I and II) are not Government policy but provides guidance for agencies to use when deciding to invest public funds. The Phase I report was prepared by the Department of Environment in 2003, and the Phase II report by the Natural Resource Management Council of Western Australia in 2006.

DPIRD

DPIRD has responsibilities under the *Soil and Land Conservation Act 1945* (the Act) to prevent and mitigate land degradation, promote soil conservation and encourage and educate landholders but does little to actively manage salinity. On the ground activities have reduced and landholders such as farmers and industry are increasingly required to fund activities that are now seen by Government as having a largely private benefit.

DPIRD has information on dryland salinity publically available on its website including explanation of the science of dryland salinity, general information about the extent, potential spread and impact. There is also information about management options available for landholders.

The Act provides for the appointment of a Soil and Land Commissioner and the establishment of Land Conservation District Committees (LCDCs). The committees can manage projects and follow direction from and provide assistance to the Commissioner. The LCDCs were established in 1988, and perform authorised functions within a land conservation district relating to land degradation and soil conservation. Membership and sustainability of many groups is an on-going issue with only 20 committees remaining in operation in the South West agricultural region. Previously there were just over 140 authorised and active LCDCs.

Under the Act the general functions of the Commissioner include the prevention and mitigation of land degradation, and the promotion, encouragement and education of landholders and the public in soil conservation. The Commissioner can also investigate complaints about land management causing land degradation and issue soil conservation notices to landholders.

DPIRD is not effectively using all its legislative powers to prevent land degradation. Measures to prevent land degradation are mostly reactive and reliant on applications for drainage or complaints from the public.

Since 2008, the Commissioner has investigated 303 land degradation complaints, of which 2 were directly related to salinity, and according to the Commissioner, 39 related to non-notified drainage where salinity was most likely to be the issue. Although there are avenues for prosecution DPIRD's compliance and enforcement policy does not favour this approach. We are not aware of any landholder being prosecuted for failing to mitigate land degradation.

With up to 2 million hectares affected by salinity, and the problem predicted to get worse, we would expect a more proactive approach to the prevention and mitigation of land degradation.

DBCA and DWER

DBCA and DWER have wide responsibilities to protect and conserve the natural environment and manage water resources. They advise that given the wide extent of dryland salinity and limited resources they have prioritised which assets they protect. While they have had some success with those assets, native flora and fauna are still at significant risk and other water resources have become more saline.

DBCA has overall responsibility for the State's biodiversity assets, both within and outside the reserves system. Dryland salinity has had a significant impact on biodiversity assets particularly wetland areas which are susceptible to altered hydrology. The Department estimated in 2002, that 850 species of plants and animals are threatened with regional or global extinction due to salinity. Rising water tables have resulted in waterways and wetlands being far wetter than they have ever been and often the salinity level has significantly risen. Many native species are not able to survive in wetter and more saline environments.

DBCA's responsibilities are derived primarily from the *Conservation and Land Management Act 1984, Wildlife Conservation Act 1950* and the *Biodiversity Conservation Act 2016*. The

Salinity Action Plan, released in 1996 identified 6 key high diversity value wetlands that needed to be protected under a Natural Diversity Recovery Catchment Program; the Department's key salinity management program. All 6 were adversely affected by altered hydrology with increasing salinity and groundwater levels. They were:

- Buntine-Marchagee
- Drummond
- Lake Bryde
- Lake Warden
- Muir-Unicup
- Toolibin Lake.

In 2002, the Government committed to increasing the number of wetland recovery catchments to 25, however this never happened. DBCA has advised that currently recovery work continues in 2 of the catchments (Toolibin Lake (see case example below) and Lake Bryde) and recovery work in a limited capacity continues at Lake Warden and Muir-Unicup.

In December 2016, DBCA released its results of the South West Wetlands Monitoring Program for the period 1977-2015. This reported water levels and salinity data for 105 monitored wetlands. Most of the wetlands are within National Parks or Nature Reserves, including some within the wetlands prioritised under the Natural Diversity Recovery Catchment Program. DBCA advised this program is also reducing making the trend data less informative.

Case example – Toolibin Lake

Toolibin Lake is an internationally recognised (Ramsar) wetland, situated 180 kms south east of Perth. Approximately 90% of the lake's catchment of 48,977 hectares has been cleared. Clearing began in the late 1890's.

The lake floor is just over 300 hectares, wooded with paperbarks and sheoaks and is an important breeding and feeding habitat for migratory waterbirds. Up to 50 bird species have been recorded at the lake.

The large scale clearing of the catchment altered the hydrology of the lake. Groundwater has risen and become saline. As there is freshwater sitting above the saline layer, it is the only one in the bioregion that is still classed as a freshwater lake.

In 1995, a diversion channel was built around the western side of the lake to divert highly saline water from entering the lake. In 1997, a groundwater pumping system was installed to lower the saline water table beneath the lake. In 2001, another 3 pumps were installed. All discharge flows into a sacrificial lake – Lake Taarblin.

Photo by Gary Mills – DBCA

In 2007, another diversion waterway was constructed upstream of Toolibin, making it easier to control salinity and inflows. In 2010, sumps and channels were constructed on the lake floor to collect and remove saline water. The saline water is then pumped into Lake Taarblin.

Opening of diversion gate at Toolibin Lake

Management reviews of the Toolibin Lake catchment in 2001 and 2012 confirmed there had been measureable improvement in key plant species, the water table had gone down and high saline flows diverted.

Ongoing management of the catchment and surrounding wetlands is implemented in accordance with the Toolibin Lake Catchment Recovery Plan 2015-2035.

DWER has broad responsibility for the State's water resources, including ground and surface water. It manages the State's waterways; streams, rivers and estuaries. Principal legislation administered includes *Country Areas Water Supply Act 1947*, *Rights in Water and Irrigation Act 1914*, *Water Services Act 2012* and the *Waterways Conservation Act 1976*.

The Salinity Action Plan (1996) and the State Salinity Strategy (2000) identified 5 key potable water supplies in the South West as Water Resource Recovery Catchments. All 5 were declared water resource catchments under the *Country Areas Water Supply Act 1947* and had increasing salinity levels. Salinity situation assessments were completed for the catchments to understand where and why the rivers were becoming marginal or brackish. A range of actions were taken across the catchments to prevent and contain the salinity. Some areas of cleared land were revegetated, some areas fenced and engineering trials undertaken to divert the flow of saline water away from water storage areas. These catchments are:

- Helena River (Mundaring Weir)
- Collie River (Wellington Dam)
- Warren River
- Kent River
- Denmark River.

DWER advised that:

- salinity levels in the Helena and Denmark Rivers have reduced to drinking water target levels
- interventions in the Collie River catchment such as tree planting are ongoing as the salinity in the Wellington Dam continues to exceed target levels and is of marginal quality for irrigated agriculture
- native vegetation levels in the Warren River catchment are maintained to mitigate any further increases in salinity levels within the catchment
- there is no work done in the Kent River because there is no demand for the water and the scale of intervention is too large.

The agency also advised that it provided information for the current Wellington Dam proposal to use treated water to support irrigated agriculture.

Case example – Denmark River

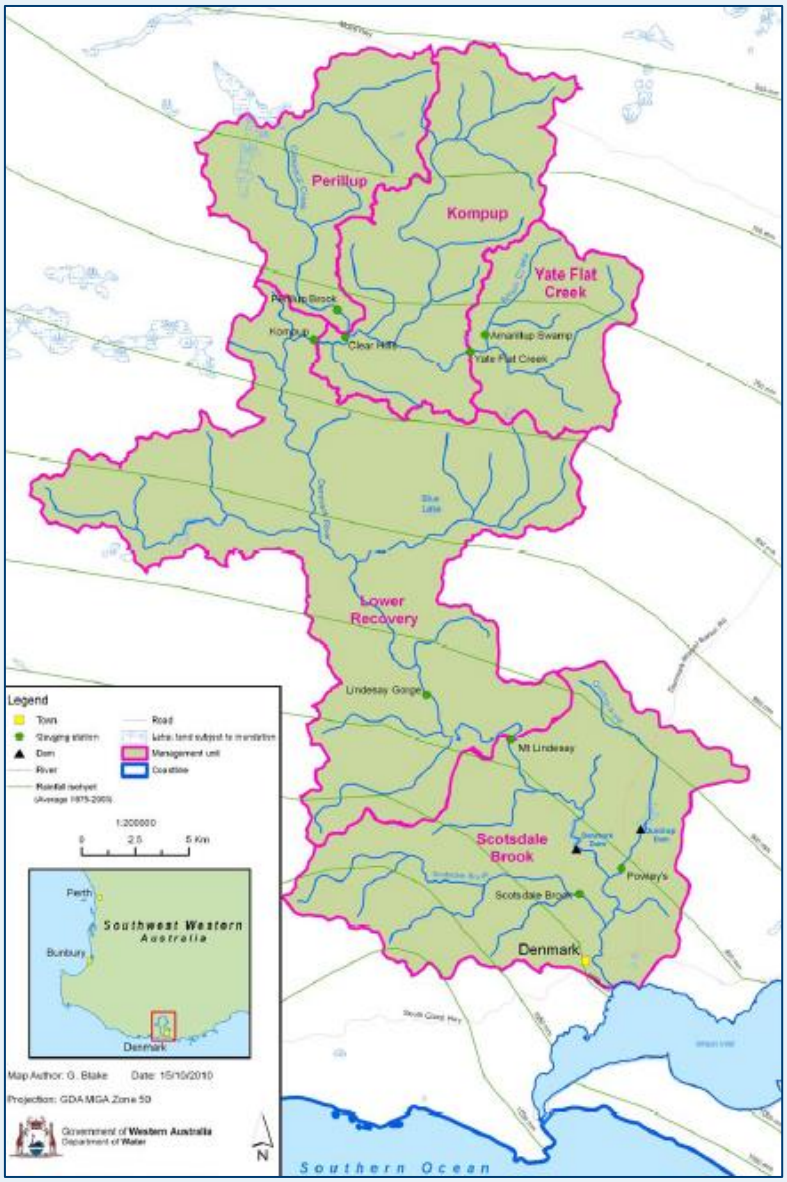
The Denmark River has been used as a fresh water supply for the town of Denmark since the construction of the Denmark Dam in 1961.

Clearing native vegetation in the upper catchment areas began in 1870.

Rising salt levels led to the ban of further clearing in 1961. At that time, 40% of the upper catchment had been cleared.

The River was declared as a water supply catchment in 1978 and in 1996 the Salinity Action Plan identified the Denmark River as a key water resource recovery catchment. This was in response to recognising the importance of the Denmark River as a water supply but acknowledging that salinity levels in the dam had made the water unsafe to drink.

In the late 1980's an additional dam (Quickup) was built and an alternative source at Scotsdale Brook was used to supplement the water supply needs.

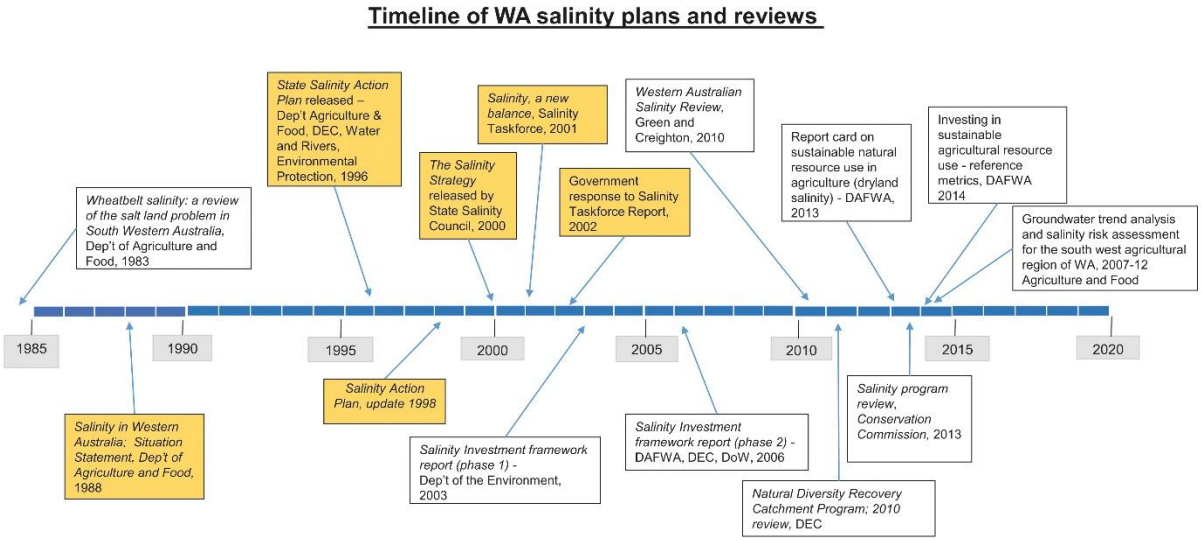


As a result of a range of management interventions (private tree plantations, revegetation and fencing sensitive areas) in the upper catchment salinity levels are within Australian Drinking Water Guidelines for drinking water quality.

In 2013 and 2014 DWER won national sustainable and innovation awards for its work in the Denmark Catchment.

DWER advise that the Denmark River is the only river in Australia to recover from rising salinity.

Appendix 1. Salinity initiatives since 1990



Auditor General's Reports

Report number	2018 reports	Date tabled
7	Controls Over Corporate Credit Cards	9 May 2018
6	Audit Results Report – Annual 2017 Financial Audits and Management of Contract Extensions and Variations	8 May 2018
5	Confiscation of the Proceeds of Crime	3 May 2018
4	Opinions on Ministerial Notifications	11 April 2018
3	Opinion on Ministerial Notification	21 March 2018
2	Agency Gift Registers	15 March 2018
1	Opinions on Ministerial Notifications	22 February 2018

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