



Salinity Inquiry
Submission No. 61

THE CABINET OFFICE
NEW SOUTH WALES

Committee Secretary
Standing Committee on Science and Innovation
House of Representatives
Parliament House
CANBERRA ACT 2600

29 OCT 2003

Dear Sir/Madam

I am pleased to provide the attached submission, on behalf of NSW Government agencies, to the inquiry into the coordination of the science to combat the nation's salinity problem.

If the Committee wishes to obtain further information in relation to the submission, the relevant contact person is Peter Regan, Program Leader, Salinity Management, NSW Agriculture (ph. 02 6391 3185).

Yours sincerely

A handwritten signature in black ink, appearing to be 'R. Wilkins', with a long horizontal flourish extending to the right.

Roger B Wilkins
Director-General

**NSW Agencies' Submission to the House of Representatives Standing
Committee on Science and Innovation**

Inquiry into coordination of the science to combat the nation's salinity problem

a) Use of the salinity science base and research data (including the development of new scientific, technical and engineering knowledge) in the management, coordination and implementation of salinity programs

The NSW Government has a collaborative approach to salinity research and development, which is coordinated through the Salinity Research and Development Coordinating Committee (SRDCC). Considerable effort is directed to understanding how and where salinisation is developing in the landscape. This high level strategic research is complemented by equal effort to understand the impact of salinity on rural and urban areas, and to develop solutions to help land managers deal with its impacts.

This research underpins NSW's regional natural resource planning and the development of government-endorsed Catchment Blueprints, which include salinity targets for the major inland rivers and the Hunter River on the coast. The Blueprints, and associated regional investment strategies, were developed by Catchment Management Boards, which will soon be reconstituted as Catchment Management Authorities (CMAs). The regional investment strategies contain management actions for salinity mitigation, which are based on the best available scientific knowledge and provide the strategic plan for investment (eg. from the National Action Plan for Salinity and Water Quality (NAP)). Therefore, good science underpins NSW's strategic natural resource management plans, which in turn direct investment in actions that will provide the most benefit for the least cost to meet agreed salinity targets.

Individual land managers and local government access this scientific knowledge base through a highly professional extension and advisory network. Access to a range of products and information through the Internet is also available.

(i) Understanding the fundamentals

The manner in which salt manifests itself in the landscape varies. Therefore, the science required to assess and quantify salinity also varies. For example, a major cause of dryland salinity in NSW relates to local scale fractured rock aquifers. The techniques for analysing and managing these differ from those that are appropriate to Western Australia, where the geologic setting is different. NSW is well advanced in developing the techniques for salt and water balance modelling from a paddock to whole-of-catchment scale. The models developed in NSW also measure the impacts of various management actions.

Detailed salinity assessment across the whole landscape is both impractical and financially prohibitive. NSW is therefore using science to support salinity management at three levels:

a) Basin Level

At this scale, the main questions are:

- What is the current and expected future size and extent of the salt problem?
- How does salt generated in one catchment impact on downstream catchments and States?

NSW has undertaken audits to identify the magnitude of the problem and its driving factors. The published audits of the NSW Murray-Darling Basin and the Hunter catchment were peer reviewed by CSIRO. An audit of the remaining coastal area of NSW is nearing completion. These audits used data on groundwater levels and river salinity as the basis for estimating future dryland salinity trends. The Catchment Management Boards used the audits as the primary source of information when setting end-of-valley salinity catchment targets in their Catchment Blueprints.

The river basin Integrated water Quantity and Quality Model (IQQM) is able to analyse how daily flows and salt loads from contributing tributaries travel through the main river systems of NSW. Combined with CATSALT (a sub-catchment scale salt and water balance model), integrated land use change scenarios can be analysed at a basin scale to evaluate contributions to achieving salinity targets and also determine the implications for water sharing plans. This internationally peer reviewed approach is more robust and comprehensive than alternative models used federally and interstate.

This modelling makes the best use of available basin scale geographic data by extrapolating soil salinity and hydrological properties from a variety of data sets. Research and modelling are ongoing to make these data sets widely available. This work is being undertaken collaboratively with other state agencies in NSW, the CSIRO and other organisations such as the Cooperative Research Centre for Catchment Hydrology.

Compilation of data sets such as groundwater flow systems maps, using catchment classification protocols, has been implemented across most of the State. These studies provide a useful descriptive conceptual framework for reading the landscape, but cannot by themselves quantify salinity impacts. Only the analytical approach outlined above provides that link.

b) Sub-catchment level

At the sub-catchment level the questions are:

- Where is the salt?
- Is it being mobilised?
- Where are management options best located to achieve required outcomes?
- What undesirable consequences, such as impacts on water yields, might there be?

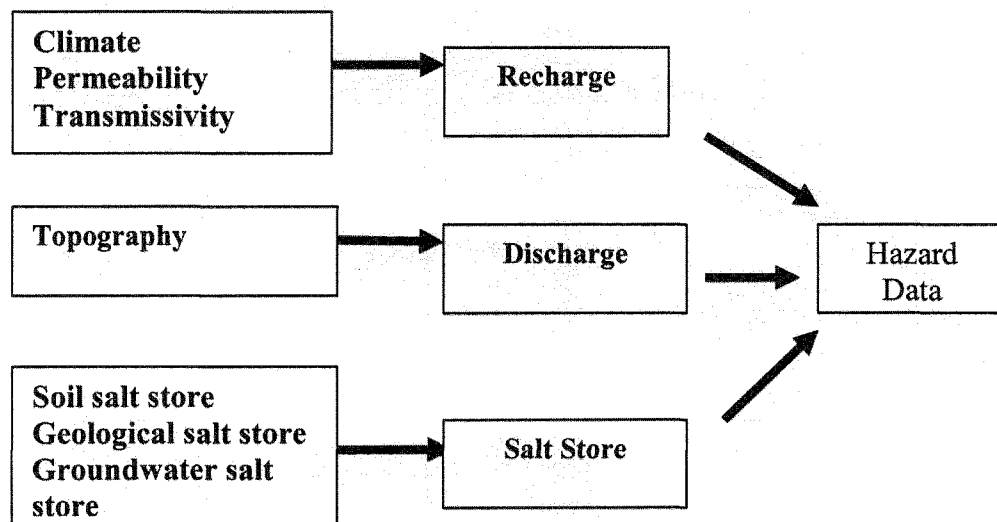
To answer these questions, NSW is undertaking a new hazard and risk assessment. Salinity hazard is the extent to which natural physical characteristics, excluding land cover, predispose a landscape to salinisation. The NSW framework for salinity hazard assessment is being applied on a consistent basis statewide.

Salinity risk is the likelihood that land use (including urban development) and management will lead to increased salinity in the landscape. The evaluation of salinity risk requires consideration of both likelihood and consequence. It is also necessary to consider time frame, as risk changes over time. Only by combining the consideration of water balance with salt hazard can land use induced risks be quantified in terms of the catchment salt balance. The risk factors (ie. the impacts of land use) are estimated using expert opinion and currently available data and modelling to identify changes in recharge, discharge and salt stores as a result of different land uses.

CATSALT modelling is currently being rolled out in 150 sub-catchments of NSW. This modelling is part of the risk assessment process being undertaken in conjunction with hazard identification. CATSALT provides a daily time series analysis of land use change impacts on groundwater and

surface wash-off of salt from priority tributaries identified in the Murray-Darling Basin, Hunter and Coastal Audits.

A new version of the CATSALT model, currently under development, will enable NSW to quantify the impact of different agricultural practices on salt movement, such as increasing the adoption of better pasture management techniques.



c) Property level

At the farm or property scale the questions are:

- Is salt a problem from current or future land use and management?
- What options are available to mitigate it?
- Where are the options best located?
- How effective are the options?

The techniques described above can be used to assess where to locate on-ground options in the landscape, taking into account the complexity of many interdependent factors.

The Land Use Options Simulator (LUOS) is a decision support tool developed in NSW for extrapolating CATSALT results to calculate the effectiveness or impacts of a land use option, down to the paddock scale, on the average annual river salinity.

The interaction of the basin, sub-catchment and property levels allows for the examination of the paddock to basin continuum. For example, it enables the impact of a change in land use in the upper Namoi Valley to be assessed:

- locally;
- at a downstream target location such as Tamworth's water supply;
- at the end of Namoi valley; and
- through the Darling River to the Murray River at Morgan.

(ii) Developing Solutions for agriculture

Salinity is one of a range of natural resource management issues that have largely arisen due to the development of commercial agriculture in Australia. Studies in NSW show that around 85 per cent of the land in most catchments is privately owned and used for commercial agriculture. Therefore,

if the community wants to make changes at the landscape scale, significant changes will have to be made by commercial agriculture. A cost effective way to make the changes is to show commercial farmers that they will be more profitable if they do change their land use to systems that reduce the onset or increase of salinity.

A broad knowledge base exists that describes the fundamental salinity processes in the rural landscape. Salinity is exacerbated by the inadequate use of incident rainfall, deep drainage below the rootzone of vegetation, rising water tables and mobilisation of stored soil salts. Some general causes of salinity include:

- the removal of deep-rooted perennial vegetation and replacement with shallow-rooted annual species for agriculture, which use less incident rainfall;
- leaky agricultural systems (ie. those that allow excessive drainage to groundwater systems). Agriculture is the dominant land use (up to 85 per cent of land area) in catchments where salinity is a problem; and
- excessive irrigation on inappropriate soil types.

Solutions to help farmers tackle dryland salinity require a greater use of incident rainfall in catchments with a high salinity hazard. These solutions:

- require change in agricultural systems to incorporate perennial species that reduce deep drainage, while balancing natural resource management goals with profitable commercial agricultural targets;
- will incorporate forestry in some areas where tree species are suitable for alley farming and interception plantings;
- will use an effective science-based, integrated approach to salinity mitigation. Salinity can not be seen as a single issue, it needs a system based approach that incorporates consideration of all aspects of a catchment; social, economic and biophysical;
- will include higher water use systems at the farm scale that are more profitable. Research by NSW Agriculture has shown that cropping decisions based on available soil water and likely seasonal conditions can deliver profitable and effective water management. This is called opportunity cropping;
- must be developed in a partnership/learning process with farmers, so that they know these new systems meet their needs, that they are profitable, and that the new systems can be managed by farmers without excessive risk.

A range of sources provides landholders and government advisory officers with access to scientific information related to the management of salinity. These sources include:

- Internet sites for agriculture and natural resource agencies provide technical information as well as an outline of research work in progress.
- The Community Access to Natural Resource Information (CANRI) web site provides access to maps and other data held at various Internet sites by all natural resource management agencies in NSW and other stakeholders. The Department of Infrastructure, Planning and Natural Resources (DIPNR) manage this facility.

- A Management Options Register (MOR) will provide information on the most profitable land use option for particular climatic conditions and site specific landscape parameters.
- The National Land and Water Resources Audit reports broad scale data on salinity and associated biophysical data.
- The Water Information System for the Environment (WISE) managed by NPWS provides access to the most up to date information for catchments and collects community education material on the salinity and water quality.
- The Soil and Land Information System (SALIS) is a database that contains descriptions of soils, landscapes and other geographic features from across NSW and is managed by DIPNR.
- The network of extension, advisory and education specialists attached to NSW government agencies provides easy access for farmers and private agronomists to the latest scientific information.
- Scientific publications provide refereed, validated scientific data to support our understanding of the processes of salinity and possible solutions.
- Accredited education courses provide students with up to date scientific information through the involvement of education institutions in research.
- Policies, strategies and regional plans that incorporate scientific information as a basis provide links to information sources.

b) Linkages between those conducting research and those implementing salinity solutions, including the coordination and dissemination of research and data across jurisdictions and agencies, and to all relevant decision makers (including catchment management bodies and land holders)

(i) Linkages between research and extension in NSW

The *NSW Salinity Strategy (2000)* identified the need to improve the linkages between research outcomes and salinity management solutions to better inform decision making, and instituted an effective mechanism to address this. Six regional Salt Action Teams, jointly managed and staffed by NSW Agriculture and DIPNR, were established around the State. The six teams, which include an Urban Salt Action Team, work with government agencies, local government, CMAs and community groups. The Teams work on catchment specific solutions to ensure that research results and data are managed in a consistent manner, while also ensuring that region specific needs are addressed.

A primary role of the teams is to facilitate the adoption of on-ground change and to facilitate the transfer of technology, skills and knowledge from agencies' technical staff to the catchment and landscape level. The Team Leaders and disciplinary experts within the teams also provide a critical contact for stakeholders involved in the translation and interpretation of research results into salinity management solutions. To this end, the Team Leaders have regular contact with research organisations, including the DIPNR Centre for Natural Resources, NSW Agriculture, relevant Cooperative Research Centres, CSIRO, and the Bureau of Rural Science to keep abreast of major research outcomes. The teams play a key role in the dissemination of relevant information and the

development of information products for local government, CMAs, DIPNR, other agencies and, where appropriate, the broader community.

NSW Agriculture also has a very effective extension network of over 400 extension, communication and education staff. In addition, DIPNR provides advisory services to CMAs and other government agencies on the strategic direction for natural resource management in NSW. There are clear roles and responsibilities for each agency. This network of extension staff and technical advisory services is linked to research being conducted by NSW Government agencies and other research organisations. For example:

- Private advisors who work with landholders on a day to day basis are an important provider of technical information, which complements NSW Agriculture's extension network. Both agency extension staff and private advisors have participated in salinity training delivered by the NSW Salt Action Teams. This training ensures an integrated and consistent approach when delivering salinity information to land managers, including Catchment Management Authorities.
- NSW Agriculture provides training for irrigators in more efficient water use, matching irrigation to crop water requirements and reducing leakage from channels and storages.

(ii) Linkages between research and land managers

Collaborative research programs in NSW include both landholders and researchers in the planning, implementation and demonstration processes. Inclusion of landholders in research helps develop appropriate solutions that lead to increased adoption.

Recognising that desktop and field based diagnostic techniques need to be used together, the NSW Government has invested in the development and application of tools to assist land managers in managing salinity information and making land management decisions for salinity outcomes, including:

- The first application of CSIRO/Land and Water Australia's Fuzzy Landscape Analysis GIS (FLAG) model by DIPNR to assess wetness and salinity hazard. Following a successful pilot at a whole-of-catchment scale, it was implemented across the State in a manner applicable to landscape and paddock scale issues, creating one of the first common data sets for natural resource management at a detailed scale. The availability of FLAG across the State enabled detailed modelling such as CATSALT to be applied in a number of regions using core spatial data, and for model outputs to be used to inform on-ground decisions and strategic planning.
- The Management Options Register (MOR), which uses new navigational technology to allow land managers access to the best available information on land use options for salinity management. MOR uses new navigational technology to provide information tailored specifically to meet users' needs. It includes information from a wide range of sources, including scientific papers, technical reports, maps and modelling products, and will capture the knowledge of experienced technical and field staff who work with land managers to implement on-ground works and apply research findings at the local level.

(iii) Linkages between research and natural resources planning

The new CMAs will each be made up of an independent chair and a maximum of seven board members with agricultural, scientific, environmental, economic and local government expertise. The CMAs will take responsibility for local natural resource management and services. These community based entities rely on high quality scientific research and technical advice on a range of

natural resource issues, including salinity. DIPNR, the new Natural Resources Commission, Salt Action Teams and relevant NSW Government agencies will provide technical and scientific support to ensure that decisions made by CMAs are supported by the best available science.

(iv) Multidisciplinary links among salinity research

Multidisciplinary research (e.g. biophysical, economic, and social research) is required to develop integrated solutions.

Tree planting has been used successfully in some areas, but is not a universal solution. Effective coordination of approaches between farming and forestry systems is required to develop proposals that benefit the agricultural industries and natural resource sector.

More favourable economics and the payment for environmental services may be necessary to gain widespread adoption of more appropriate land uses. The NSW Government is funding several initiatives under the Salinity Strategy to ensure that there is sufficient scientific and technical knowledge of salinity impacts to support the development of innovative approaches in this area.

Research integrated with education and extension programs is required to achieve on-ground change in land management practices. The Cooperative Research Centre (CRC) model addresses the issue of dissemination of research through a structured and funded extension program, which works with industry groups, industry development officers and private and public extension officers. NSW Agriculture is the NSW government link to the CRC for Plant Based Management of Dryland Salinity with involvement in all research and education programs. The NSW Department of Mineral Resources is linked to the CRC for Landscape Environments and Mineral Exploration and DIPNR is linked to the CRC for Catchment Hydrology. Both CRCs are conducting complementary salinity related research.

Research also needs to be linked to policy and planning processes to implement salinity related issues across agencies and jurisdictions. NSW has the following frameworks that achieve this:

- the NSW Salinity Strategy, which provides the basis for coordinated State wide research;
- the Salinity Research and Development Coordinating Committee (SRDCC) which provides a framework for salinity research and development in NSW. The SRDCC has identified the key knowledge questions that need further work;
- Murray Darling Basin Commission (MDBC), which provides a broad framework for inter-government action to address water quality' and
- involvement in a range of Cooperative Research Centres and the National Dryland Salinity Program.

(v) Spatial links

In NSW, the expression of salinity in either water quality or saline land is often distant from the cause. Therefore, those affected, particularly by the impacts of saline river water are usually remote from the land managers who can directly address the cause. This poses challenges for the provision of incentives to change land management. Market based mechanisms are being explored to enable beneficiaries to contribute to the solution. Several pilot projects supported jointly by the Commonwealth (NHT) and NSW through the *NSW Salinity Strategy* are examining different incentive models. As previously discussed, the value of the environmental service resulting from specific land management actions is being quantified to provide more certainty and transparency in future cost sharing arrangements. A multi-agency Environmental Services Scheme pilot project is being led by DIPNR.

Mapping of hydrogeological systems and salinity hazard by DIPNR has helped to understand ground water flow systems and the spatial context of salinity in catchments. A major project under the Salinity Strategy is developing a NSW Salinity Hazard and Risk Data Set. This modelling is based on many individual data layers and provides a high-level strategic product for CMAs and government agencies to plan salinity management action.

Regional boundaries within NSW natural resource agencies are largely based on catchment boundaries, so that links between agencies, CMAs and local government, is assured.

Salinity occurs in both rural and urban landscapes, which makes it a whole of community issue. Therefore, links need to be made that:

- create acceptance that salinity is a whole of community issue;
- generate understanding of the spatial dimension of salinity; and
- connect cause and effect between land use and salinisation across the landscape, regardless of urban boundaries or jurisdictions.

c) Adequacy of technical and scientific support in applying salinity management options.

(i) Strategic approaches

A critical purpose underlying the establishment of Salt Action Teams across the State under the *NSW Salinity Strategy 2000* was to improve the translation of scientific and technical output of key agencies for effective application in salinity management decision making and on-ground works.

To this end, the Salt Action Teams have been active in:

- facilitating linkages between key stakeholders at the regional level;
- ensuring that appropriate scientific information is available and applied in the regional context; and
- promoting effective communication with key research bodies, including DIPNR at the State level as well as universities, CSIRO, and Cooperative Research Centres, and translating the outputs of these entities for frontline staff.

The cross-agency coordination and facilitation methods adopted by the Salt Action Teams in accessing scientific information for delivery in a community planning context has proven particularly effective. The teams are assisting NSW Government agencies focus on achieving outcomes such as catchment targets through the implementation of the NSW Government endorsed Catchment Blueprints and related investment strategies. This will continue with the implementation of new Catchment Action Plans by the Catchment Management Authorities.

The flexibility of the Salt Action Team model has allowed it to work effectively with staff from DIPNR, NSW Agriculture, Department of Environment and Conservation (including NPWS), Catchment Management Boards, local government and community groups to ensure the provision of appropriate and adequate technical and scientific support in salinity management decision making and the application of management solutions.

The *NSW Local Government Salinity Initiative*, developed as part of the *NSW Salinity Strategy* has a key role in ensuring technical and scientific support for local government's application of salinity management options. A designated Urban Salt Action Team has been charged with implementing this statewide initiative, including:

- raising local councils' awareness of salinity issues;
- providing access to information and technical support for the development and implementation of salinity management strategies and land use planning instruments;

- developing methodologies to assess salinity hazard in urban areas;
- encouraging councils to use a 'total water cycle' approach to urban water management that incorporates natural resource management partnerships with state agencies, innovative technologies and management systems, demand management, community education empowerment programs and funding options;
- facilitating research into building methods and materials that are suitable for saline areas and develop best practice guidelines or building codes for salinity; and
- developing an Urban Salinity Planning Guide to assist the provision of development consents so that urban salinity problems are not exacerbated.

In line with the *Strategy's* requirements to improve scientific and technical support to local government, the Urban Salt Action Team has produced the following six booklets for general distribution to councils within NSW:

- Introduction to Urban Salinity;
- Indicators of Urban Salinity;
- Broad Scale Resource for Urban Salinity Assessment;
- Site Investigations for Urban Salinity;
- Roads and Salinity; and
- Building in a Saline Environment.

Technical advice on salinity management has also been extended to councils in the form of training sessions at a number of locations around NSW to support the distribution of the booklets. These training sessions will continue, ensuring that all local government areas have an opportunity for the training of their key staff requiring knowledge of salinity for management decision making or advice. The booklets have been circulated to all States and Territories except the Northern Territory, and local government officers from the ACT and Victoria have also attended the training sessions.

Issues that need to be addressed at the national level in relation to urban salinity include:

- Requesting the Australian Transport Council to consider a national road project by Austroad to identify best practice in maintaining roads in saline conditions to preserve the life of the road and to avoid exacerbating salinity. This project should involve Austroads, Australian Local Government Association, the Institute of Public Works Engineering Australia, relevant Catchment Management Authorities and councils. Councils that are trialling different road maintenance methods should disseminate different methods and produce a manual (Recommendations 48 and 49 of the NSW Select Committee on Salinity Report on Local Council Management of Salinity).
- Expediting the work of the technical working party on salinity established by the Australian Building Code Board at its 2001 National Technical Summit, including enhancing the level of research and investigation into urban salinity;
- Improving the technical and scientific input, through more research, into the development of Australian Standards called up by the Australian Building Code and construction specifications; and
- Developing agreed national competencies and training packages to improve education in urban salinity, and developing National Guidelines on Urban Salinity.

(ii) Site specific information

Some issues relating to successful salinity mitigation remain unsolved and to implement effective solutions the following matters need further work:

- A large amount of useful scientific information already exists that provides simple solutions to salinity problems, but these are often not implemented due to lack of information relating to economics, potential impact or awareness. For local solutions to be adopted, they need to be realistic, suitable and at least as profitable as current systems. To this end NSW Agriculture has been successful in gaining NAP funding to establish a network of economists to work with the Salt Action Teams. In addition, in recognition of the critical importance of achieving the right balance between, economic, social and environmental outcomes, DIPNR has recently established the Office of Social and Economic Impact Assessment.
- Site specific solutions need to be designed for the right situation. Research by NSW Agriculture aims to develop new farming systems that incorporate appropriate species, management practices and solutions for landholders to adopt.
- Further scientific information on the mobilisation of salt and water through catchments is essential if appropriate land use systems are to be put in place. Each catchment is unique and requires careful evaluation, as there are no 'blanket solutions'. For example, a much better understanding of local landscape hydrology is required to ascertain the effectiveness of different pastures and crops within specific areas of the landscape. A large investment is directed at obtaining the relevant hydrogeological information that is essential to evaluate and implement solutions to dryland salinity.
- Extension information needs to be in a format that is specific and relevant to the farm businesses being targeted. Similarly, for maximum effect, all salinity information (scientific journal articles to extension leaflets) needs to be written with the end users in mind.
- Reliable output is needed from biophysical models that are based on good science and ground truthing. The research and demonstration sites operated by NSW Agriculture and DIPNR and the hydrogeological mapping by DIPNR are of fundamental importance to validate the models.
- Scientific information is required to identify 'hot spots' on the landscape so that appropriate land use is applied in the correct locations and so gain maximum return for investment. Information that describes the location of salt in the landscape, the path of water through the landscape and the impact of different changes to the movement of salt and water are all fundamental to the deployment of successful solutions.
- Research is required to determine the impacts of current and predicted dryland salinity on:
 - iconic terminal wetlands, particularly those protected in conservation reserves;
 - crop and pasture land;
 - biodiversity; and
 - built infrastructure.

(iii) Time frame for salinity management

Salinity is a long-term problem with complex solutions that require considerable knowledge and expertise to implement. NSW agencies have made commitments through their internal structures and programs to develop these solutions over the long-term.

Mitigation of salinity is a long-term process that requires recognition of and commitment to long-term management changes by landholders and Government alike. For example, to identify the effect of farming systems on hydrology, at least 6 years of data is required to cover variation in climate between seasons and for treatments to take effect.

Salinity impacts may progress slowly over a long time frame so we need early indicators of impacts and adaptive measures to prevent irreversible damage. At present, there is no standard system to indicate the level of progress made by new land use systems in ameliorating salinity. The NSW Government has developed salinity targets at the catchment level and these are incorporated into the Catchment Blueprints. New Catchment Action Plans are being developed that will include regional targets and indicators against which performance can be monitored. NSW is also participating in national processes through the Natural Resources Management Ministerial Council to develop natural resources management indicators at the national level.

There is a need to develop productive uses for saline land and the ability to live with saline land, as salinity will get worse in the near future regardless of the good work done thus far because of the time frames of the processes that are operating. The NSW Government has a long involvement in issues relating to the productive use of saline land, which is a high priority for DIPNR. DIPNR (formerly DLWC) has been represented on the National Productive Use of Saline Land (PUR\$) group since 1990. Specifically work includes: saltbush grazing trials for species and establishment; native grasses for saline land; significant work on saline agro-forestry of national significance; other species establishment on saline land; saline site demonstrations under the Salt Action Program across the State.