

Salinity Inquiry
Submission No. 32.....

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SUBMISSION TO:

INQUIRY INTO THE COORDINATION OF THE SCIENCE TO COMBAT THE NATION'S SALINITY PROBLEM

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SUMMARY

The terms of reference are addressed in relation to the adequacy of the scientific understanding and the adequacy of support for decision makers and land managers.

Scientific Understanding

The adequacy of the scientific understanding is addressed because the effectiveness of any program ultimately depends on the reliability of the information on which it is based.

The official version of scientific understanding is given in the background paper, that tree removal has increased groundwater recharge and that the associated rise in the water table brings salt to the surface. This suggested understanding does not pass the normal scientific test as dryland salinity need not be associated with either tree clearing or a rise in the water table. Some results show that land use impacts can decrease groundwater recharge. Also, the official explanation contains no reference to soils when:

- a. Land use impacts directly on vegetation and soils
- b. The hydrology of systems depends on the interaction between the vegetation, soil and climate.

An alternate explanation is given that has dryland salinity being caused by a decline in soil structure. Tree clearing can exacerbate the impact but it is not the prime cause.

The uncertainty as to cause is important as remediation addressing symptoms is unlikely to be effective. Also, it identifies that there will always be limitations in information, knowledge and understanding, and these deficiencies must be allowed for in salinity programs. Program structures should not be rigidly based on uncertain assumptions. The programs must incorporate a strong feedback loop to ensure the achievement of objectives and continuous improvement in performance.

Adequacy of Support Mechanisms

Delivery and support mechanisms are discussed by reference to historic trends, highlighting:

- a. The development of a new organisational structure to address environmental issues with ill defined accountability and responsibilities where a more appropriate structure already existed.
- b. The increasing role of State agencies in the development and administration of environmental legislation.
- c. The prior role of State agencies in extension but the general trend to have industry now provide such service delivery to:
 - Ensure that the beneficiary pays and prevent hidden costs.
 - Remove the potential for a conflict of interest.
 - Provide cost efficiencies.

The current very limited role of industry in providing environmental services is identified as being a major limitation to the provision of technical support. Development of an industry capacity through an appropriate program structure is seen as a key requirement to achieving the long term objectives of salinity programs. Industry involvement best addresses community and landholder capability building where this has social, business and environmental benefits.

TERMS OF REFERENCE

The Terms of Reference are essentially:

1. The application of knowledge and information in salinity programs.
2. Flow of research results to those responsible for planning remedial actions.
3. Adequacy of the scientific and technical support in salinity management.

The scope of the terms of reference can be broadly or narrowly interpreted. The one broadening adopted here is to address point 3 in two parts:

- a. The adequacy of the scientific understanding
- b. The adequacy of the transfer of the existing understanding and knowledge.

This subdivision is significant as it identifies a need for program structures to take account of the reality that information, understanding and knowledge will always contain deficiencies.

The inquiry has arisen because salinity programs are seen as being deficient in producing expected benefits. The terms of reference are strongly directed towards the identification of deficiencies in administration and extension. From a business perspective the inquiry essentially addresses how well a product is being marketed. However, an alternate circumstance should also be considered, that deficiencies may have arisen, at least in part, because the product being marketed does not adequately address the needs. Deficiencies can arise through the limited applicability of a product as well as inappropriate marketing.

The effectiveness of any program ultimately depends on the reliability of the information on which it is based. In particular, land managers are unlikely to support conclusions and interpretations that run contrary to their observations. This is exacerbated where remedial programs do not provide the predicted benefits, as has occurred. The development of effective programs depends on gaining support from the suggested beneficiaries and this can only arise where the programs are based on relevant and appropriate knowledge and information.

Structure of the Response

The response is essentially given in reverse order to the Terms of Reference. The scientific base represents the knowledge and understanding used to develop appropriate salinity management programs. The issue then is how to translate this into effective actions on the ground. Such application basically involves capability building through education and technology transfer and development but, as in all management, it should incorporate a feedback cycle to promote continuous improvement in performance.

ADEQUACY OF THE SCIENTIFIC UNDERSTANDING

Official Position

The official explanation for the development of adverse salinity with dryland agriculture is given in the background material to the inquiry. The mechanism for dryland salinity is said to be the same as for adverse salinity associated with irrigation. It is said that salt rises to the land surface due to a rise in the water table. This explanation begs the question of what causes the salt to 'rise'. There can only be bulk mass movement of water and salt up towards the surface in confined and semi-confined aquifers. Given the occurrence of dryland salinity in systems without such aquifers there must be alternate explanations if this model is to be accepted.

The issue that dryland salinity can arise in the absence of confined or semi-confined aquifers is now generally addressed by suggesting that salt rises in water drawn to the surface through capillary action. This mechanism can arise in systems where there is a well defined watertable in close proximity to the surface. However, dryland salinity arises in systems without water tables remotely close to the surface.

A key issue is that, accepting there can be increased accession of water to a groundwater system (increased percolation) with tree clearing, the water generally does not rise in the sense of moving vertically upwards. The water simply fails to drain away as rapidly as it is supplied. As water has to move vertically upwards to the surface to bring salt to the surface, the discrimination between a failure to drain and a vertical upwards movement ('rising') is of paramount importance.

Another limitation of the official explanation is that it infers that the development of dryland salinity is essentially independent of the seasonality of climate. The occurrences of dryland salinity in Australia and throughout the world illustrate otherwise. Dryland salinity is most prevalent in Mediterranean climates, as is expected given a rigorous examination of the underlying mechanisms.

Exceptions such as identified above negate the official explanation or model for dryland salinity when applying the scientific method. The exceptions mean that the suggested model is either incorrect, a specific case of a more general model, or one of a suite of alternate mechanisms.

The official version of the cause of dryland salinity was strongly promoted several years ago and is entrenched in official documents. However, discussions of dryland salinity are now much broader due to the increasing number of observations that do not accord with the official model. There has been a pronounced change in the nature of discussions but this has yet to be reflected in official documents.

There are many reasons why an incorrect mechanism has been identified as the sole cause of dryland salinity but four are prominent. One issue relates to the inability to directly measure the factor deemed responsible, namely the rate of recharge (percolation) to groundwater systems. Another relates to very limited knowledge of the functioning of natural systems and a third to the definition of groundwater. The fourth is the limited attention paid to the effects of land use impacts on soils and the consequences of these impacts for the hydrology of systems. Australia was once world leading in research on soil and plant water relations but could now be regarded as weak.

Alternate Explanation of the Cause of Dryland Salinity

From a logical viewpoint it is difficult to see how any explanation of dryland salinity can exclude a reference to soils. Land use impacts both vegetation and soils, and the hydrology of systems depends on both the vegetation and soils as well as climate.

The issue of the mechanism for dryland salinity is discussed in the attached paper on Scenario for Dryland Salinity. This examines historic and current perceptions and information. The paper does not resolve all issues as this cannot be achieved with the existing information. However, it concludes that dryland salinity is generally associated with a decline in soil structure that is largely caused by a decline in soil organic matter. The decline in soil structure increases the near surface lateral flow of water in the soil, and also increases the salinity of the water moving through the soil. Adverse salinity arises where this water accumulates at lower parts of the landscape and is concentrated through evaporation.

The key requirements in the development of dryland salinity are:

- Increased mobilisation of salt through changes to the hydrology of the system.
- A blockage to the outflow of water.

Blockage of water outflow is essential to the development of adverse soil salinity as salt cannot accumulate where water freely drains. Blockages or restrictions to flow can arise for many reasons and are often associated with a decrease in the hydraulic gradient (low slopes).

With this mechanism dryland salinity can be exacerbated by tree clearing but tree clearing is not the prime cause. Soil degradation arises with other land use impacts such as grazing. Grazing is of particular consequence due to its extensive and long term occurrence.

The significance of these considerations for the development of remedial actions is that rising groundwater levels and adverse salinity are symptoms of land degradation. Remediations that address symptoms are seldom effective. Best results are achieved by addressing the cause which is likely the degradation of soil structure initially associated with a decline in organic matter. Accumulation of sodium in the soil exacerbates the structural decline.

Programs directed at remediation of soil structure would have production as well as environmental benefits. There are sound social, economic and environmental reasons for focusing remedial actions on the health of soils.

Expressions of Dryland Salinity

The basic physical processes underlying the mechanism for dryland salinity are reasonably well known, albeit not fully, but this does not guarantee accurate prediction of realised outcomes. The realised outcomes depend on the pathways for the subsurface flow of water as well as the general surficial impacts arising from land use. Water preferentially flows along pathways of least resistance hence the expressions of adverse salinity can be strongly determined by geological structures such as fractures, fault lines and unconformities. As reliable information on such structural controls is not available for incorporation in models the results from models can be greatly in error.

Significance of Deficiencies in Knowledge and Understanding to Salinity Programs

The key issue is that any program must allow for deficiencies in knowledge and understanding. Appropriate directions and remedial actions therefore cannot be directed down from the top through centralist control. There is a need for independent assessment on the ground to develop approaches and methods that effectively address the specific local circumstances.

The key requirements, which are addressed further later, relate to the assessment of local circumstances prior to setting project directions, and the need for monitoring and feedback to provide for continuous improvement in performance. The approach of 'one size fits all' cannot be used. Application of the ISO14004 principles for environmental management that call for monitoring the effectiveness of activities in producing the desired outcomes is essential.

ADEQUACY OF MECHANISMS FOR THE APPLICATION OF INFORMATION

This addresses the remainder of the terms of reference that relate to the adequacy of mechanisms to apply information to achieve the desired outcomes. Issues include:

- Adequacy of program structures to support application (administration).
- Adequacy of technical support facilities (extension or technical services).

These question the effectiveness of the incorporation of information and knowledge into salinity programs, and the effectiveness of application.

From a procedural viewpoint these issues can be subdivided into evaluating how well current organisational structures and programs address:

- The incorporation of information in salinity programs.
- The application of salinity information by land managers.
- The feedback of results from land management actions to improve salinity programs.

These issues are addressed here in a generic way. They are also addressed in the attached paper: *Dryland Salinity: Providing Solutions*.

Organisational Structures

The historic organisational structure for the development and application of scientific information to land management in Australia has been:

- Development of information occurred at the national level.
- Regulation of land use mainly occurred at the State level.
- Support for application (extension) occurred through State agencies.

For agriculture this has changed over the last few decades. The situation that developed during this period can be identified as being:

- Development of information addressing National issues occurred at the national level.
- Development of information addressing regional issues occurred at the state level.
- Regulation has mainly occurred at the state level.
- Extension has increasingly been addressed by industry (agricultural consultants).

The current situation for environmental issues can be identified as being:

- Development addressing National issues occurring at the national level.
- Development addressing regional issues occurring at the State level.
- Regulation at the State level but with the Commonwealth brokering common goals.
- Extension being addressed by State agencies and community groups (Landcare and Catchment Management groups).

The obvious deficiencies in the structure currently used to address environmental issues are:

- The dual role of State agencies in enforcing regulation and providing services against the regulations they police. This produces a conflict of interest.
- When State agencies are removed from extension, as is logically occurring, the lack of an appropriate skills base to ensure the effective application of information.

That is, the traditional absolute dominance of public organisations in environmental matters has resulted in a situation where the technical support needed for effective application of information essentially does not exist.

Some public organisations have sought to fill this vacuum by providing services direct to community groups. This action serves mainly to suppress the development of an industry that is ultimately essential to the development of effective land management. It also degrades the performance of the public organisation in fulfilling its intended role.

There is a need for public organisations and industry to work together to deliver the desired outcomes as industry logically fulfils the role of service delivery. The dilemma is how to develop an environment industry given the history of environmental research and extension being the domain of public organisations, particularly since this history has helped develop a belief that industry cannot successfully address environmental matters.

Program Structures

Disbursement of Funds

The early program structures used by the Commonwealth for addressing salinity involved direct disbursement of funds to activities of State agencies small community groups. Less than 10% of the funds went to Local Governments and there was no role for industry.

The current programs seek to directly fund larger community groups (eg. Catchment Management Boards) but State agencies still have strong influence due to the contribution of funds by the States. Some of the community groups are recognised by State legislation and virtually all are 'coordinated' by State agencies.

Industry can now potentially have a substantially increased role in applying information to land management through tendering for contracts let by the Catchment Management groups. However, this role is constrained by:

- The tender specifications often being developed by public organisations, such as State agencies.
- Industry having to compete with publicly funded organisations such as State agencies for work that is tendered.

The current situation provides opportunities for breaches of the Trade Practices Act and the Competitive Neutrality Regulations that are commonly realised.

Organisational Structure

The development of a new organisational structure to address land management by way of catchment management groups has introduced complexities and created duplication. There are also social issues that include:

- How well the community groups represent the interests and needs of the community.
- The capacity of the community groups to influence change.

Councils represent a democratically elected community group that have the legislative responsibility for regulating land use and management. They are logically the appropriate body for implementing regional programs. The main deficiency of councils, which is well known, relates to their generally small size. This is gradually being addressed by State

governments but can also be addressed in funding programs by dealing with Regional Organisations of Councils (ROCs).

Using councils as the means for implementing programs has benefits but does not resolve all issues and raises others. For example, some councils see such funds a means of developing their 'business'. Safeguards are required, such as:

- The role of councils should be restricted to program management.
- The proportion of funds used for management should be capped.
- All activities associated with technical advice and implementation should be subject to open tender.

Basic Limitations of the Existing Program Structure

The development of new organisations without well defined accountabilities and responsibilities, such as catchment management boards, makes little sense as it increases costs and creates new uncertainties. The funding of councils as opposed to catchment management groups can have benefits by way of efficiency, accountability and effectiveness due to their legislated status. However, while the use of councils rather than catchment management groups has potential administrative benefits the realised environmental outcomes could be similar.

The main limitation of the current disbursement mechanisms is seen to be associated with restrictions to the development of an effective environment industry, and hence to the long term effectiveness of land management. Current programs suppress rather than promote the development of industry technical services that are ultimately crucial to success.

One reason for the suppression industry providing technical services is the strong 'top down' approach with the existing structure. We are told what causes dryland salinity, how it should be mapped, and how it should be remediated. There is limited scope for industry to deliver effective technical services when the problems and methods have been so rigidly defined.

The existing funding mechanism ostensibly allows for community direction through their development of projects that are assessed for funding. However, these projects have to be developed within the context of a strategic management plan produced at the beginning of a program. The directions set by this plan are necessarily based on existing perceptions of the issues and knowledge of the systems, hence funds are directed a perpetuating existing processes.

The significance of this constraint can be illustrated by reference to the application of models. Such models simply project current perceptions but they are usually the focus for the development of 'new' information in salinity programs. This focus is justified in terms of improving the performance of the model. It is assumed that limitations reside in the quality of information used to run the model rather than in the assumptions underlying the model.

While such models are strongly limited by the available information the complexity of the systems makes it inevitable that this situation will continue well into the future. Indeed, it can likely never be satisfactorily resolved. There is therefore a very strong case that programs should be based on objective measurements rather than uncertain predictions, as occurs in any well founded scientific study.

The procedure that would normally be used to set directions is to conduct a scoping analysis against defined objectives where, inter alia, this identifies gaps and deficiencies. A cost-benefit analysis addressing the gaps and deficiencies allows development of an effective

development and remediation strategy. The Landscape Futures approach of Carl Steinitz would be appropriate where this commences with work-shopping with stakeholders to identify issues and prioritise activities. The use of management plans for this purpose is completely inappropriate as they are designed to achieve the best outcome despite such gaps and deficiencies.

Management plans, strategic or otherwise, are logically based on the best available information. They should be produced after the reference information has been collected and the objectives defined. They should be the last report produced from a program and not the first.

Industry Capacity to Deliver

In terms of monetary value and community perceptions the existing 'environment' industry currently revolves around waste disposal. The environmental consulting industry, which is very small compared to waste disposal, has developed as a small arm of engineering consulting companies. The existing environment industry has essentially developed to support engineering construction and urban services.

The lack of recognition of industry involvement in the provision of technical and consulting services to support the environmental aspects of broad scale land use and management is evidenced in the ANZIC Industry Classification codes. Previously the only code applicable to a company such as NRI was *Other Personal Services* within the general category of *Personal and Other Services*. A recent revision has a more appropriate category of *Technical Services* under the general category of *Property and Business Services*, but environmental services would constitute a very small part of this category.

The general category of *Agriculture, Forestry and Fishing* best addresses broad land use and the specific category within this of *Services to Agriculture* has some applicability. However, existing agricultural services are production rather than environmentally based. There is no ANZSIC category that identifies a role for industry to provide environmental services to land use and management.

The situation evidenced in the ANZSIC Industry Codes is likely a true reflection of reality. The delivery of environmental services to land use and management has traditionally been the sole domain of public organisations and agencies. The recent changes from this position have been slight.

The prime roles and responsibilities of different types of organisations in Australia can be summarised as:

Governments: Governance (producing legislation and regulations)

Government Agencies: Policy advice, administration of legislation and regulations

Legal: Application of legislation and regulations (service delivery)

Universities: Education

Industry: Production and Service Delivery

Research is not identified as being an organisational category, nor as being associated with any particular category, as it represents an activity that should be conducted by all.

The main exceptions to these arrangements lie in the provision of services by Government Agencies. These now mainly relate to essential services, such as power, water, roads and rail but still generally include some production activities such as forestry.

Governments have been shedding capacity to directly deliver services due to:

- A desire to ensure that the beneficiary pays.
- The conflict of interest that arises where a regulator oversees their own operations.
- Cost efficiencies.

However, there has been growth in the provision of environmental services by Government agencies against this general decline, as in the management of conservation reserves.

The need for the provision of technical and support services to address environmental management is a key focus of the inquiry. Such services should logically be provided by industry but the development of such an industry has been suppressed by the traditional organisational arrangements. A key issue for the Committee is therefore how can Government programs be used to promote an industry that is ultimately essential for the effective delivery of the desired environmental outcomes.

Importance of Industry

Remoteness or limited connection between those conducting research and the intended beneficiaries represents a major barrier to the conduct of effective research where effective research is defined as producing results that provide benefits when applied rather than the simple production of a journal paper. Effective development and application is promoted by strong interaction between the developers and beneficiaries where this is strongly promoted where the developers of the information are involved in service delivery. Involvement in service delivery provides direct and immediate feedback on the benefits and deficiencies.

The options to address this requirement for improvements in the applicability and application of technology include:

- Making public organisations more involved in service delivery.
- Developing an appropriate industry capacity.

Past experience and current directions identify the latter as the preferred option. The option of developing a large publicly funded capacity for service delivery would generally be rejected due to the reasons identified above. The issue then is how to use existing publicly funded resources to develop industry capacity with the ultimate objective of developing a self-funded delivery system.

The benefits that can derive from such a development include:

- Improved accountability.
- Improved cost efficiencies.
- Automatic feedback to promote cost effectiveness.
- Promotion of full sustainability (no hidden costs).

Policy and administrative changes that would promote the development of industry capacity and capability include:

- Providing opportunities for industry to compete for public research funds.

- Ensuring industry can compete effectively with publicly funded organisations (full application of policy and legislation such as the Trade Practices Act and Competitive Neutrality legislation).
- Preventing those specifying requirements from bidding for the work (full accountability and transparency).
- Ensuring all reviews of proposals are signed and made available to the proponent.

The last point would be simple to implement and should have an immediate effect.

Governments use public organisations to review industry proposals and this is a prime role for such organisations. However, there is a severe conflict of interest where the reviewers compete directly or indirectly with the companies they review. The options are to prevent public organisations from competing for funds or to ensure complete accountability and transparency. It is imperative that individuals as well as organisations be held accountable for their actions.

Benefits of Industry Involvement

Industry interacts with clients to address their specific needs. Solutions address particular circumstances, and developments are directed at meeting needs identified by the community. Ongoing support is provided to ensure the achievement of desired outcomes. This capability development is conducted within the context of legislative requirements set by governments.

Industry can provide the information, technology and support for land users to allow them to achieve desired outcomes. It can develop the capacity of the community to set priorities, make decisions and evaluate their performance. Industry involvement best addresses community and landholder capability building where this has social, business and environmental benefits.