6.5 Dryland salinity management

The actions and projects identified in this section apply to the Salinity Management Areas with predominantly dryland salinity including Bengworden, Foster, Port Albert, Reeve, Rosedale, Stratford, Trafalgar, and potentially Walhalla. As shown in Figure 1, these areas cover the South Gippsland region and all areas south of the Latrobe River, the catchment of Lake Reeve, the forested area to the north of the region and the areas outside the Macalister Irrigation District.

6.5.1 Management Actions and Resource condition targets

The management actions to address dryland salinity are summarised in Table 37 including the asset being protected and the prioritisation. More details on each of the management actions is provided in the following sections.

The change in resource condition that the recommended management actions are expected to achieve is shown in Table 38 including the assumptions upon which the analysis is based. The change in resource condition from the implementation of the management actions is much more difficult to predict in the dryland relative to the irrigated Salinity Management Areas due to the lack of knowledge of the processes causing salinity and the effect of the management options on these processes. Therefore, there is a much greater level of uncertainty as to whether the resource condition targets can be achieved and they should be regarded as preliminary only. As more information is gained on the processes causing salinity and the effect of the management options, the resource condition targets should be revised.

- **Table 37: Management Action Targets to address dryland salinity**

Management Actions	MAT Number	5 Year Management Action Targets	Salinity Management Program							Asset Class							Priority
			Farm Plans	Sal Mapping and Invest.	Perennial past	Trees	GW Pumping	Living w. salt	Mon. eval. rep	Water	Land	Biodiversity	Atmosphere	People	Infrastructure	Production	
Map land salinity	DA1	All land salinity mapping of remainder of Bengworden, Lake Reeve, Bass Hills, the Powlett catchment and the area south of Wonthaggi complete and informing management option planning	○	●	○	○	○	○	○	○	●	○	○	○	●	●	Priority 1
Map urban salinity	DA2	Investigations complete into threat of urban salinity in West Gippsland townships and informing management options for remediation of urban salinity	○	●	○	○	○	○	○	○	●	○	○	●	●	○	Priority 1
Map GFSs	DA3	Groundwater flow systems study completed and used to determine site specific action plans incorporating salinity, biodiversity and other issues	○	●	●	●	○	○	○	●	●	●	○	○	○	○	Priority 1
Quantify impact of management actions	DA4	Expected effects of the various management actions recommended in the GFS study (DA3) quantified. Management actions modified and fed into existing farm forestry, native vegetation and agronomic programs	○	●	○	○	○	○	○	●	●	●	○	○	○	●	Priority 1
Assess land capability and economics	DA5	Capability of land for management actions recommended in DA3 and DA4 assessed. Economics of implementation assessed. Management actions modified and fed into existing programs	○	●	○	○	○	○	○	○	●	●	○	○	○	●	Priority 1
Build capacity and develop adoption methods	DA6	Methods for building community capacity to implement change reviewed and innovative methods for program delivery developed. Management actions modified and fed into existing programs	○	●	○	○	○	○	○	○	○	○	○	●	○	○	Priority 1
Integrate actions	DA7	Set of on-ground actions developed for each salinised area to address a number of NRM issues	○	●	○	○	○	○	○	●	●	●	○	○	●	●	Priority 1
Develop Whole Farm Plan guidelines	DB1-4	Guidelines completed and used to assess Whole Farm Plans	●	○	○	○	○	○	○	●	●	●	○	○	○	●	Priority 1
Develop WFP info central repository and database	DB2	Central repository complete and being used to develop Whole Farm Plans	●	○	○	○	○	○	○	●	●	●	○	○	○	●	Priority 1

Management Actions	MAT Number	5 Year Management Action Targets	Salinity Management Program							Asset Class							Priority
			Farm Plans	Sal Mapping and Invest.	Perennial past	Trees	GW Pumping	Living w. salt	Mon. eval. rep	Water	Land	Biodiversity	Atmosphere	People	Infrastructure	Production	
Run Whole Farm Planning courses	DB3	6 courses a year for 5 years = 30 courses	●	○	○	○	○	○	○	●	●	●	○	○	○	●	Priority 1
Whole Farm Plan review	DB4	Review conducted of whole farm planning across dryland areas of West Gippsland	●	○	○	○	○	○	○	●	●	●	○	○	○	○	Priority 1
Map perennial pastures	DC1	Extent of perennial pastures in key recharge areas determined	○	○	●	○	○	○	○	○	●	○	○	○	○	●	Priority 1
Increase perennial pasture	DC2	Plan for perennial pasture establishment complete and extension program in place. 25% increase in the area of perennial pastures in strategic low rainfall areas	○	○	●	○	○	○	○	○	●	○	○	○	○	●	Priority 3
Increase farm forestry	DD1	Economics and cost sharing study for encouraging farm forestry completed. Financial incentive program in place supported by extension program	○	○	○	●	○	○	○	○	●	●	○	○	●	○	Priority 1
Revegetate key areas	DD2	Prioritisation process for current revegetation projects to include salinity benefits from tree planting. Extension program in place to encourage tree planting through incentives program	○	○	○	●	○	○	○	○	●	●	○	○	○	○	Priority 1
Maintain and manage native vegetation	DD3	Provide input and support for current programs of native vegetation protection	○	○	○	●	○	○	○	○	●	●	○	○	○	○	Priority 1
Investigate additional Groundwater Control Pumps	DE1	Economic studies complete and groundwater pumping options for Rosedale and Port Albert investigated	○	○	○	○	●	○	○	●	○	○	○	●	●	●	Priority 4
Additional private pumps	DE2	Targeted Exploration Drilling Scheme and Capital Grants Scheme in operation	○	○	○	○	●	○	○	●	●	○	○	○	●	●	Priority 4
Plant salt tolerant crops	DF1	Investigation program complete and extension program in place for salt tolerant crops	○	○	○	○	○	●	○	○	○	○	○	●	○	●	Priority 3
Review saline land buy back	DF4	Feasibility study into buy back of saline land complete and recommendations implemented	○	○	○	○	○	●	○	○	●	●	○	○	○	○	Priority 3
Continue groundwater monitoring	DG1.1	Continuation of current monitoring of nearly 80 observation bores in South Gippsland for waterlevels and salinity with progressive implementation of monitoring review recommendations. Continuation of current bore monitoring funded through the salinity program. Monitoring of proposed new bores in Rosedale and Port Albert.	○	○	○	○	○	○	●	●	●	○	○	○	●	○	Priority 1
Watertable depth mapping and reporting	DG1.2	Yearly watertable depth maps for South Gippsland and the Rosedale and Port Albert townships. Annual reporting to include analysis of climate variability. 5 yearly reports to include trend analysis.	○	○	○	○	○	○	●	●	●	○	○	○	●	○	Priority 1

Table 38: Resource condition targets for Dryland Salinity Management Areas

Asset Class	Asset	Salinity Management Area	Resource Condition Target (RCT)	Time frame for RCT	Assumptions for RCT	Management Action Targets contributing to RCT
Land, Production, Infrastructure, Biodiversity	Agricultural land, rural roads and other in-ground infrastructure, native vegetation	Port Albert	RCTD1: Less than a 10% increase in area of <2m depth to watertable from 2002 levels	15 years	Based upon a realistic target of a 10% improvement on the "do nothing extra" scenario.	Mainly MATs DB1, DB2, DB3, DB4, DA4, DC2, DD1, DD2, and DD3.
		Foster	RCTD2: Greater than a 9% decrease in the area of <2m depth to watertable from 2002 levels	15 years		
		Bengworden	RCTD3: Greater than an 8% decrease in the area of <2m depth to watertable from 2003 levels	15 years		
		Reeve, Trafalgar, Stratford	RCTD4: To maintain the area of <2m depth to watertable at 2003 levels	15 years	Based on these Salinity Management Areas being a lesser priority for salinity control implementation to protect land and the expected increase in watertable levels when rainfall returns to average	
Infrastructure	Urban infrastructure	Rosedale, Port Albert	RCTD5: A 10% reduction in the area of <2m depth to watertable in urban areas at risk of salinity (eg Rosedale and Port Albert)	15 years	Urban salinity can justify engineering options to reduce the effects and/or risk of salinity. Engineering options are more effective in reducing watertable levels than agronomic options. The target is based on an unqualified estimate of the possible effect of engineering options such as groundwater pumping	Mainly small contributions from MATs DA4, DC2, DD1 and DD3.
Biodiversity	Existing native vegetation	All dryland Salinity Management Areas	RCTD6: No net loss of native vegetation in strategic recharge areas contributing to saline discharge	5 years	Assumes that the current policy of "net gain" of native vegetation continues to be implemented	MAT SA1 and DA1 to fill knowledge gaps followed by MAT DD3

6.5.2 Strategy

The investigation and remediation of dryland salinity in West Gippsland is in its infancy. There are still significant gaps in our knowledge of the extent and effect of dryland salinity. Therefore, a set of priority actions is dedicated in this plan to further mapping and documentating the extent and effect of salinity on key assets (Section 6.5.3).

This plan recommends a long term strategy development process or "road map" (Figure 14) to address dryland salinity in the region, whilst also providing shorter term "best bet" approaches that can be implemented while the longer term strategy is being formulated. As stated in Section 4.4, the Salinity Management Areas with the greatest environmental, social and economic costs of dryland salinity include Port Albert, Bengworden, Rosedale and Foster. Therefore, these are the priority areas for future investment in dryland salinity remediation.

A four year investigation program to provide the information required to properly address dryland salinity and related natural resource management issues is shown in Figure 14. This "road map" provides a plan to ensure that management options that address a number of other natural resource management issues are integrated. The road map provides two exit points for information to be fed into existing programs such as the native vegetation, soil erosion and/or forestry programs (at the end of Years 2 and 4).

As previously stated, the character of the groundwater flow systems causing dryland salinity are relatively unknown. This affects the ability to test and recommend effective management options in dryland areas, which may include strategic planting of trees and perennial pastures. The first step in the long term strategy (Figure 14) is to define and characterise the groundwater flow systems to ensure management actions can be matched to the appropriate scale and characteristics of the groundwater flow patterns. The next step in the process is to quantify the potential salinity benefit from implementing the recommended management actions from the groundwater flow systems study. Such an approach is likely to require groundwater modelling. This is followed by a land capability assessment to investigate the biophysical constraints to implementing the recommended management actions. The analysis should also include not just biophysical elements but social and demand analysis. An economic, social and environmental assessment of the management actions is also a crucial step to understanding all of the costs and benefits of the actions to aid in the prioritisation of management actions. The analysis should include the benefits to other resource management issues such as biodiversity, soil erosion and water quality. The analysis should be as quantitative as possible but inevitably many of the parameters can only be assessed qualitatively.

Once this assessment is complete, the results can be fed into existing natural resource management programs operating in the area. In particular, the current programs to implement the various biodiversity action plans and the farm forestry activities could be greatly enhanced by the inclusion of management actions to address salinity. This will exploit the multi-benefits of single actions such as tree planting.

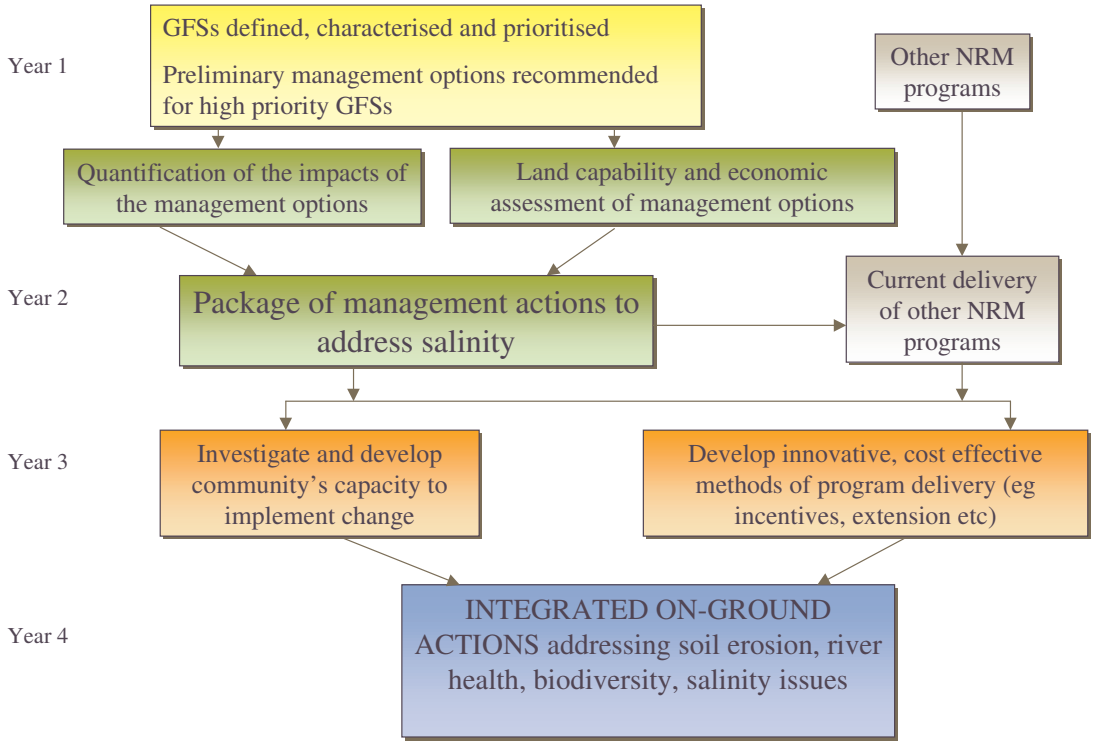
The capacity of the community to implement change is crucial to successful delivery of the planned on-ground activities and outcomes. The community and farming community need

to be comfortable with the proposed land management changes. Landowners should be presented with a number of options for land management changes rather than being too prescriptive. The method adopted should build on experiences of others particularly in West Gippsland.

Developing appropriate program delivery mechanisms will require the outputs from all previous steps. Only those management actions that show net positive economic, social and environmental benefits will be chosen for this assessment. Program delivery mechanisms should be focussed on the community's capacity to implement change. Cost sharing arrangements should be based on a combination of the ratio of public to private benefits and the incentive required to engender change in line with Government policies.

There are already financial incentives available to landowners for activities such as tree planting for biodiversity purposes. These will need to be reviewed in light of the additional salinity benefit. The ultimate goal is to produce sub-catchment plans that not only address salinity issues but also other related natural resource management issues including biodiversity, soil erosion, water quality and river health. This model is currently being implemented in the North Central CMA and provides an excellent example of a more holistic approach to land salinity management.

- **Figure 14: Road map for the long term strategy to address dryland salinity management**



For the Bengworden Salinity Management Area, there is already knowledge on the groundwater flow systems causing salinity and identification of the key recharge areas for targeting of tree planting. However, for the Rosedale, Port Albert, Foster and Reeve Salinity Management Areas, this information is unavailable.

The long term strategy outlined above will take some years to implement given the length of time required for data collection and investigations. Whilst the long-term strategy is an important step for ensuring well-informed future decisions on salinity management, a shorter term "best bet" strategy is also recommended to mitigate the impacts of salinity in the meantime. There are currently a variety of revegetation projects in West Gippsland that could provide salinity benefits if appropriately targeted. The short term approach for each of the priority dryland Salinity Management Areas is outlined in Table 39.

Table 39: 'Best bet' approach to dryland salinity management in each of the high priority Salinity Management Areas

Salinity Management Area	Key assets affected or at risk of dryland salinity	'Best bet ' current approach	Approach based upon…
Bengworden	▪ Agricultural land ▪ Wetlands on northern shores of Lake Wellington	▪ Utilise existing revegetation projects targeted for the Red Gum Plains area for the planting of trees in priority high recharge areas as identified in SKM (2002b). To ensure multi-benefits are achieved, tree planting should be either targeted towards forestry activities or biodiversity purposes. Any tree planting for salinity/biodiversity purposes should be consistent with the Red Gum Plains Biodiversity Action Plan (DSE 2004) and the draft West Gippsland Native Vegetation Plan (WGCMA, 2003). ▪ Investigate the economics of farm forestry in the region especially the potential of plantations of Radiata pine and other species appropriate for this rainfall zone on high recharge sandy dunes. ▪ Ensure new irrigation developments are efficient and minimise off-site impacts.	▪ Local and intermediate groundwater flow systems contributing to salinity (SKM 2002b). ▪ Recharge areas identified from airborne radiometrics and on-ground inspections (SKM, 2002b). ▪ Anecdotal evidence that tree production on sand dunes is economically viable.
Port Albert	▪ Agricultural land ▪ Rural infrastructure such as roads and buildings ▪ Port Albert township ▪ Jack Smith Lake	▪ Plant trees on expected high recharge sand dunes above saline discharge areas of coastal plains around Yarram and at the break of slope above discharge sites. To ensure multi-benefits are achieved, tree planting should be either targeted towards forestry activities or biodiversity purposes. Any tree planting for salinity/biodiversity proposed should be consistent with the draft West Gippsland Native Vegetation Plan (WGCMA, 2003). There is significant potential for expansion of commercial timber operations in the area and the development of economically viable farm forestry ventures. ▪ Utilisation of current tree planting activities as part of biodiversity programs to obtain salinity benefits. ▪ Potential engineering salinity control options to protect Port Albert township.	▪ Conclusions made by SKM (1998) that there are local groundwater flow systems causing salinity in the Yarram Plains area. ▪ Conclusions from Yarram Salinity Group (2000) that the longitudinal sand dunes in the Yarram Plains area have a high permeability as described by Sargeant (1997) and measured in the field.

Salinity Management Area	Key assets affected or at risk of dryland salinity	'Best bet ' current approach	Approach based upon…
Foster	▪ Agricultural land ▪ Rural infrastructure such as roads and buildings	▪ Tree planting should be targeted on the higher permeability soils immediately above saline discharge sites and at the break of slope immediately above discharge sites. To ensure multi-benefits are achieved, tree planting should be either targeted towards forestry activities or biodiversity purposes. Any tree planting for salinity/biodiversity purposed should be consistent with the draft West Gippsland Native Vegetation Plan (WGCMA, 2003). ▪ Perennial pastures can be used on the lower slopes to reduce recharge although are not likely to be very effective given the high average rainfall.	▪ Groundwater flow systems are likely to be local based upon dryland salinity occurring in similar landscapes in other parts of the state (although no information is available for the local area). ▪ The area has an average rainfall in excess of 900mm which is best suited to tree planting.
Rosedale	▪ Agricultural land around Rosedale and Lake Reeve ▪ Dowd Morass ▪ Lake Reeve ▪ Rosedale township	▪ Investigation of salinity in the township of Rosedale and the potential use of engineering options to remediate.	▪ Urban salinity issues in Rosedale have been identified by Rosedale Landcare Group. ▪ Some engineering options already being applied in Rosedale township.
Reeve	▪ Rural infrastructure such as roads and buildings ▪ Agricultural land ▪ Lake Reeve	▪ Map land salinity in the Lake Reeve catchment, particularly around the townships of The Honeysuckles and Seaspray. ▪ Extension to encourage farmers to plant salt tolerant vegetation. ▪ Investigate possibility of more flushing flows from Merrimans Creek.	▪ Report into hydrology of Lake Reeve (SKM, 2004e).
Stratford	▪ Agricultural land	▪ Map salinity on the land adjacent to the Princes Hwy and between the highway and Bengworden Rd. ▪ Extension to encourage farmers to plant salt tolerant vegetation.	▪ Anecdotal evidence that land along the Princes Highway and Bengworden Rd is saline.

6.5.3 Salinity Mapping and Investigation Program

The salinity mapping and investigation program is designed to address current knowledge gaps in the extent, significance, causes and remediation of dryland salinity.

There are still gaps in the knowledge of the extent and significance of salinity in dryland areas that restricts the planning of management options to address salinity. The key knowledge gaps are identified below and management action targets to fill these gaps are summarised in Table 40 including a five-year work program.

The key knowledge gaps in the extent and significance of salinity are:

- the extent of land salinity mapping in the following Salinity Management Areas:
  - Bengworden Salinity Management Area;
  - Lake Reeve area of Rosedale Salinity Management Area;
  - Reeve Salinity Management Area; and

- Area south of Wonthaggi, the eastern flanks of the Bass Hills and the Powlett catchment in the Foster Salinity Management Area. (It is likely that much of this salinity will be primary, although there may also be some secondary salinity).

- Urban salinity mapping:
  - Salinity in the township of Rosedale has not been properly mapped. The local Landcare Group has indicated that there is a significant salinity problem in the town;
  - Anecdotal evidence suggests that salinity is having an effect on infrastructure in Port Albert but the extent and significance has not been determined; and
  - It is likely that there is either an existing urban salinity problem or a potential problem (due to a shallow watertable) in some towns in West Gippsland. An investigation is required to determine the extent and significance of urban salinity in West Gippsland.

There are also gaps in our knowledge of the extent and effect of salinity in wetlands. This issue is addressed in Section 6.7.

To ensure the implementation of the long term strategy to investigate and mitigate dryland salinity in the areas presented in the previous section, a number of investigation activities are required as detailed in Table 40.

- **Table 40: Management actions to address key knowledge gaps in the extent, significance, causes and remediation of salinity in the dryland salinity management areas**

Management options	Potential future actions	Type of project	Overall priority	5 year management actions						5 year Management Action Target	WGCMA partners
				2004/05^	2005/06	2006/07	2007/08	2008/09	2009/10		
DA. Salinity mapping and investigation											
DA1: Agricultural land salinity mapping	Continue program of land salinity mapping in:1) Bengworden 2) Lake Reeve area of Rosedale, Lake Wellington and Reeve and 3) Area south of Wonthaggi	Research and Investigation	**Priority 1**							**MAT DA1:** All land salinity mapping complete and informing management option planning	DPI
DA2: Salinity mapping in urban areas	1) Map salinity in areas known or suspected to have salinity problems (Rosedale, Seaspray and Port Albert). 2) Thorough investigation in areas known to have urban salinity - Rosedale, Seaspray and Port Albert. 3) Investigate the potential impact of salinity in other towns with high watertables as indicated by the depth to watertable map.	Research and Investigation	**Priority 1**							**MAT DA2:** Investigations complete into threat of urban salinity and informing management options for remediation of urban salinity	DPI, Local Govt
DA3: Groundwater flow system investigation	Define and characterise shallow groundwater flow systems causing salinity in the West Gippsland region. Recommend preliminary management actions matched to the characteristics of the groundwater flow systems. Feed management actions into existing farm forestry, native vegetation and agronomic programs.	Research and Investigation	**Priority 1**							**MAT DA3:** Completion of study into groundwater flow systems	DPI
DA4: Impact of management actions	Quantify the expected effects of the various management actions recommended in the groundwater flow systems study (DA3). Modify management actions and feed into existing farm forestry, native vegetation and agronomic programs.	Research and investigation	**Priority 1**							**MAT DA4:** Completion of study into effects of management actions	DPI
DA5: Land capability and economic assessment	Assess capability of land for management actions recommended in DA3 and DA4. Assess economics of implementation. Modify management actions and feed into existing farm forestry, native vegetation and agronomic programs.	Research and investigation	**Priority 1**							**MAT DA5:** Completion of land capability and economic assessment	DPI
DA6: Capacity building and methods for adoption	Review methods to build community capacity to implement change and develop innovative methods for program delivery. Modify management actions and feed into existing farm forestry, native vegetation and agronomic programs.	Research and investigation	**Priority 1**							**MAT DA6:** Completion of investigation into capacity building and program delivery	DPI, Gippsland Private Forestry Inc, LandCare
DA7: Integrated actions	Develop a set of on-ground actions for each salinised area that addresses a number of NRM issues including salinity, soil erosion, water quality and biodiversity achieving positive economic, social and environmental outcomes	Research and investigation	**Priority 1**							**MAT DA7:** Completion of sub-catchment plans to address a variety of NRM issues	DPI, DSE, LandCare

6.5.4 Whole Farm Planning

On-ground strategy

This plan recommends that Whole Farm Planning be the key planning tool for natural resource management activities on dryland areas at a farm scale including salinity management. The implementation of the farm scale revegetation and 'living with salt' management actions identified in this plan should ideally be included within, and guided by, Whole Farm Plans. In the West Gippsland area, farm planning is very different in dryland and irrigated areas. As previously described, farm planning in irrigated areas is focussed on the planning of irrigation and drainage infrastructure and is usually compiled by specialist contractors. The preferred term for these sorts of plans is "Irrigation Farm Plans" (see Section 6.4.3). Conversely, Whole Farm Plans in dryland areas are generally broader and are prepared by the landowner with the assistance of air photos and GIS information to incorporate a cross-property or sub-catchment perspective, particularly for retention of vegetation remnants and revegetation activities linking them.

Whole Farm Plans should be informed by the various land and water management plans to ensure an integrated approach to natural resource management at a farm and paddock scale. Whole Farm Planning also helps build capacity for individuals and groups to address various natural resource management issues including salinity.

Implementation mechanisms

Unlike irrigated areas, there is not a strong culture of Whole Farm Planning in dryland areas. There are numerous natural resource management programs occurring in the region that would benefit from being conducted under an appropriate umbrella such as sub-catchment plans at a local level or Whole Farm Plans at a farm and paddock level (eg soil erosion, salinity, river health, biodiversity etc). None of the incentives offered for revegetation or protection of existing vegetation are contingent on landowners having a Whole Farm Plan.

Funding is currently provided to run four Whole Farm Planning courses a year for farmers. This plan recommends increasing the number of Whole Farm Planning courses to six per year. This plan also recommends a review of the relevance and implementation of Whole Farm Plans in natural resource management in dryland areas incorporating the outcomes of past reviews (eg SKM, 2001) and the experiences of other regions. Not withstanding the outcomes of such a review, this plan recommends:

- The development of guidelines for extension staff and farmers about the requirements and resources available to compile Whole Farm Plans;
- The development of a central repository of information useful for compiling whole farm plans (eg overlays showing: recharge sites, areas of important biodiversity, soils maps etc); and
- The provision of training to extension staff on how to construct Whole Farm Plans and their value.

Barriers to adoption and knowledge gaps

The key barriers to adoption and knowledge gaps are:

- Absence of local guidelines for the development of Whole Farm Plans; and

- An absence of an accessible central location of information important to the development of Whole Farm Plans such as recharge and saline discharge areas, soil types and biodiversity distribution.

Recommended actions, prioritisation and management action targets.
Recommended actions and projects based on the above discussion are outlined in Table 41.

- **Table 41: Management actions for the Farm Planning program**

Management options	Potential future actions	Type of project	Benefit-risk score	Overall priority	5 year management actions						5 year Management Action Target	Impact on salinity over 30 years	WGCMA partners
					2004/05	2005/06	2006/07	2007/08	2008/09	2009/10			
DB: Whole Farm Planning													
DB1: Guidelines	Develop guidelines for the development and assessment of Whole Farm Plans	Research and Investig.	**NA**	**Priority 1**							**MAT DB1:** Guidelines completed and used to assess Whole Farm Plans	Integrates salinity planning with broader natural resource management planning	DPI
DB2: Database	Develop a central database of information to be used for the development of Whole Farm Plans	Research and Investig.	**NA**	**Priority 1**							**MAT DB2:** Central repository complete and being used to develop Whole Farm Plans		DPI
DB3: Training	Whole Farm Planning courses for both farmers and extension officers	Extension	**NA**	**Priority 1**							**MAT DB3:** 6 courses a year for 5 years = 30 courses		DPI
DB4: Review	A review of the relevance and implementation of whole farm planning extension programs	Policy	**NA**	**Priority 1**							**MAT DB4:** Review completed and begun to be implemented		WGCMA only

6.5.5 Perennial pasture program

On-ground strategy

This plan advocates the use of perennial pastures in low rainfall, local groundwater flow systems where recharge and discharge areas are located within the same local catchments. Their use in larger scale groundwater flow systems is not recommended due to the lower overall impact and the longer time frame required to take effect. In the higher rainfall areas around Yarram, Inverloch and Wonthaggi, perennial pastures are to be used only to provide supplementary recharge control to the tree planting program. However, in the lower rainfall areas around the Giffard Plain and Bengworden, they can play a much more dominant role in reducing recharge in key areas adjacent to saline discharge areas. Although there is no current mapping of the distribution of perennial pastures in either South Gippsland or Bengworden, anecdotal evidence suggests that much of these areas have been sown to perennials already. Native perennial pastures may also be well suited to the region and are effective for recharge control in areas less than approximately 600m rainfall.

Implementation mechanisms

An extension program will be implemented to provide farmers with advice on the establishment and management of perennial pastures. The extension program will also provide advice on the most appropriate location of perennial pasture establishment for maximum economic and salinity benefit based on the analysis of groundwater flow systems. There may also be a need to introduce a financial incentive scheme for the establishment of perennial pastures similar to those operating in other parts of the State (North Central). Once sufficient background information is collected, a thorough economic analysis may be undertaken to identify the need and justification for an incentives program. It is estimated that the strongest case for incentives is likely to be in lower rainfall areas around the Giffard Plain and Bengworden.

Barriers to adoption and knowledge gaps

The key barriers to adoption and knowledge gaps are:

- Lack of information on the current extent of perennial pastures in key recharge areas;
- Lack of available information in South Gippsland and Bengworden on suitable perennial pasture species for the area. Available information needs to be gathered where it exists and extended or new information sought where it is unavailable; and
- An economic analysis of perennial pasture establishment for salinity benefits is unable to be undertaken for the local area given current knowledge gaps.

Recommended actions, prioritisation and management action targets.

Recommended actions and projects based on the above discussion are outlined in Table 42.

- **Table 42: Management actions for perennial pasture establishment for dryland recharge control (in addition to management actions DA3 to DA7 – see Table 40)**

Management options	Potential future actions	Type of project	Benefit-risk score	Overall priority	2004/05^	5 year management actions					5 year Management Action Target	Impact on salinity over 30 years	WGCMA partners
						2005/06	2006/07	2007/08	2008/09	2009/10			
DC: Perennial Pasture Program													
DC1: Perennial pasture mapping	**DC1:** Determine extent of perennial pastures in key recharge areas identified in DA3, DA4, DA5 and DA7	Research and invest.	**NA**	**Priority 3**							**MAT DC1:** Extent of perennial pastures mapped	No direct impact – need to know existing distribution prior to recommending new sowings	Dept of Primary Industries
DC2: Perennial pasture establishment and management	**DC2:** Implement perennial pasture program recommended from management actions DA3, DA4, DA5, DA6 and DA7 (see Table 40). This is likely to invoive extension and potentially financial incentives to landowners.	Extension	**39**	**Priority 3**							**MAT DC2:** 25% increase in the area of perennial pastures in strategic low rainfall areas identified as requiring recharge reduction.	Reduction in area of <2m DTWT. Quantification of effect will be determined in DA4	Dept of Primary Industries

6.5.6 Tree and native vegetation program

On-ground strategy

The tree and native vegetation program will consist of the following sub-programs:

- Protection of existing native vegetation to prevent future salinity; and
- Planting of new trees and other woody vegetation to reduce groundwater recharge.

The tree and native vegetation planting program will be focused in the high rainfall Salinity Management Areas with a high social, environmental and economic cost of dryland salinity such as the Port Albert, Foster and Bengworden Salinity Management Areas.

Trees and other native vegetation planted for salinity purposes alone are not likely to have a net positive economic, social or environmental benefit unless combined with other benefits such as biodiversity or forestry. If biodiversity and salinity benefits are to be achieved, then any tree or native vegetation establishment should be consistent with the indigenous Ecological Vegetation Class (EVC). Given the huge variety of EVCs, there needs to be a degree of flexibility with the choice of native vegetation used for salinity control. In some areas, eucalypts will be appropriate while in other areas native shrubs or grasses may be more consistent with the local EVC. All

plantings need to be consistent with the species and targets established in the draft West Gippsland Native Vegetation Plan (WGCMA, 2003).

The most effective tree or native vegetation planting options to reduce groundwater recharge and land salinity are likely to be:

- Break of slope plantations above saline discharge sites; and
- Planting of high recharge areas contributing to saline discharge in areas of local groundwater flow systems.

In the Bengworden region, a study of the groundwater flow systems in the area has identified tree planting on the longitudinal sand dunes south of the Bengworden Road as being the most technically effective salinity management option for the region. Although the region has a lower rainfall than the South Gippsland region (approximately 584mm/year), field trials in the region have shown that Radiata pine and a number of Eucalypt species can grow effectively on the sandy dunal systems (Gippsland Private Forestry, 2004). The recommended additional tree planting amounts to approximately 2680 ha. A realistic target is approximately 25% of this area planted to trees in the next 15 years (ie 45 ha/yr). Calculations suggest that this target will achieve a reduction in area of less than 2 metres depth to watertable of between 100 to 150 ha over 30 years depending on the lag time between tree planting and the effect on down-gradient discharge.

For other management areas with dryland salinity (Foster, Port Albert, Rosedale, Reeve), the groundwater flow systems have not been investigated. Without knowledge of the groundwater flow systems and relationship between recharge and discharge areas, it is difficult to specify the amount of tree planting required to have any significant effect on the salinity problem. In the South Gippsland region (Port Albert and Foster Salinity Management Areas) most of the salinity and expected corresponding recharge areas receive in excess of 600 mm rainfall, where trees are expected to be the most viable and effective option to reduce groundwater recharge. Pines and Blue Gums are known to be suited to the soils, rainfall and topography in the area (BRS, 2000) and other Eucalypt species are expected to have commercial potential as well.

Economic assessment

An economic assessment was undertaken for the planting of 45ha per year of trees in the Bengworden Salinity Management Area (SKM, 2004d). No economic analysis could be justified in the other dryland salinity management areas due to the lack of information on groundwater flow systems and targeted area for tree planting.

No studies have been undertaken to determine the lag time between planting the trees and seeing the effect in the down-gradient discharge area. However, the assessment of tree planting in the Bengworden Salinity Management Area assumed that the groundwater flow systems are local in nature (SKM, 2002) and there is a lag time of between 5 and 20 years as indicated by Walker *et al* (2003). The results of the analysis are given in Table 43 and Table 44 for a 5-year and 20-year salinity impact delay respectively.

- **Table 43: Economic analysis of tree planting rate of 45 ha/yr for 15 years in the Bengworden Salinity Management Area, assuming a 5 year salinity impact delay***

Item	With timber production		Without timber production	
	4% discount rate	8% discount rate	4% discount rate	8% discount rate
Benefits				
Salinity benefits	$ 46,000	$ 22,000	$ 46,000	$ 22,000
Timber production	$ 9,076,000	$ 4,554,000	$ -	$ -
Total benefit	$ 9,122,000	$ 4,576,000	$ 46,000	$ 22,000
Costs				
Establishment	$ 682,000	$ 444,000	$ 358,000	$ 286,000
Maintenance	$ 465,000	$ 289,000	$ 237,000	$ 181,000
Harvest & transport	$ 4,801,000	$ 2,409,000	$ -	$ -
Lost agricultural production	$ 887,000	$ 514,000	$ 887,000	$ 514,000
Fencing	$ 605,000	$ 484,000	$ 605,000	$ 484,000
Administration	$ 180,000	$ 122,000	$ 116,000	$ 92,000
Research and investigation	$ 39,000	$ 39,000	$ 39,000	$ 39,000
Total costs	$ 7,659,000	$ 4,300,000	$ 2,242,000	$ 1,597,000
Net Present Value	$ 1,494,000	$ 276,000	-$ 2,196,000	-$ 1,575,000
Benefit Cost Ratio	1.20	1.06	0.02	0.01

*Values rounded to nearest $1,000 to illustrate salinity benefit. Note however that uncertainty is greater than +/- $1,000.

- **Table 44: Economic analysis of tree planting rate of 45 ha/yr for 15 years in the Bengworden Salinity Management Area assuming a 20 year salinity impact delay***

Item	With timber production		Without timber production	
	4% discount rate	8% discount rate	4% discount rate	8% discount rate
Benefits				
Salinity benefits	$ -	$ -	$ -	$ -
Timber production	$ 9,076,000	$ 4,554,000	$ -	$ -
Total benefit	$ 9,076,000	$ 4,554,000	$ -	$ -
Costs				
Establishment	$ 682,000	$ 444,000	$ 358,000	$ 286,000
Maintenance	$ 465,000	$ 289,000	$ 237,000	$ 181,000
Harvest & transport	$ 4,801,000	$ 2,409,000	$ -	$ -
Lost agricultural production	$ 887,000	$ 514,000	$ 887,000	$ 514,000
Fencing	$ 605,000	$ 484,000	$ 605,000	$ 484,000
Administration	$ 180,000	$ 122,000	$ 116,000	$ 92,000
Research and investigation	$ 39,000	$ 39,000	$ 39,000	$ 39,000
Total costs	$ 7,659,000	$ 4,300,000	$ 2,242,000	$ 1,597,000
Net Present Value	$ 1,417,000	$ 254,000	-$ 2,242,000	-$ 1,597,000
Benefit Cost Ratio	1.19	1.06	0.00	0.00

*Values rounded to nearest $1,000 to illustrate salinity benefit. Note however that uncertainty is greater than +/- $1,000.

The average annual cost to landowners for tree planting for timber production is expected to be between $6,100 and $11,100 per hectare based on conversion of 45 hectares per year over 15 years. This includes harvesting and transport of the timber. The average annual cost to landowners for tree planting without timber production is expected to be between $2,100 and $3,100 per hectare based on conversion of 45 hectares per year over 15 years.

It is important to note that the above economic analysis does not take into account the substantial biodiversity and carbon sequestration benefits of tree planting. The economic results indicate that without the benefits of production, trees are not economic on their own to remediate salinity. However, when included with tree harvesting for timber production, trees can be economic especially over a 30 year or longer time frame. Also, tree planting for salinity purposes can be justified when combined with existing biodiversity programs justified on their environmental benefits.

There is a need to analyse the predicted economic returns on commercial tree growing ventures located on areas targeted for recharge control (and other natural resource management purposes) and to compare these returns to those available from sites that deliver current industry benchmark plantation returns. This analysis will allow a calculation of the 'investment return gap' that needs to be bridged by cost sharing through the salinity program to encourage adoption by landowners.

Implementation mechanisms

The protection of existing native vegetation will be implemented outside the salinity plan through the implementation of Victoria's Native Vegetation Management Framework (DNRE, 2002b). These guidelines recommend a 'net gain' of native vegetation for any authorised clearing activities and prevents clearing of important native vegetation stands. Market-based incentives are currently used to protect native vegetation stands in the area (e.g. the Bush Tender program) and new incentives are being offered for carbon sequestration purposes. Therefore, even without the salinity plan, native vegetation is likely to be protected at least to some extent. However, in the implementation of the Native Vegetation Management Framework, the impact of native vegetation clearing on future land salinisation should be taken into account when issuing clearing permits. Therefore, the salinity program has a role to play in informing relevant agencies of key strategic areas to avoid clearing from a salinity perspective. From a salinity perspective, while remnant protection will help prevent future salinity, it is revegetation that will help to mitigate existing salinity.

The plan will implement the tree planting program via the following mechanisms:

Implementation of the Gippsland Regional Farm Forestry and Plantations Strategy

This strategy was developed by Gippsland Farm Plantations Inc (now Gippsland Private Forestry Inc) and provides a strategic plan for the development of farm forestry in Gippsland. The strategy is currently being implemented by Gippsland Private Forestry Inc with funds being provided by both Federal and State Governments. The strategy has a number of key elements for promoting farm forestry in Gippsland including developing local and regional markets, community capacity building and extension programs. Of particular relevance to the salinity issue is the program to maximise environmental benefits from tree growing such as

improved water quality, soil erosion and salinity. Gippsland Private Forestry Inc is currently exploring mechanisms for rewarding and encouraging farm forestry enterprises with public environmental benefits. This issue is also being investigated at a State level through the development of a Plantations Investment Strategy, which will aid in the development of a local approach.

The region around Yarram is particularly suited to forestry due to the high rainfall, low topographic relief and access to the timber mill at Yarram. There is a significant potential for economically viable farm forestry ventures in the Yarram region particularly the farming of pine trees (R Willersdorf, *pers. comm.*, 2004). In the Bengworden region, farm forestry also has potential although the lower rainfall is likely to significantly reduce the economic viability.

The salinity program will aid Gippsland Private Forestry Inc to implement the Gippsland Farm Forestry Strategy by providing information on the most appropriate locations of trees for maximum salinity benefit and contribute to the discussion on the public and private environmental benefits of plantation tree planting including appropriate cost sharing arrangements.

Any new plantation developments will need to take into account the potential effect on water resources (eg reduction in runoff). The State Government's paper on water reform, *Our Water Our Future* (DSE, 2004a) states that Statewide policies will be introduced to ensure acceptable impacts on water resources. The planting of any additional trees for salinity control will need to take these policies into account.

Working with commercial forestry operations

There is the opportunity for Government to work in partnership with commercial forestry operations to enhance the potential salinity benefits from commercial tree growing. For instance, Australian Paper is considering plans to expand its pulp facility at Maryvale. If this were to proceed, it would generate demand for additional Blue gum plantation expansion in the region, some of which may be able to be located in areas targeted to reduce groundwater recharge. There may be opportunities to work with commercial forestry operators to share the capital and/or on-going costs of tree growing to ensure maximum salinity and other environmental outcomes. Again, this issue is currently being explored at local, State and National levels.

Implementing the West Gippsland Native Vegetation Plan (WGCMA, 2003)

A range of revegetation projects are undertaken in the West Gippsland region, funded by Federal and State Governments and corporate sponsorship. These projects are undertaken on private and public land and directed by the priorities of the West Gippsland Native Vegetation Plan, the Regional Catchment Strategy and other Statewide policies. Revegetation projects should aim to achieve multiple benefits to add value to the works being carried out, so that salinity benefits can be tied to strategic gains in biodiversity.

The calculations in Table 43 and Table 44 show that trees can produce a salinity benefit over a 30 year time period through increased agricultural production on salinised land. Depending on the scale of the groundwater flow systems, the landowners incurring the costs of planting trees in recharge areas are not likely to be the same as the down-gradient beneficiaries. This social inequity can either be resolved by the beneficiaries partly paying for the costs of tree planting or some form of Government assistance provided for tree planting. This plan favours the latter due to the difficulty in identifying the beneficiary and quantifying the benefit.

Once research and investigation work to determine the most appropriate location of trees to achieve a salinity benefit is completed, this plan advocates the provision of additional funding to already established revegetation programs rather than creating a new program. The economic analysis (see below) indicates that tree planting purely for salinity benefits is likely to be uneconomic and needs to be combined with other benefits to justify. Of course the location of trees for maximum salinity benefit is not necessarily the same location for farm forestry or biodiversity purposes. However, there are likely to be significant areas where multi-benefits can be achieved. This plan recommends the targeting of trees for salinity purposes only in these areas where multi-benefits can be achieved. The already established revegetation programs that this plan advocates the provision of additional salinity funding for include:

- Extension programs provided by Gippsland Private Forestry Inc for advice on farm forestry;
- Greening Australia receives Commonwealth and State funding to provide landowners with advice and financial assistance to enhance biodiversity over the West Gippsland CMA region. The program could be easily expanded to ensure that salinity benefits are taken into account in the criteria used for selecting appropriate projects;
- Greening Australia also runs a program in the Maffra and Districts LandCare network (primarily in the Macalister Irrigation District and surrounds) funded by Edison Mission Energy and Commonwealth and State Governments to enhance biodiversity and land capability; and
- GippsLandcare also provide incentives for revegetation projects and for salt tolerant vegetation. There is a salt tolerant species trial planned in Clydebank funded by Landcare.

The salinity funding provided to these programs should be based around the magnitude of the additional public benefit achieved from the targeting of tree planting for salinity purposes. Although, the economic calculations detailed above are only for the Bengworden Salinity Management Area, there are likely to be similar (or greater) salinity benefits achieved in other dryland salinity management areas. However, until the groundwater flow systems are investigated and an assessment of the impact of tree planting conducted, the magnitude of this effect is very difficult to estimate. Gippsland Private Forestry Inc's experience over the past 3 years with the Indigenous Species Plantation (ISP) Project providing financial assistance for small plantation establishment, shows that offering financial support of $700 per hectare has attracted a response of approximately 25ha/year (R. Willersdorf, GPF, *pers. comm.* 2005). Using this per hectare figure, funding of $32,000/year for the Bengworden Salinity Management Area may be required to encourage the desired extent of planting. Additional funds will be required for the other Salinity Management Areas such as Port Albert and Foster. For the purposes of costing this plan, a nominal value of an additional $50,000 per year has been assigned to the current revegetation programs to ensure that tree planting is targeted towards achieving salinity benefits in addition to biodiversity, carbon sequestration and production benefits. However, this plan recommends that this additional

funding only be provided to these existing programs once the investigation programs to determine targets and location of trees for salinity control are completed (2006/07).

Barriers to adoption and knowledge gaps

The key knowledge gaps and barriers to the adoption of the tree planting program include:

- Lack of understanding of the groundwater flow systems contributing to salinity in the dryland areas which prevents an analysis of the areas and types of landscape required to be revegetated;
- Lack of information on priority dryland areas for the location of trees in the landscape to maximise recharge reduction benefits (apart from the Bengworden Salinity Management Area);
- There are few examples of economically sustainable farm forestry ventures in South Gippsland or Bengworden for use in promoting farm forestry in the region;
- The initial costs to convert agricultural land to farm forestry is regarded as prohibitive for many farmers, even though returns may be greater in the long term; and
- Very large scale commercial forestry plantations may have an impact on surface water yield.

Recommended actions, prioritisation and management action targets.

Recommended actions and projects based on the above discussion are outlined in Table 45.

- **Table 45: Management actions for establishment of trees for dryland recharge control (in addition to management actions DA3 to DA7)**

Management options	Potential future actions	Type of project	Benefit-risk score	Overall priority	2004/05^	5 year management actions					5 year Management Action Target	Impact on salinity over 30 years	WGCMA partners
						2005/06	2006/07	2007/08	2008/09	2009/10			
DD. Recharge control – Agronomic options													
DD1: Tree planting on recharge areas – commercial forestry and/or farm forestry	**DD1:** 1) In conjunction with Gippsland Private Forestry Inc, review the economics of tree establishment to identify the public benefits and determine appropriate cost sharing arrangements to encourage increased farm forestry in strategic recharge areas (part of DA5) 2) Implement forestry program recommended from management actions DA3, DA4, DA5, DA6 and DA7 (see Table 40). This is likely to involve extension and potentially financial incentives to landowners.	Research and Investigation On-ground works Extension	**46**	**Priority 1**							**MAT DD1:** Economics and cost sharing study for encouraging farm forestry completed. Financial incentive program in place supported by extension program	Reduction in area of <2m DTWT	Gippsland Private Forestry Inc
DD2: Tree planting – recharge control plus increased biomass and biodiversity (including break of slope plantings and alley farming)	**DD2:** Ensure prioritisation process for current revegetation projects takes into account the need to plant trees in strategic areas as identified in Table 39 in the short term and the outcomes of DA3, DA4, DA5, DA6 and DA7 (see Table 40) in the longer term. This will be implemented through the existing programs such as Landcare and the West Gippsland Native Vegetation Plan. Additional financial incentives for establishment of native vegetation will be determined as part of DA5 and DA7 .	On-ground works Extension	**49**	**Priority 1**							**MAT DD2:** Prioritisation process for current revegetation projects changed to strengthen the salinity benefits from tree planting. Extension program in place to encourage tree planting through incentives program	Reduction in area of <2m DTWT	Department of Primary Industries, Greening Australia and GippsLandcare
DD3: Maintaining and managing existing native vegetation	**DD3:** 1) Work closely with biodiversity programs to ensure that existing native vegetation is protected or there is a "net gain" of native vegetation in any instances of clearing. 2) Review the "Bush Tender" trial program to determine if applicable to wider area.	Research and Investigation On-ground works	**52**	**Priority 1**							**MAT DD3:** Provide input and support for current programs of native vegetation protection	Reduction in area of <2m DTWT	Department of Primary Industries

^ 2004/2005 management actions are being undertaken in 2004/05 and were recommended by the draft West Gippsland Salinity Management Plan.

6.5.7 Groundwater pumping program

On-ground works

The groundwater pumping program will focus on investigating the potential for public and private groundwater pumps to protect high value assets affected by dryland salinity. The lower value assets such as dryland agriculture are not expected to justify the economic expenditure as shown by calculations in Section 6.4.5. Investment in public groundwater control pumps could potentially be economically justified to protect high value urban infrastructure in the towns of Rosedale and Port Albert. Also, there may be justification for investment in groundwater pumping in the higher value irrigated agricultural areas around Yarram and Tarraville. These irrigated areas are included in the dryland salinity category because they were affected by dryland salinity prior to the introduction of irrigation. Irrigation potentially exacerbates the problem but is not the major cause of salinity in the region. Government investment in public or private groundwater pumps in the Bengworden and Foster Salinity Management Areas is not expected to be economically viable due to the lower value of the assets being affected by dryland salinity. Also, the potential to find suitable shallow aquifers for either public and private groundwater pumping is expected to be limited due to the expected low aquifer yields.

Implementation mechanisms

The limited opportunity for groundwater pumping to reduce dryland salinity will be explored by adopting a similar approach to the irrigated areas, where investment decisions are based on the economic, social and environmental values of threatened assets. A thorough analysis of the private and public groundwater control pumping opportunities requires investigation before incentives can be legitimately recommended.

Economics

The estimates of the benefit cost ratio of groundwater control pumps protecting dryland areas affected by irrigation salinity presented in Table 30 (irrigation section) is indicative of the economics of groundwater control pumps to protect dryland salinity. The calculations suggest that it is unlikely to be economic to protect dryland agricultural areas through groundwater pumping if there is no consumptive use of the groundwater. The economics are more favourable to groundwater pumping where higher value assets are protected such as urban areas or wetlands or where the groundwater is used on farm.

Barriers to adoption and knowledge gaps

The key barriers to adoption and knowledge gaps are:

- The technical feasibility of shallow groundwater pumping around the key high value assets such as the urban infrastructure in the towns of Rosedale and Port Albert;
- The economic viability of groundwater pumping for salinity control in areas of high value assets (eg urban salinity in Rosedale and Port Albert); and
- Disposal options for pumped groundwater around the key high value assets is likely to be limited depending on proximity to the coast.

Recommended actions, prioritisation and management action targets.

Recommended actions and projects based on the above discussion are outlined in Table 46.

- **Table 46: Groundwater pumping management actions to address dryland salinity**

Management options	Potential future actions	Type of project	Benefit-risk score	Overall priority	2004/05^	5 year management actions					5 year Management Action Target	Impact on salinity over 30 years	West Gippsland CMA Partners
						2005/06	2006/07	2007/08	2008/09	2009/10			
DE. Groundwater Pumping													
DE1: Public Groundwater Control Pumps	**DE1** 1) Conduct economic calculations to determine benefit to cost ratios of potential pumping schemes for protecting urban areas from salinity such as Rosedale and Port Albert 2) Investigate potential pumping sites using the "Salinity Mitigation Procedure" established for the Macalister Irrigation District	Research and Investigation + on-ground works	**32**	**Priority 4**							**MAT DE1:** Economic studies complete and groundwater pumping options for Rosedale and Port Albert investigated.	Reduction in area of <2m DTWT	Southern Rural Water
DE2: Private Groundwater Pumping	**DE2:** Investigate areas of good quality groundwater where private pumping may be suitable as a salinity control measure	Research and Investigation + extension	**34**	**Priority 4**							**MAT DE2:** Sites for additional private pumping investigated and extension program commenced	Reduction in area of <2m DTWT	Southern Rural Water

^ 2004/2005 management actions are being undertaken in 2004/05 and were recommended by the draft West Gippsland Salinity Management Plan.

6.5.8 Living with Salt Program

On-ground strategy

The Living with Salt program will focus on improving the productivity of saline land and water. Saline land will be addressed through fencing and livestock management to reduce grazing impacts and the sowing of salt tolerant crops and pastures. The planting and management of salt tolerant crops and pastures should be part of the farm planning process and farmers should be encouraged to include this in their Whole Farm Plans.

This plan recommends that 25% of areas affected by Class 2 and 3 dryland salinity be sown to salt tolerant pastures or crops over the next 30 years provided they are economic to the landowner (see economic discussion below). The productivity for areas of Class 1 salinity is likely to be maximised through the use of normal pastures (ie not salt tolerant pastures) explaining why areas of Class 1 salinity are not targeted in this program. The target for the sowing of salt tolerant pastures equates to an area of approximately 2,100ha over 30 years or 70 ha per year.

Prior to the sowing of salt tolerant crops and pastures, it may be necessary in some locations to determine the likely rate of continued soil degradation. If a moderately salt tolerant species were to be sown at a site where soil salinity levels were rapidly increasing, then the species would not survive if the site were to become severely salinised. It would not be economically viable or even beneficial to sow this species in this environment. It is important to ensure that the sowing of any introduced species does not become a weed. Special care needs to be taken when sowing salt tolerant crops and pastures in areas adjacent to environmentally sensitive areas such as wetlands. Species such as Tall Wheat Grass have been known to spread outside their sown areas and can become weeds.

There may also be the potential for land retirement or Government buy back of saline land that has a low agricultural value but a high environmental value.

Implementation mechanisms

The main mechanism to implement the Living with Salt program will be extension. Research and investigation is also important to address some of the key knowledge gaps and barriers to adoption.

Barriers to adoption and knowledge gaps

The key barriers to adoption and knowledge gaps for the Living with Salt program include:

- Current lack of information on types and economics of salt tolerant crops and pastures suited to local conditions; and
- Compatibility of salt tolerant crops and pastures with adjacent landuses, such as wetlands, to prevent weed infestation.

Economic Analysis

An economic analysis was conducted for planting Tall Wheat Grass for the target areas described above. The calculations were conducted separately for beef/sheep and dairy landuses. The economic analysis including all assumptions is discussed in SKM (2004d). The economic analysis assumed that gypsum application is not required, which may not be valid in some cases. The need for gypsum effectively doubles the cost of sowing. The results are shown in Table 47.

Table 47: Economic analysis of planting Tall Wheat Grass on 70ha/yr for 30 years assuming gypsum is not required

	Dryland beef or sheep enterprise		Dryland dairy enterprise	
	4% discount rate	8% discount rate	4% discount rate	8% discount rate
NPV, 30 years	-$ 2,500,000	-$ 1,700,000	$ 140,000	- $ 330,000
Benefit cost ratio	0.1	0.1	1.0	0.8

The average annual cost to landowners for planting salt tolerant pasture species is expected to be between $500 and $600 per hectare based on conversion of 70 hectares per year over 30 years. This excludes fertiliser costs.

The results in the above table indicates that planting Tall Wheat Grass may not be economic. There are other intangible public benefits that can be used to help justify the use of Tall Wheat Grass such as improved aesthetics and reduced saline runoff from saline land. However, the activity needs to be economic from the landowners perspective to be legitimately recommended in this plan to ensure reasonable uptake rates and that landowners are not economically disadvantaged. The dominance of private benefits over public benefits means that large amounts of Government investment are not justified (eg investment in a financial incentives scheme). However, the small proportion of public benefits justifies investment in research and investigation to find salt tolerant pastures and crops that may be more economic than the Tall Wheat Grass example used in the above tables. This is an area that is receiving significant attention on a State and National scale and there is justification for conducting investigations into possible local applications of new developments in this area.

The economics of Government buy back of saline land has not been investigated. Justification would need to demonstrate that:

- the environmental value of the land was worth more than the economic return from agriculture (either rehabilitated or in its current state); and
- the costs of rehabilitating the land in private ownership was greater than the combined purchase, rehabilitation and management costs in public ownership.

In most cases, the above criteria are unlikely to be satisfied. However, in very unusual cases of extremely high environmental value (eg RAMSAR listed wetlands), these conditions have the potential to be satisfied.

Recommended actions, prioritisation and management action targets

Recommended actions and projects based on the above discussion are outlined in Table 48.

- **Table 48: Management actions for 'Living with Salt Program'**

Management options	Potential future actions	Type of project	Benefit-risk score	Overall priority	2004/05^	5 year management actions					5 year Management Action Target	Impact on salinity over 30 years	WGCMA partners
						2005/06	2006/07	2007/08	2008/09	2009/10			
DF. Living with Salt													
DF1: Fencing off saline areas and sowing salt tolerant crops, pastures or native vegetation (eg Melaleuca)	**DF1:** i) Review any documentation or results from previous local trials plus general literature review of salt tolerant crops and pastures ii) Extension of appropriate salt tolerant crops and pastures to farmers in salt affected areas with preference to areas not expected to be affected by other management options	Research and Investigation Extension	**39**	**Priority 3**							**MAT DF1:** Investigation program complete and extension program in place	Production increased from 40% to 80% on salt-affected land	Department of Primary Industries
DF2: Aquaculture	**DF2:** No action – benefit-risk score too low												
DF3: Salt harvesting	**DF3:** No action – benefit-risk score too low												
DF4: Government buy-back of saline land for rehabilitation	**DF4:** Review saline land around Lake Reeve, McLennan Straits to determine if it is worth rehabilitating and investigate option of buy back	Research and Investigation	**37**	**Priority 3**							**MAT DF2:** Feasibility study into buy back of saline land complete and recommendations implemented	Increased production on saline land	Department of Sustainability and Environment, Parks Victoria
DF5: Evaporation basins	**DF5:** No action – benefit-risk score too low												

^ 2004/2005 management actions are being undertaken in 2004/05 and were recommended by the draft West Gippsland Salinity Management Plan.

6.5.9 Monitoring, evaluation and reporting

The monitoring, evaluation and reporting program for this plan was guided by the Gippsland Monitoring Evaluation and Reporting Framework (SKM, 2004g). The monitoring, evaluation and reporting component of the salinity plan has a number of key objectives:

- To determine the progress towards the resource condition targets and the aspirational targets;
- To inform investors on the success or otherwise of salinity control works; and
- To allow new programs to develop taking into account previous successes and failures.

The key monitoring, evaluation and reporting activities for the irrigation, dryland and surface water salinity programs are shown in Table 49. Wherever possible, the monitoring of control sites should also be undertaken when determining the effectiveness of management actions or on-ground works.

Table 49: Key monitoring, evaluation and reporting activities for the Dryland Salinity Management Program

Resource Condition Targets	Timeframe for RCT	Monitoring to determine level of achievement of resource condition targets	Salinity Management Area	Overall priority	5 year management actions						Evaluation and reporting to determine if resource conditions have been met	WGCMA partners
					2004/05^	2005/06	2006/07	2007/08	2008/09	2009/10		
Less than a 10% increase in area of <2m depth to watertable from 2002 levels	15 years	**MAT DG1.1:** Continuation of the current monitoring of nearly 80 observation bores across the South Gippsland area for water levels and salinity with progressive implementation of recommendations of monitoring review conducted by SKM (2004a) Continuation of current bore monitoring funded through the salinity program A number of bores need to be drilled in and around the Rosedale and Port Albert townships. These bores should be monitored on a monthly basis.	Port Albert	**Priority 1**							**MAT DG1.2:** Yearly depth to watertable maps created for South Gippsland area using a consistent methodology to allow comparison with previous maps. Evaluate changes from previous map to determine achievement. Maps should be communicated to all stakeholders including the community and government. The annual reporting should also include analysis of climate variability including distinction between depth to watertable changes induced by rainfall changes relative to control options. 5 yearly reports on major spatial and temporal trends in watertable levels and salinity are recommended. Creation and analysis of a yearly depth to watertable map for the Rosedale and Port Albert townships and reported to Wellington Shire council and the general community through the Wellington Implementation Committee of the West Gippsland CMA	DPI
Greater than a 9% decrease in the area of <2m depth to watertable from 2002 levels	15 years		Foster	**Priority 1**								DPI
Greater than an 8% decrease in the area of <2m depth to watertable from 2003 levels	15 years		Bengworden	**Priority 1**								SRW
To maintain the area of <2m depth to watertable at 2003 levels	15 years		Reeve, Trafalgar, Stratford	**Priority 1**								SRW
A 10% reduction in the area of <2m depth to watertable in urban areas at risk of salinity (eg Rosedale and Port Albert)	15 years		Rosedale, Port Albert	**Priority 1**								SRW, DPI, Wellington Shire
No net loss of native vegetation in strategic recharge areas contributing to saline discharge	5 years	No monitoring required in addition to that undertaken as part of the West Gippsland Native Vegetation Plan	All dryland Salinity Management Areas	**Priority 1**							No additional reporting required for salinity program in addition to reporting conducted for the West Gippsland Native Vegetation Plan	