# Executive Summary

This study presents the distribution and characteristics of groundwater flow systems causing salinity in the West Gippsland region.

**Background to the salinity issue and the need for this study**

The extent, effect and causes of salinity in the West Gippsland region are detailed in the draft West Gippsland Salinity Management Plan (WGCMA, 2005). There are just over 24,000 hectares of mapped land salinity in the region (Figure 1) and approximately 26,500 hectares of wetland or lake salinity (Figure 2) that has at least some human induced origin. There are still gaps in the mapping of land and water salinity so these areas of salinity are likely to be an underestimate.

The key types of salinity include irrigation-induced salinity on irrigated land and adjacent dryland, ocean-induced salinity, dryland salinity; and natural (primary) salinity. This study is focussed on the groundwater processes causing salinity. Therefore, ocean-induced salinity and the natural or primary salinity is not considered in this study.

“Groundwater flow systems characterise similar landscapes in which similar groundwater processes contribute to similar salinity issues and where similar salinity management options apply” (Coram *et al.*, 2001). Knowledge of the type of groundwater flow systems that contribute to the discharge of groundwater in salinised areas is critical to developing management options that address the cause of the problem. The time taken for recharge control measures to affect discharge areas is largely dependent on the scale of the groundwater flow systems. Generally, the larger the scale of the groundwater flow systems, the slower the response to changes in recharge. Walker *et al*. (1999) classifies dryland catchments into three main groupings:

- Local flow systems – flow path is generally less than 5 kilometres long;
- Intermediate flow systems – flow path is between 5 and 50 kilometres long; and,
- Regional flow systems – flow path is greater than 50 kilometres long.

**Objectives and methodology**

The objectives of the project were to:

- define and characterise groundwater flow systems in the region with specific focus on the systems causing salinity;
- broadly assess salinity management options suited to each of the key groundwater flow systems causing dryland salinity; and
- scope the next phase of the investigation involving a quantitative assessment of management option effects.

The method used to achieve the above objectives and outcomes included:

- Preparation of a ‘discussion document’ outlining an initial definition of the shallow groundwater flow systems in the region based on a broad literature review (SKM, 2005)
- A 2 day workshop involving key technical, agency and community representatives;
- Revising the groundwater flow systems based on the feedback from the workshop;

- Compiling information on the implications of the groundwater flow systems for salinity management and scoping the next phase of the process.

**West Gippsland Groundwater Flow Systems**

A total of 12 groundwater flow systems (GFSs) were defined for the West Gippsland region using a combination of information on geology, hydrogeology, soils, slope and local knowledge. The distribution of the groundwater flow systems is shown in Figure 12. Six of the GFSs were classified as a high priority based on their contribution to the extent and effect of secondary salinity. Preliminary management actions are identified for each of the priority groundwater flow systems based on knowledge of effectiveness, viability and the characteristics of the groundwater flow system. The high priority GFSs and the corresponding key management options are shown in Table ES1 below.

A map was created to highlight the key priority areas for tree planting for salinity control (Figure 28). The map was based on parameters such as distance to current saline or future potentially saline areas, scale of groundwater flow systems, soil permeability and distance from the coast. The resultant map is **not** intended for use in local scale planning of tree planting. Rather it highlights the general areas of tree planting priorities on a regional scale.

The actions for addressing irrigation salinity are now well established and are currently being implemented. Conversely, the plan to address dryland salinity is currently in its infancy and requires a number of further investigations as detailed in the draft West Gippsland Salinity Management Plan (WGCMA, 2005) and shown diagrammatically in Figure 4. This groundwater flow systems study is a key step in this process. This study also summarises the key issues that need to be addressed in the subsequent steps of the plan including quantification of salinity control effects, land capability analysis, capacity building, and the establishment of integrated sub-catchment plans incorporating a number of natural resource management issues.

The groundwater flow systems framework presented in this study should be continually updated and reviewed as information comes to hand. This document should be seen as a live not static document and is likely to change as our understanding of the complex hydrogeological systems evolve. This study recommends that the document be continually updated with a formal review every five years. Some of the key knowledge gaps highlighted by this study include:

- The relationship between the water table aquifer and the deeper aquifers and the effect on salinity of declining groundwater pressures in the deeper aquifers;
- The aquifer hydraulic characteristics in the high priority GFSs 4, 5, 8, 10 and 12 require further investigation;
- The groundwater processes causing salinity in the Rosedale area within GFS 4; and,
- The extent of mapped salinity.

■ **Table ES1: Summary of high priority groundwater flow systems and salinity management actions**

| Groundwater flow system | Salinity problem | Scale of groundwater flow path | Recharge Control Potential[1] | | | | | Groundwater discharge enhancement potential[1] | | | Salt tolerant crops and pasture potential[1] | Most suitable salinity management options |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pasture or crop | Trees for biodiversity | Trees for forestry | Surface drainage | Irrigation Management | Groundwater pumping | Tile and mole drains | Break of slope trees | | |
| GFS 4<br>Tertiary sediments – Rosedale area) | Dryland salinity on the margins of the Rosedale township | Intermediate | M | M | M | W | S | M | - | M | S | Low rainfall is likely to suit tree planting and perennial pasture establishment. Salt tolerant crops and pastures on saline scalds. Possible groundwater pumping options to protect high value urban assets. |
| GFS 5<br>Tertiary sediments – general | Agricultural land north of Yarram and between Inverloch and Leongatha. Potentially urban salinity in coastal townships. | Intermediate | W | S | S | M | W | M | - | M | S | High rainfall is likely to suit tree planting for farm forestry and/or native vegetation enhancement. However, economically trees cannot compete with dairy around Inverloch and the area is a little further from markets for forestry. At a local level, there is a need to look for highly permeable sites to get maximum recharge control. Salt tolerant crops and pastures appropriate. |
| GFS 8<br>Quaternary sediments - Lower Bengworden region | Bengworden area: Salinity in low lying interdunal areas and plains and wetlands adjacent to Lake Wellington | Intermediate to local | S | S | S | W | W | W | - | M | S | Trees and perennial pastures planted on tops of the dunes are an option, potentially lucerne, low rainfall farm forestry. Salt tolerant crops, pastures and shrubs |
| GFS 9<br>Quaternary sediments in the Macalister Irrigation District | Severest salinity occurs in the dryland areas adjacent to the irrigated areas (especially Nambrok and Clydebank). Lower level salinity in irrigated areas. Salinisation of significant wetlands especially adjacent to Lake Wellington and the Latrobe River | Intermediate | W | W | W | M | S | S | W | S | S | More efficient irrigation combined with groundwater pumping has proven to be effective and should be increased. Strong potential for using salt tolerant crops and pastures to increase productivity of saline land. |

| Groundwater flow system | Salinity problem | Scale of groundwater flow path | Recharge Control Potential[1] | | | | | Groundwater discharge enhancement potential[1] | | | Salt tolerant crops and pasture potential[1] | Most suitable salinity management options |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pasture or crop | Trees for biodiversity | Trees for forestry | Surface drainage | Irrigation Management | Groundwater pumping | Tile and mole drains | Break of slope trees | | |
| GFS 10<br>Quaternary sediments – lower permeability soils | Dryland salinity in the Heyfield, Lake Coleman and Bengworden areas. Wetland salinity including Dowd Morass and Lake Coleman | Intermediate | M | S | S | M | S | M | - | W | S | Perennial pastures where rainfall is <600mm/year, farm forestry and/or native revegetation where rainfall is >600mm/year. Lucerne unlikely to be suitable in the Giffard area due to temporary waterlogging and clay horizon. Salt tolerant crops and pastures suitable especially in areas of coastal primary salinity. |
| GFS 11<br>Quaternary sediments – higher permeability soils | Agricultural land around Newry, Yarram, Lake Reeve and Merrimans Creek area. Predominance of primary salinity close to the coast (especially Lake Reeve area) | Intermediate | M | S | S | W | S | M | - | W | S | Perennial pastures where rainfall is <600mm/year, farm forestry and/or native revegetation where rainfall is >600mm/year. Lucerne is a possibility. Salt tolerant crops and pastures suitable especially in areas of coastal primary salinity. Increase in private groundwater pumping depending on aquifer characteristics. |
| GFS 12<br>Recent alluvial sediments | Main salinity along floodplains of Latrobe, Macalister, Thomson and Avon Rivers | Local but accepts water from adjacent intermediate GFSs | W | S | S | W | S | M | W | S | S | Reduce the recharge in abutting GFSs through more efficient irrigation and groundwater pumping. Potential for break of slope tree planting. Steep slopes on GFSs abutting GFS9 – almost unproductive because they are so steep – good for revegetation. River areas – plantings with many multi-benefits though not compelling from a salinity perspective. |

[1]Note: S = Strong potential, M = moderate potential, W = Weak potential, dash = No potential.