2.1 Salinisation caused by land clearing and irrigation

Salt is a natural feature of the Australian landscape coming from the weathering of rocks and sediments and/or imported through either rainfall or ocean inundation. Prior to European settlement, most of this salt lay below the root zone of plants and some discharged to the surface in saline seeps or wetlands as primary salinity. The volume of water entering the groundwater (recharge) is approximately balanced by the volume of groundwater discharging to the surface. This process is illustrated in Figure 4.

Since European settlement, the water balance has been changed by two main activities:

- Land clearing and the planting of low water using shallow rooted crops and pastures to replace the high water using, deep rooted native vegetation. Approximately 52% of the vegetated land in the West Gippsland CMA region prior to European settlement has now been cleared (West Gippsland CMA, 2003).
- Irrigation especially in the Macalister Irrigation District, small pockets around Yarram and more recently in the Bengworden area. The addition of irrigation onto already cleared land can accelerate the salinisation process. Irrigation areas typically require drainage and salt export to be sustainable. The Macalister Irrigation District in particular requires groundwater pumping

and surface drainage to ensure water logging and salinity problems do not threaten key economic and environmental assets. This concept is further explored in Section 6.4.

The effect of these two land use changes has been to increase the volume of water entering the groundwater system (recharge) with a consequent increase in the water table level. This process is illustrated in the second frame of Figure 4. Over time, the groundwater system reaches a new equilibrium with recharge again equalling discharge but the volumes of recharge and discharge are substantially greater than prior to European settlement.

Discharge occurs via two main processes:

- Evapotranspiration of the near surface water table resulting in salt precipitating in the near surface soil and a reduction in plant growth (see Figure 4). Runoff over this salinised land can wash into wetlands and streams.
- Discharge of saline groundwater directly into wetlands and streams.

Discharge tends to occur in the lowest part of the landscape where the water table and the land surface are closest. The result is salinisation of land, surface water and wetlands.

There are three main types of salinity related to a high water table in the region:

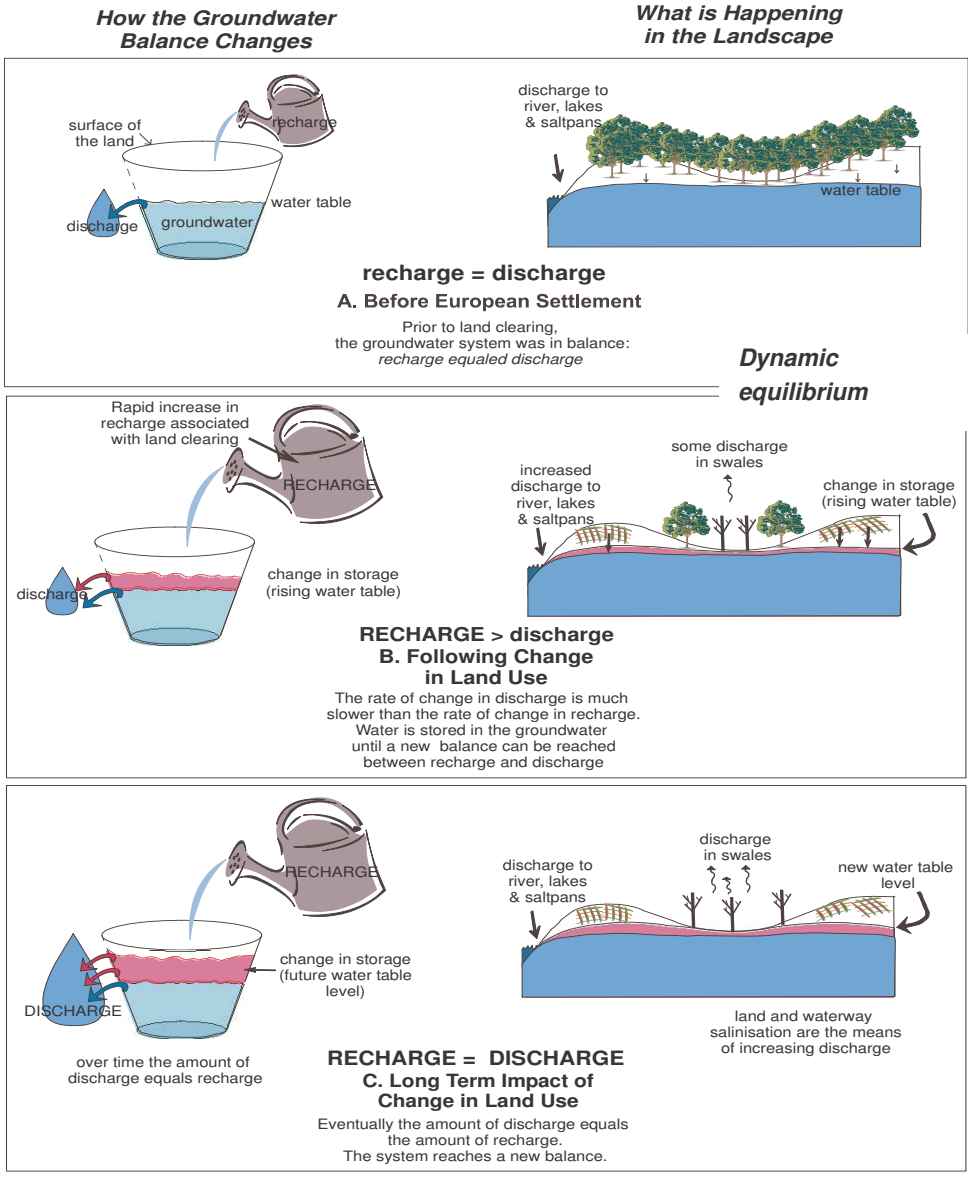
- **Irrigation salinity in irrigated areas** – caused by a combination of irrigation and land clearing. This type of salinity is most prevalent in the Macalister Irrigation District and causes significant economic impacts to the predominantly dairy industry in the area.
- **Irrigation salinity in dryland areas** – caused by a combination of irrigation in up-catchment areas and land clearing. The most severe salinity in the region occurs in the dryland areas adjacent to irrigation areas. In these areas, up-gradient irrigation has resulted in an increase in the water table level with the soils only flushed with rainwater and not irrigation water. The result is that more salt can build up in the soils relative to the adjacent irrigation areas where fresh irrigation and rainwater is continually flushing salt through the soil profile. The extensive salinity in the lower Clydebank area is the best example of this type of salinity in the region.
- **Dryland salinity –** caused by the replacement of high water using native vegetation with low water using pastures and crops. Dryland salinity is not as concentrated as irrigation salinity in the area and occurs in small pockets over many of the dryland catchments. It is most prevalent in the Bengworden, Foster and Port Albert Salinity Management Areas. Dryland salinity tends to occur in the lower parts of the landscape where the topography and water table are closest.

Depth to water table is a useful parameter for determining the areas either currently salinised or at risk of becoming salinised. Figure 5 shows the current depth to water table across the region compiled from observation bore data and topographic information. The reliability of the map is highly variable depending on the density of bore information (Figure 5 inset). The highest reliability occurs in the Macalister Irrigation District and surrounds where there are more than 300 observation bores monitored on a monthly basis. However, Salinity Management Areas such as Trafalgar have very few observation bores with a consequent low reliability of depth to water table mapping. Depth to water table is the primary factor in determining salinity risk, although there are

other factors such as groundwater salinity, degree of flushing and rainfall. The depth to water table map corresponds well with the mapped saline areas. However, it also highlights areas that have the potential to become salinised in the future.

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. A more detailed description of this concept is given in SKM (2005 in prep).

- **Figure 4: Change in recharge/discharge relationship after the clearing of land**



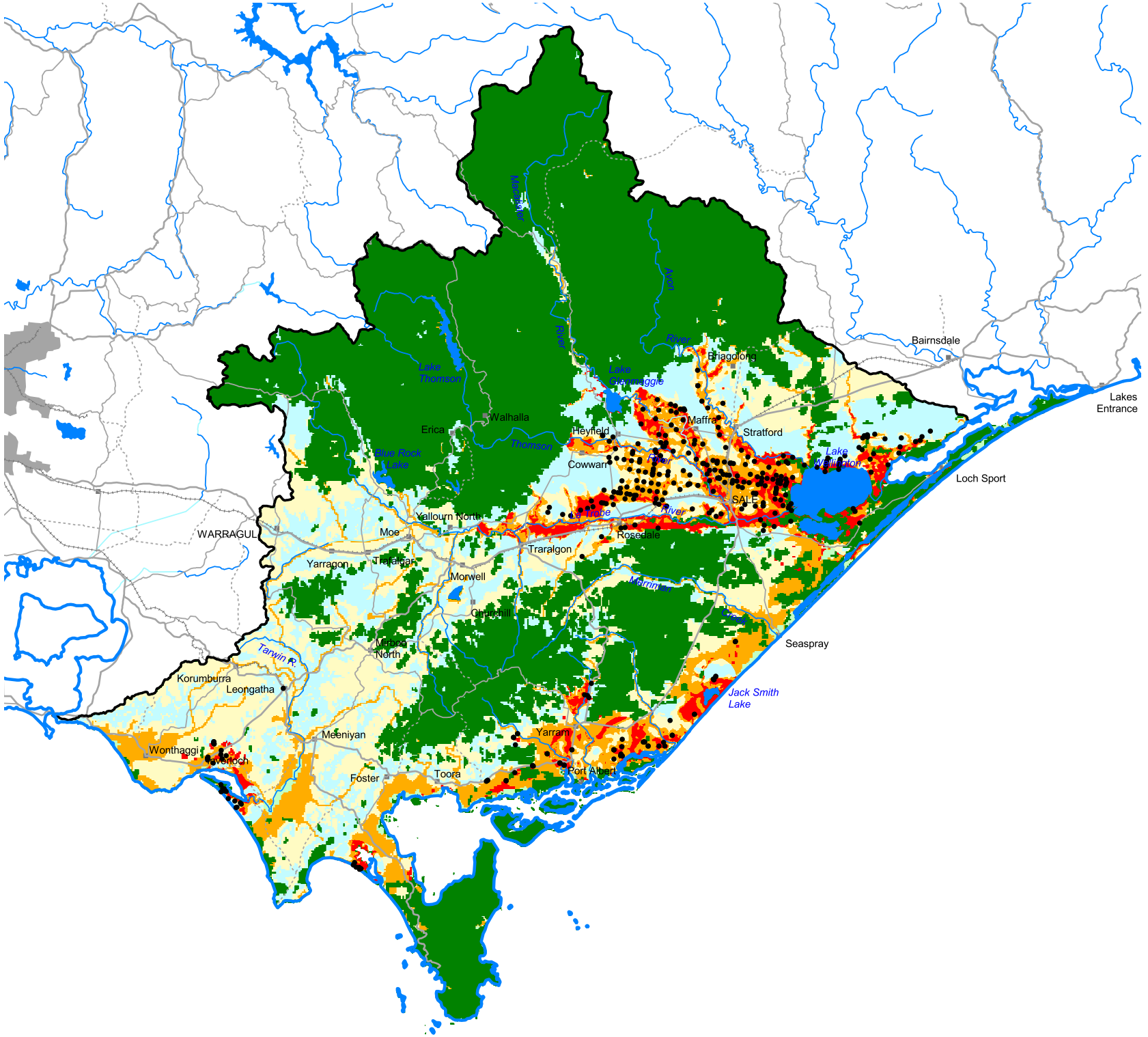
i:\wcms\wc01035/031/images/figure1_2.cdr

Figure 5

West Gippsland Catchment Management Authority

West Gippsland Salinity Management Plan

Interpreted Watertable Depth (2002)



0 10 20 30 40 50 Kilometres

Watertable Depth (m)

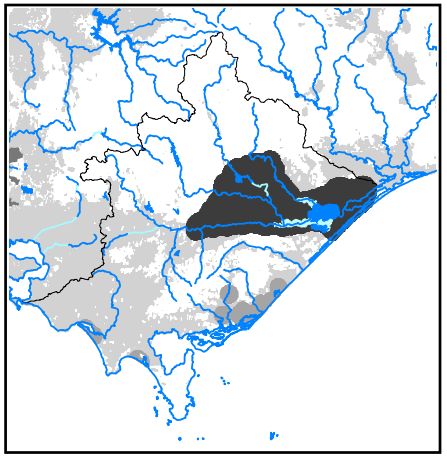
- < 2
- 2 - 5
- 5 - 10
- > 10
- Costal Plain (After NLWRA)
- Forest (After NLWRA)

Location of bores used in the Macalister Irrigation District and Surrounds and the South West Gippsland Salinity Review.

Reliability

- High (Macalister Irrigation District and surrounds)
- Moderate (South West Gippsland Salinity Review)
- Low (National Land and Water Resources Audit)
- No Data

Reliability



SKM

Refer to Sinclair Knight Merz document WCMS\wc02655\technical\gis\Wc02655t002.apr; Watertable depth (Layout)