2. Method

2.1 Key data sets to compile GFS maps

The method used to define groundwater flow systems in West Gippsland was broadly based on the national approach (eg Coram *et al*., 2001 and Coram *et al*., 2000). The methodology involved analysing four key information sets:

- Geology;
- Topographic slope;
- Soil permeability; and
- Knowledge of groundwater characteristics of specific areas.

Geology

The key parameter that dictates the behaviour and flow patterns of groundwater is geology which was the primary criteria used to divide the area into groundwater flow systems. The geology information was sourced from the GIS layers of the Sale, Warragul, Warburton and Bairnsdale 1:250,000 scale geology sheets. The hundreds of mapped geological units were lumped into the categories shown in Table 1 based on their expected hydrogeological characteristics. The resultant geology map is shown in Figure 5.

Table 1: Geology categories

Age	Rock/sediment type	Formations
Palaeozoic	Igneous and metamorphic	Omeo Metamorphics, Wentworth Group, Buchan group, Omeo Group, Adminaby Group, Cobbanah Group, Jordan River Group, Cathedral Group, Seaspray and Sale Groups
Cretaceous	Sedimentary	Strzelecki Group
Tertiary	Basalt	Latrobe Valley Coal Measures
Tertiary	Sands	Haunted Hills Gravels
Tertiary	Limestone	Gippsland Limestone
Quaternary	General alluvial deposits	-
Quaternary	Recent River Alluvials	-
Quaternary	Swamp deposits	-
Quaternary	Coastal dunes	-
Quaternary	Inland aeolian dunes	-
Quaternary	High level terraced alluvial deposits	-

Topographic Slope

Topographic slope can provide valuable information on the length of the groundwater flow path from recharge to discharge (ie regional, intermediate or local). This is because watertable levels tend to be subdued reflections of the topography and therefore groundwater flow directions tend to follow topographic slope (ie from high to low elevation). Although this is not always the case, this rule of thumb can be used to gauge the general flow direction and length. For instance, in heavily undulating hills, the groundwater flow paths tend to be short with recharge and discharge areas located close together. Conversely, in flat plains, groundwater flow paths tend to be much longer with tens or hundreds of kilometres between recharge and discharge areas.

To create a map of slope, a digital elevation model was first created using the following information:

- Vicmap 1:25,000 scale topographic contours;
- Vicmap 1:25,000 scale spot heights;
- Surveyed natural surface elevations from a selection of observation bores; and
- Surveyed natural surface elevations in key urban areas such as Sale, Leongatha, Port Albert, Inverloch, Rosedale and Seaspray. (These areas are important for another project investigating urban salinity).

The resultant topography surface is shown in Figure 6.

The following slope categories were used in this study consistent with the method used to define the National Groundwater Flow Systems Map (Coram *et al.*, 2000):

- <0.3° (less than 5 metres rise over 1 kilometre),
- 0.3 to 1° (5 to 17 metres rise over 1 kilometre),
- 1 to 2° (17 to 35 metres rise over 1 kilometre),
- 2° to 5^0 (35 to 87 metres rise over 1 kilometre).
- 5° to 10^0 (87 to 176 metres rise over 1 kilometre).
- $>10^0$ (greater than 176 metres rise over 1 kilometre)

The topographic slope map is shown in Figure 7.

Soil permeability

Soil permeability is a critical factor in determining the amount of vertical recharge to the underlying water table. The recharge characteristics have a large bearing on the types of management options planned for a particular landscape. In this study soil permeability was used to divide some of the geological units into areas of radically different recharge characteristics.

The soils of West Gippsland have been mapped by Sargeant and Imhof (2000) and Sargeant and Imhof (in press). As part of this study of groundwater flow systems, the mapped soils were classified into relative permeability categories ranging from very high to very low as shown in Figure 8. The permeability classification is based on local experience in soil mapping rather than

any specific measurement of the soil permeability. Therefore, the map should be viewed as an interpretation only and subject to change as more information is collected.

Knowledge of specific areas

Knowledge of groundwater characteristics of specific areas were also used to define the groundwater flow systems including:

- A study by SKM (2000) of the groundwater flow system in the Bengworden area that indicated the Quaternary dunes systems located north of a line joining Paynesville and Perry Bridge have clay cores and are not connected to the regional shallow aquifer. This contrasts with the dune systems south of this line, which do not have clay cores and are connected to the regional aquifer system.
- A variety of studies into the geology/hydrogeology and salinity issue in the Macalister Irrigation District and surrounds that indicate the watertable is largely controlled by a shallow semi-confined gravel aquifer between 10 to 20 metres deep (eg SKM (1998), WGCMA (2005) and SKM (2004c)).