3 Hydrogeology

A detailed description of the hydrogeology of the Timor West targeted area is provided in the brochure 'Timor West Targeted Salinity project' (Perry 2003). Saline discharge at the base of Black Range and Mount Hooghly (Figure 3) is interpreted to be the result of local groundwater systems, where recharge (top-mid slope) and discharge (base of slope) occur very close together. The change in morphology from hills to flat plains causes groundwater to discharge at the break-of-slope. High upward pressures are evident at these sites where bore waterlevels rise close to the surface during wetter seasons, as seen in Bore 5126 located in the Black Range (Appendix 1).

Groundwater flow systems in Timor West

The groundwater flow systems that occur in the Timor West targeted area include local flow systems in sedimentary and metamorphic fractured rock aquifers′; local to intermediate flow systems in upland alluvial plains and basaltic rocks; and local flow systems in decomposed granite (Figure 4). The metamorphic ridges of the Black Range are deeply weathered fractured rocks. Local groundwater systems occur in this type of aquifer. Groundwater recharge is high, particularly on the upper slopes and crests. Groundwater migrates from the slopes towards the adjacent valley floor and is transmitted largely by the underlying fractured rock. Groundwater discharge and salinity occurs at the break-of-slope and valley floor (Coram, Dyson & Evans 2001).

Two major groundwater flow systems in the Timor West area are the local flow systems in granite and local to intermediate flow systems in upland alluvial plains (Shepparton Formation). Groundwater flow systems in the granite are characterised by small flow systems in superficially weathered rocks, with groundwater flow converging on downslope regions. Recharge occurs in phase with seasonal rainfall patterns and produces a distinct filling and draining response in high areas, which is subdued in the lower landscape. Saline discharge occurs at break-of-slope as well as into streams (Corum, Dyson & Evans 2001).

The local to intermediate flow systems associated with the upland alluvial plains forms a major aquifer in the area and groundwater is saline, ranging from 3000 to more than 20 000 EC (Table 1).

Groundwater recharge occurs on the slopes of the broad valleys, converging on the semi-confined transmissive aquifers on the valley floors. Recharge is episodic, reflecting climatic variation with seasonal fluctuations observed on the hydrographs of 1–2 m a year not uncommom (e.g Bore no. 149, near Emu Creek, Appendix 1).

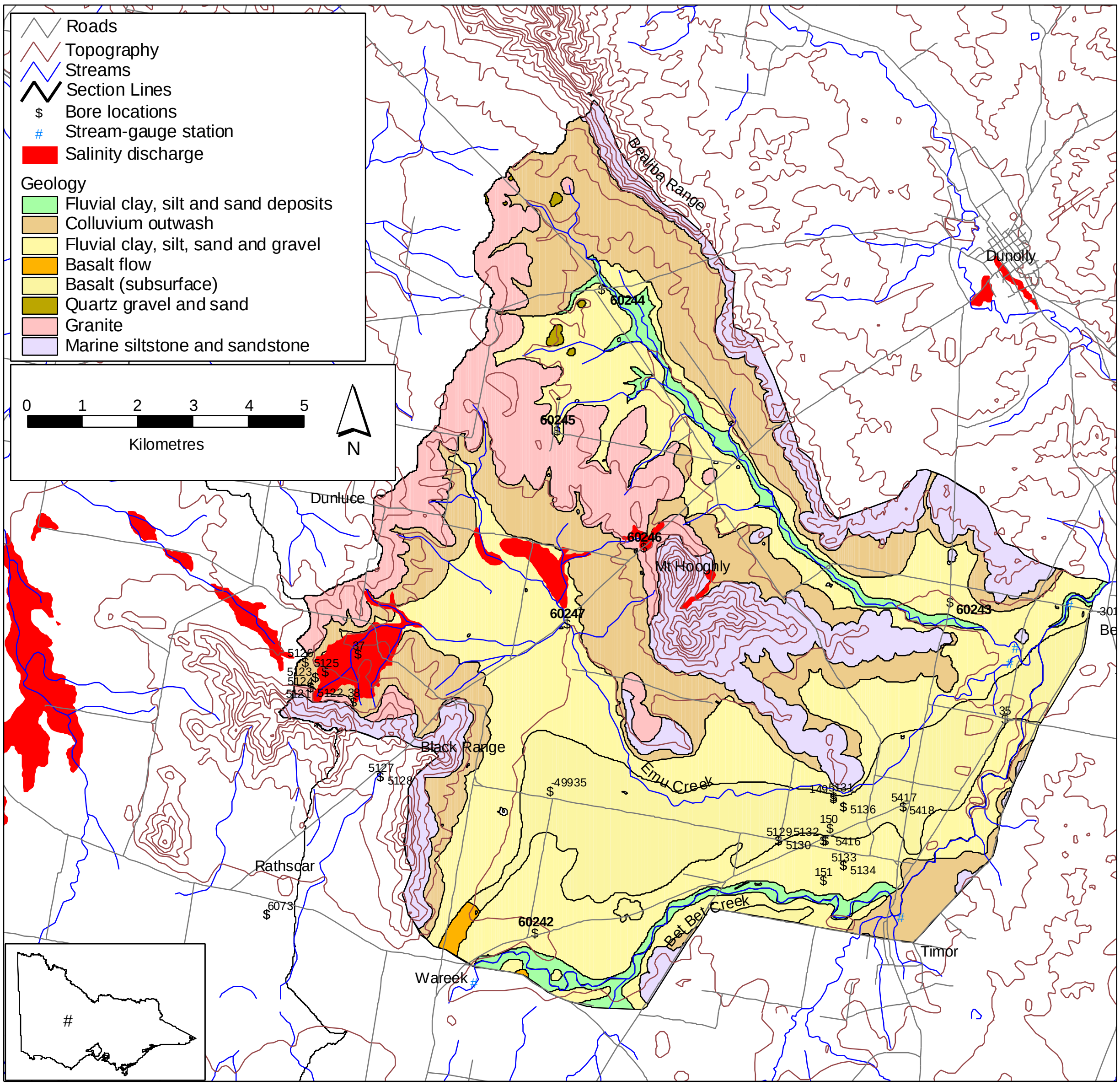

Figure 3 Map of geology of the Timor West targeted area

Current groundwater trends in Timor West

There are 19 groundwater monitoring bores across the Timor West targeted area with six new bores installed to fill the gaps in the groundwater monitoring network. A primary aim of long-term groundwater monitoring is to detect changes in groundwater trends that may be attributable to land use change or the adoption of certain land management practices. It is a feature of the Timor West targeted area that strong groundwater fluctuations are observed in hydrographs as groundwater systems in the area tend to be very responsive to local climatic variation.

Representative hydrographs in the Timor West area show groundwater response in the different aquifers. Bores 5121-22 (Appendix 1) show that the metamorphic ridge around the Black Range is highly responsive to climatic variation.

Fluctuations in the groundwater level of 2–3 m can occur during times of high rainfall, with the sharp drop in water level (seen as a trough in the hydrograph) indicating that the groundwater moves quickly. The hydrograph for 5121-22 shows a strong falling trend since 1997, which is indicative of groundwater trends in response to the period of low rainfall for the Timor West area.

Bore 37 (Appendix 1) shows very strong fluctuations in water level, as groundwater levels are less than 1 m from the ground surface. This bore is 18 m deep, indicating possible upward groundwater pressure. Bores 5123-24, like 5121-22, rise and fall in response to climatic variation, but are less amplified. When rainfall was high in the late 1980s, when rainfall was high, water levels began to rise, in some cases by 3 m in three years (e.g. Bores 5125, 5123-24). Water levels began to fall dramatically in 1996, when annual rainfall was below average.

Bore 5125 exhibits groundwater trend behaviour indicative of high recharge in a deeply weathered, fractured rock aquifer, typical of the metamorphic ridges in the Timor West area. The strong peaks and sharp falls indicate a groundwater system that is very responsive to local climatic variation and recharge occurs quickly. However, the Shepparton Formation has a more subdued response and slower recharge rate as seen in the hydrographs for Bores 5133-34 (Appendix 1) around the Timor township. This aquifer is responsive, but not to the extreme of the metamorphic ridge aquifer.

Bore 151 and Bore 36 (located in the Bet Bet Deep Lead, east of the targeted area) both monitor the Bet Bet Deep Lead. The hydrographs for both bores show a subdued response to local climatic variation, which indicates connectivity between the Bet Bet Deep Lead and overlying Shepparton Formation to the surface.

Some of the bores installed in the early 1980s have no record of a bore log, thus the aquifers through which these bores pass are inferred rather than known. This is a limitation in the available data. Also, many of the bores (e.g. Bores 5416, 5129, 149) exhibit data gaps between 1993–1997 (shown on the hydrographs as a blank period). Thus the groundwater behaviour for this period is inferred also.

Table 1 lists 19 bores monitored on a regular basis in the Timor West area. Many of these bores have 15-20 years of recorded data and therefore have a good record of change in groundwater trends over the past decade. It is noticed in the hydrographs of these bores (Appendix 1) that the highest recorded groundwater level occurred in the late 1980s and the lowest was taken from recent recordings.

Table 1 shows that when it is very wet, water levels rise to within 3 m of the surface at most bore sites. During dry periods water levels can in some cases levels drop by nearly 10 m (e.g. Bore 5121). What is interesting to note is that most bores have quite shallow waterlevels, even during the recent dry period. Many of these bores have 15-20 years of recorded data and therefore have a good record of change in groundwater trends over the past decade.

Table 1 Summary of key bore data in Timor West targeted area

Bore no.	Total depth (m)	Highest recorded waterlevel below ground level (1989)	Lowest recorded waterlevel below ground level (2002)	Record in years
35	60.0	2.5	4.5	18
36	90.0	2.5	4.5	17
37	18.0	0.2	1.5	17
38	27.0	0.7	4.0	6
149	15.0	0.2	2.3	21
150	30.7	0.5	2.7	20
5121	18.5	0.2	9.8	16
5122	6.0	0.2	9.7	16
5123	18.5	2.7	7.1	17
5124	6.0	2.7	7.1	17
5125	6.0	0.3	2.7	17
5126	6.0	0.2	1.4	22
5131	3.0	2.0	2.6	8
5132	8.8	0.4	2.5	23
5133	4.9	1.7	4.5	23
5134	3.0	1.7	3.0	13
5136	20.0	0.7	2.4	22
5417	5.2	3.2	5.5	23
5418	17.0	5.2	6.5	23
49935	22.0	No data	No data	15