3 Hydrogeology of Bet Bet

A detailed description of the hydrogeology of the Bet Bet targeted area is provided in the brochure 'Bet Bet Targeted Salinity Project' (Perry 2003). Much of the groundwater is confined to fractured sedimentary rock and sandy weathered alluvium and colluvium in local groundwater systems that strongly recharge during times of high rainfall. Saline discharge occurs at the break-of-slope (Figure 4), and along alluvial valleys and many of the creeks that drain into Bet Bet Creek and eventually into the Loddon River.

Groundwater flow systems in the Bet Bet targeted area

The groundwater flow systems (Figure 4) occurring in the Bet Bet targeted area include local flow systems in fractured sedimentary and metamorphic rocks, local flow systems in alluvial and colluvial fans on granite rocks, and local and intermediate flow systems in upland alluvial plains. This is based on the classification system by Coram, Dyson and Evans. (2000).

Local flow systems in sedimentary rock operate over scales ranging from individual hillslopes to several kilometres in length. Groundwater recharge is strongly seasonal and soils are shallowest and most permeable at the tops and upper slopes of sedimentary and metamorphic ridges. Groundwater discharge is common in two points in the landscape, at the break-of-slope and along streams (SKM 2003).

The change in the slope of the watertable is less than the slope in land surface, as the watertable approaches the land surface at the break-of-slope, the watertable intersects the land surface resulting in groundwater discharge. In the Bet Bet targeted area, the majority of the groundwater discharge occurs as saline discharge into streams and gullies (Figure 3).

Groundwater flow in granite flow systems is confined to sandy weathered material (colluvium) and operates on a hillslope scale. Discharge occurs in drainage lines and in valley floors where colluvial/alluvial material is finer and hydraulic conductivities are lower. The highest salinity reading was for Bore 60249 (Table 2), situated at a discharge site, in a drainage line running off the granite outcrop (Figure 4).

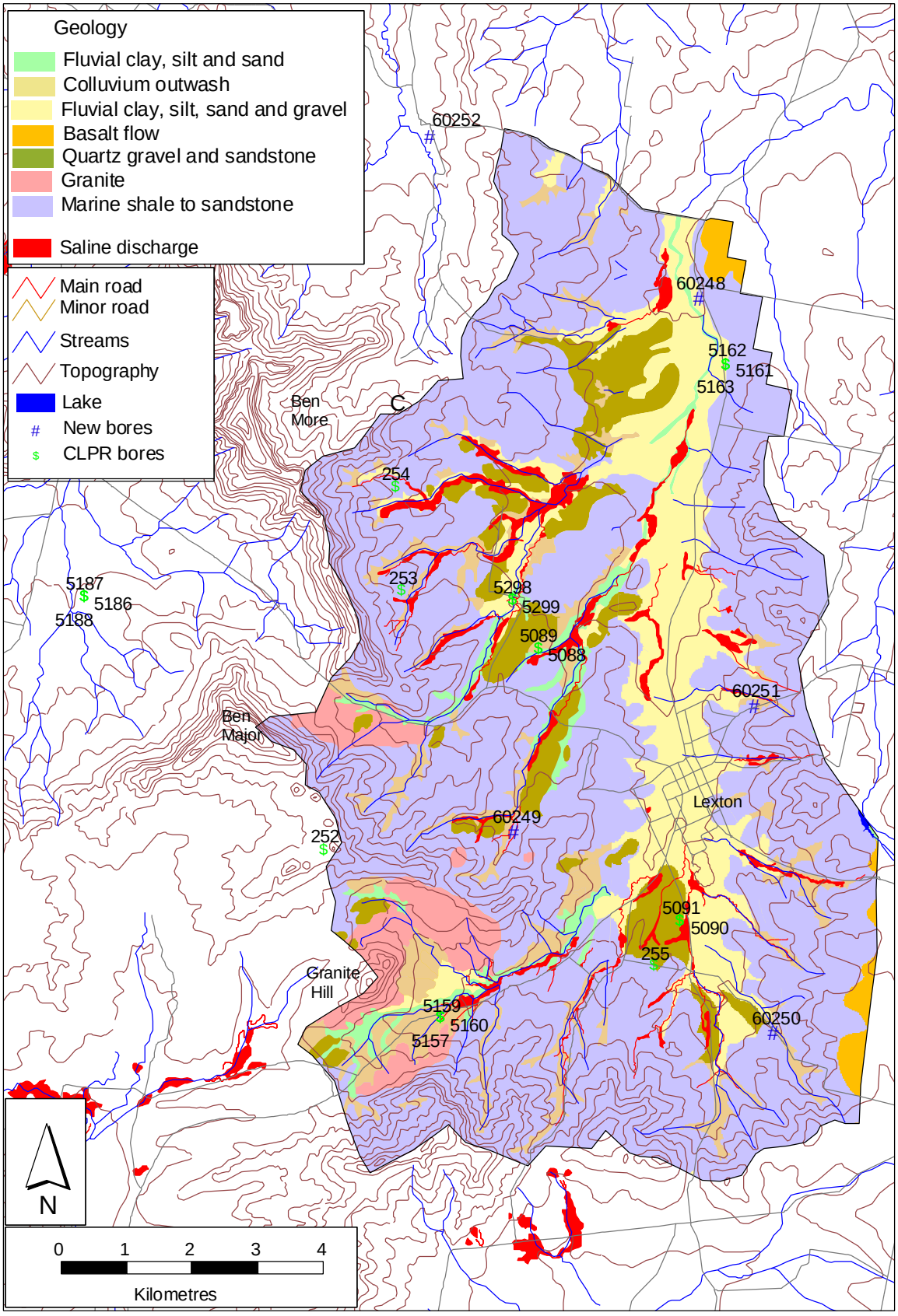

Figure 3 Map of geology, groundwater bores and saline discharge in the Bet Bet targeted area.

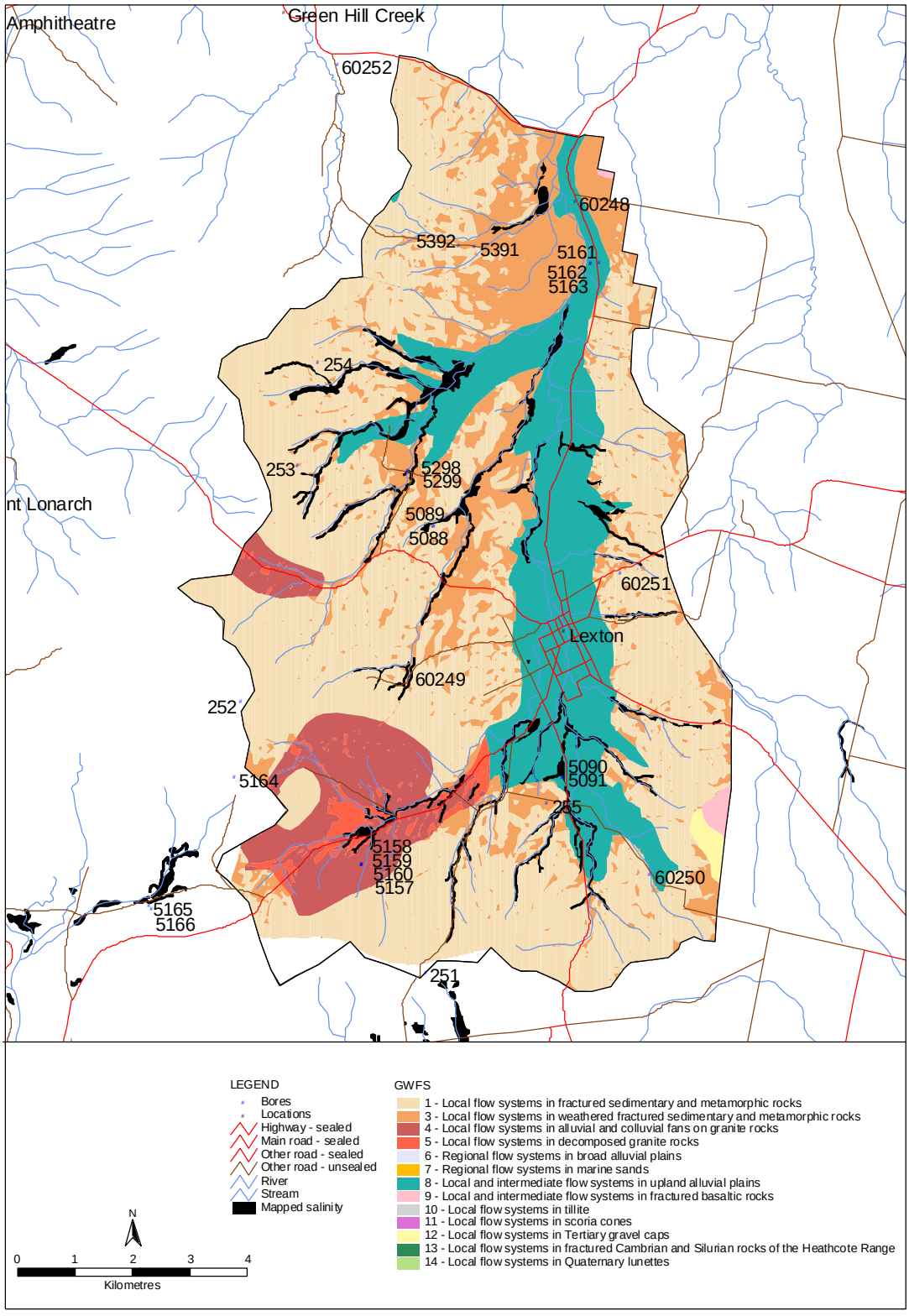

Figure 4 Groundwater flow systems in the Bet Bet targeted area

Groundwater trends in the Bet Bet targeted area

The Lexton area was one of the earliest recognised salinity affected areas in the Loddon dryland catchment area (Heislers 1996). As a result approximately 15 groundwater monitoring bores were installed in the mid to late 1980s (Table 1). Unfortunately many of these bores have either lapsed or have large gaps in the monitoring record (e.g. Bores 254, 5088-89, 5090-91, 5157, 5159, 5160 Appendix 1). However, there was enough information collected periodically from DPI monitors over the past 15 years to determine distinct groundwater trend behaviour.

A feature of the bores across the Lexton region is that strong groundwater fluctuations are observed in many of the hydrographs (e.g, Bore 5159 Appendix 1). Groundwater recharge is strongly seasonal, reflecting winter and spring rains in excess of plant requirements and soil water storage capacity. During dry periods, water levels can drop by around 4.0–6.0 m (e.g. Bores 254 and 5161).

Localised groundwater systems in the fractured sedimentary groundwater flow system tend to be very responsive to rainfall. In some cases there is up to 1 m difference between the winter and summer watertable level. An underlying falling groundwater trend is evident in some hydrographs (e.g. Bores 5160, 5159 Appendix 1). Bore 255 (Appendix 1) located above a discharge site, shows an extreme rate of recharge with water levels rising 5 m in a 12 month period over 1995–96. This indicates that the localised groundwater flow system in the fractured sedimentary rock rapidly recharges immediately after a rainfall event. Evidence of the 1994 drought can be seen as a 2 m fall in water level in bores located in local flow systems in fractured sedimentary and metamorphic rocks (e.g. Bores 253, 5161 Appendix 1).

Bores located in fluvial stream deposits and colluvial outwash from sedimentary hills tend to have a very high watertable (e.g. Bores 5088-89, 5162), which is characteristic of discharge areas. In the Bet Bet targeted area, some groundwater discharge occurs at the break-of-slope, but most is in streams. Being local groundwater systems, high recharge and discharge occurs over short periods of time, as exhibited in hydrographs for the transect of Bores 5159-63 (Appendix 1) across a discharge area. Overall data from groundwater bores shows that the Bet Bet targeted area is dominated by local groundwater systems and watertable fluctuation is very much dependant on local seasonal climatic variation.

A limitation of the data is that in many of the bores (e.g. Bores 254, 5157, 5159, 5160) there are gaps between 1993–1997 (seen on the hydrographs as a blank period). Thus the groundwater behaviour for this period is inferred. Also some bores have no readings after 1991 (e.g. Bores 5090-91). With ten years of missing data, groundwater behaviour and trends are inferred from bores located in similar groundwater flow systems. Some bores, installed in the 1980s, are missing bore logs and bore depth information (Table 1), and therefore aquifer details are inferred rather than known.

Table 1 Summary of key bore data in the Bet Bet targeted area

Bore no.	Total Depth (m)	Highest recorded waterlevel below ground level (m) (year)	Lowest recorded waterlevel below ground level (m)(year)	Record in years
253	53.0	16.5 (1991/92)	19.0 (1996)	7
254	53.0	22.5 (1991/92)	28.0 (2002)	13
255	69.0	6.5 (1991/92)	10.8 (1996)	12
5088	18.2	0.5 (1991/92)	2.2 (2002)	20
5089	6.0	0.6 (1991/92)	2.2 (2002)	20
5090	20.0	1.3 (1984)	2.5 (1990)	8
5091	7.0	1.3 (1984)	3.3 (1984)	8
5157	17.3	5.5 (1990)	10.0 (2003)	14
5159	15.2	0.5 (1991/92)	2.2 (2003)	14
5160	3.3	0.6 (1991/92)	2.2 (2003)	14
5161	19.2	6.2 (1989)	10.2 (1995)	10
5162	16.7	1.0 (1989)	2.5 (1995)	10
5163	-	1.0 (1989)	2.5 (1995)	10
5298	-	1.7 (1999)	2.7 (2003)	5
5299	-	1.5 (1998)	2.5 (2003)	2.5