Groundwater
Lower Taieri Basin
Summary Report December 09

Otago Regional Council

Project findings

Contents

Otago Regional Council (ORC) is responsible for managing the region's groundwater resources.

To ensure that its management approaches are well informed and considered, ORC undertakes a series of focused scientific investigations of the region's aquifers. Usually these investigations are directed towards determining the sustainable volume of groundwater that can be allocated for use.

This summary covers the context and findings of an investigation that was conducted in 2008 and 2009 for the Lower Taieri Basin.

The parent report, Lower Taieri Groundwater Allocation, covers the data used in the investigation, analyses the groundwater system and details computer modelling used to support the resource management tools, including the recommended allocation volume. It is a technical study based on available data and an assessment of environmental impacts. The results can be used in future policy setting after public consultation looks at all socio-economic issues.

Currently, there are relatively low volumes of groundwater pumped in the Lower Taieri Basin compared to the basin's potential groundwater resource use.

The majority of consented groundwater takes are utilised to supply Mosgiel with municipal water, and a minor quantity of takes are used for associated industry. A handful of small agricultural irrigation takes from bores make up the rest of the allocated groundwater, bringing the combined basin groundwater allocation total to 2.4 million cubic metres per annum (abbreviated to Mm^3/yr).

There are also a large number of domestic and stock water supply bores throughout the basin, which draw only modest quantities from the groundwater system.

Basin setting

The Lower Taieri Basin is a tectonic depression resting between two major faults. Three rivers cross the plains – the Silver Stream, Taieri and Waipori - so the basin has become a site for the deposition of sand, gravel, silt, clay and peat. These sediments are saturated close to the surface and the groundwater system extends to more than 200m below the surface.

The basin has no direct exposure to the coast, although brackish tidal water comes from Taieri Mouth up a bedrock gorge into the basin as far as Lake Waipori. In the Mosgiel area, the mixture of sediments is layered with discontinuous silt lenses. By contrast, the West Taieri area is consistently layered with more distinct, traceable silt, sand and gravel layers.

A fine-grained estuary deposit was also formed when a marine embayment filled the basin. It covers three-quarters of the basin from Henley to Riccarton Road, but not as far as Mosgiel. This Waihola Silt and Sand has low permeability and confines and pressurises the underlying gravel layers to produce artesian aquifers.

Flows

The basin's groundwater system is replenished by recharge from rainfall and river water infiltration. The lower reaches of the basin's rivers receive the outflow balance of groundwater as seepage through their river beds. Some outflow also takes place into the West Taieri Drainage Scheme as a result of upward groundwater seepage from the underlying aquifer.

There is a general direction of groundwater flow from the Mosgiel area, where much of the recharge occurs, to low-lying areas such as the West Taieri Drainage Scheme and Waipori-Waihola wetlands.

The Taieri River around Outram, the Silver Stream near Mosgiel and the Waipori River upstream of Berwick are all important in replenishing the groundwater system as well. Figure 1 illustrates the layout of the basin, including a schematic cross-section with the aquifer systems' groundwater flow directions.

Quality

The Lower Taieri Basin currently has few water quality impacts related to human activities. A small area of the basin around Mosgiel is susceptible to elevated nitrate concentrations. However, the remainder of the groundwater system has natural geochemical factors suppressing nitrate levels through denitrification.

Prevailing elevated iron, manganese and corrosivity levels exist through much of the groundwater system. However, these conditions are both natural and ambient.

Numerical model and allocation settings

A numerical groundwater model was developed to assess the sustainable groundwater resource and determine the potential groundwater allocation limits and restriction levels for the basin. The rationales of applying both allocation limits and level restrictions are as follows:

a) Allocation limits address cumulative effects of combined groundwater extraction on the aquifer and connected surface water.

b) Restriction levels form a back-stop role in easing the effects of any declining groundwater levels.

The basin has been divided into East and West zones due to distinctions in the potential impacts of groundwater pumping. The modelling and assessment of scientific data identified the following allocation volume limits for the Lower Taieri basin:

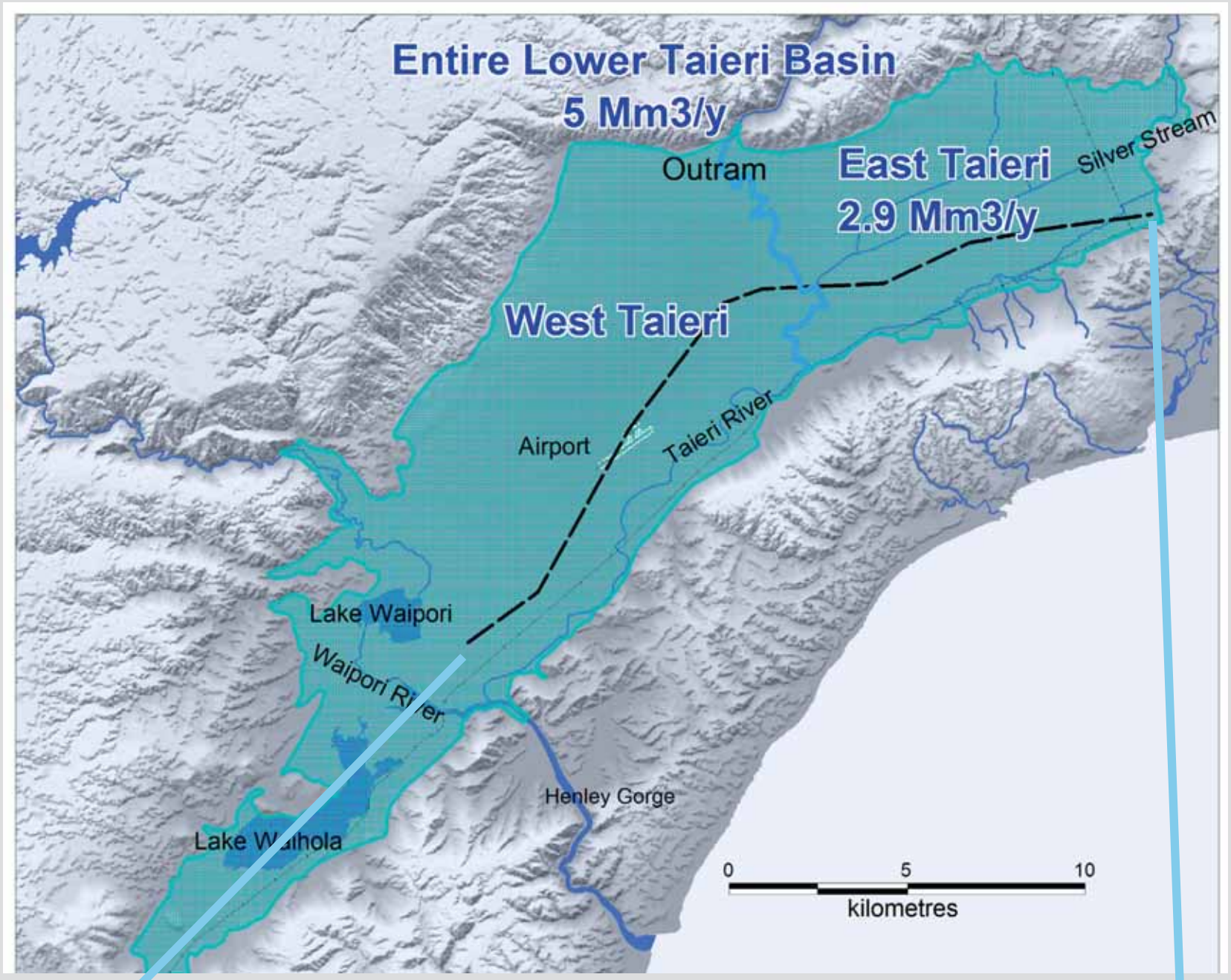
Zone	Suggested groundwater allocation cap	Current consented allocation
East Taieri	2.9 Mm3/yr	2.2 Mm³/yr
Lower Taieri Basin	5.0 Mm³/yr	2.4 Mm³/yr

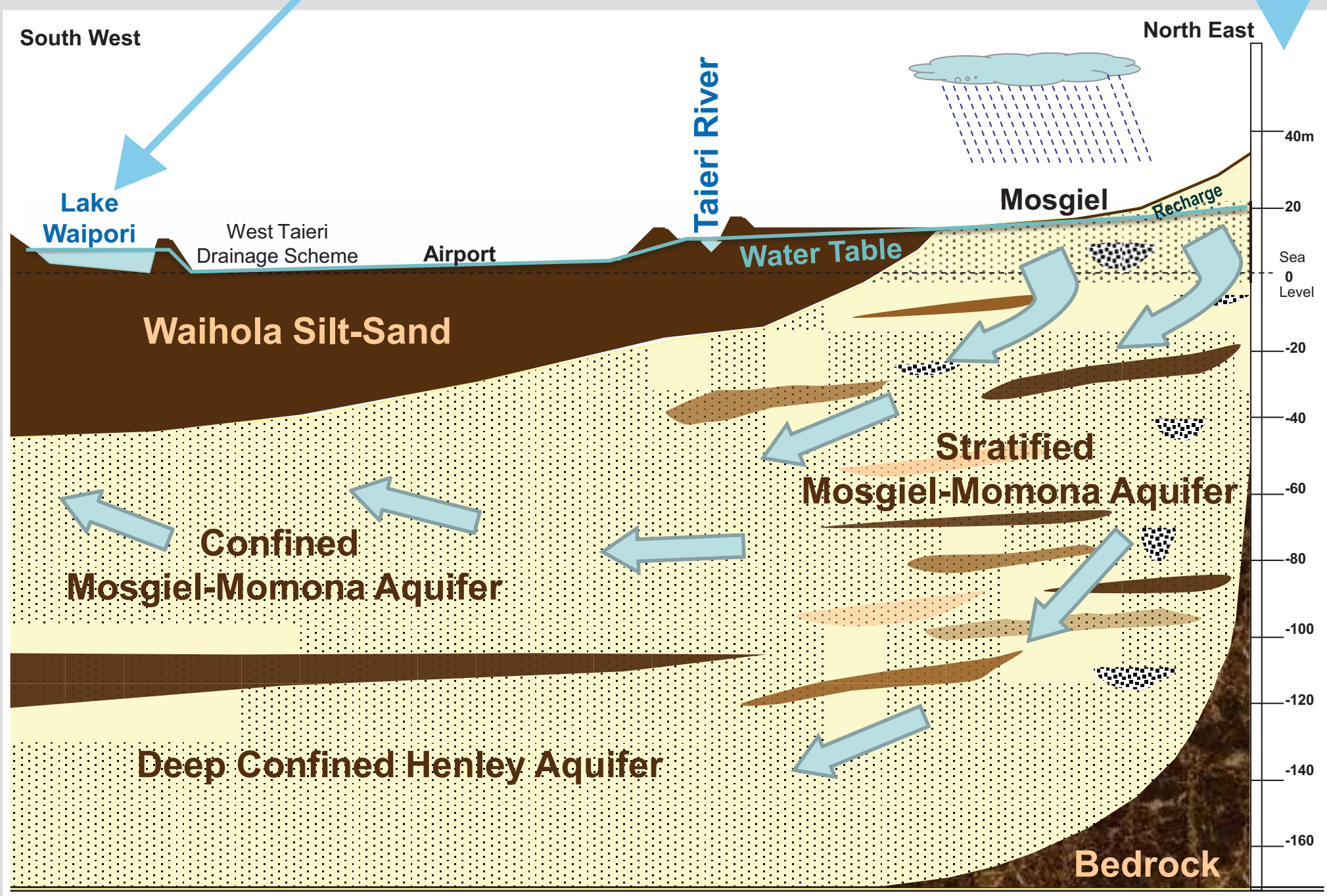
Pumping in the East Taieri zone has a greater potential impact on the flow of the Silver Stream, which justifies a more stringent allocation limit being placed on it.

The consented allocation within East Taieri is already 2.2 Mm³/yr. Setting the maximum suggested allocation cap to 2.9 Mm³/yr would lessen the likelihood of substantial effects on the Silver Stream while allowing for modest expansion of the groundwater available for utilisation. However, the suggested limit could increase the flow loss from the Silver Stream by up to 25 litres per second.

The Lower Taieri Basin allocation limit of 5 Mm³/yr represents approximately 12% of mean annual recharge of 43 million cubic metres per annum to the basin's aquifers from all sources, including rainfall recharge and river infiltration. This is illustrated in Figure 2.

Figure 1.
Map and schematic cross-section from Wingatui to Lake Waipori





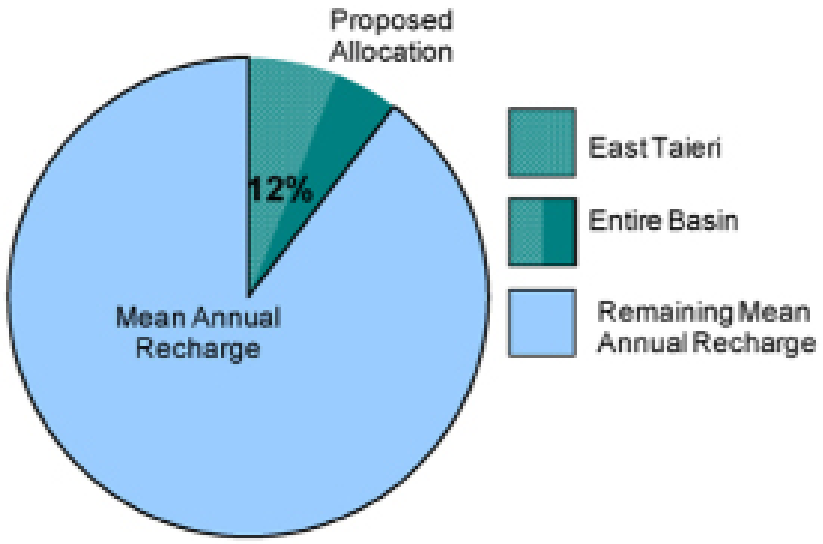


Figure 2. Proportions of water allocation of 5 Mm³/yr relative to the full mean annual recharge in the Lower Taieri Basin

The West Taieri zone is comparatively undeveloped, yet groundwater modelling suggests that further groundwater abstraction up to 3 Mm³/yr could be allowed without causing adverse effects on the aquifer or adjoining surface water systems. There is the potential for beneficial effects of such abstraction in reducing the requirement for drainage system pumping.

Level restrictions

It is suggested the Lower Taieri - East Water Take Restriction Zone levels in Schedule 4 of the Regional Plan: Restriction Levels are amended as follows:

Units: m AMSL in Harley's Bore P2	Recorded max	25% Restriction	50% Restriction	100% Restriction
Proposed	12.9	10.7	10.3	9.9
Existing	12.5	10.5	10.0	9.5

Note: When groundwater levels reach the restriction levels, consented groundwater users are required to reduce their takes by the stated percentage.

The amended restriction levels would serve as a secondary protection of the Silver Stream by limiting deep groundwater level declines as shown in Figure 3.

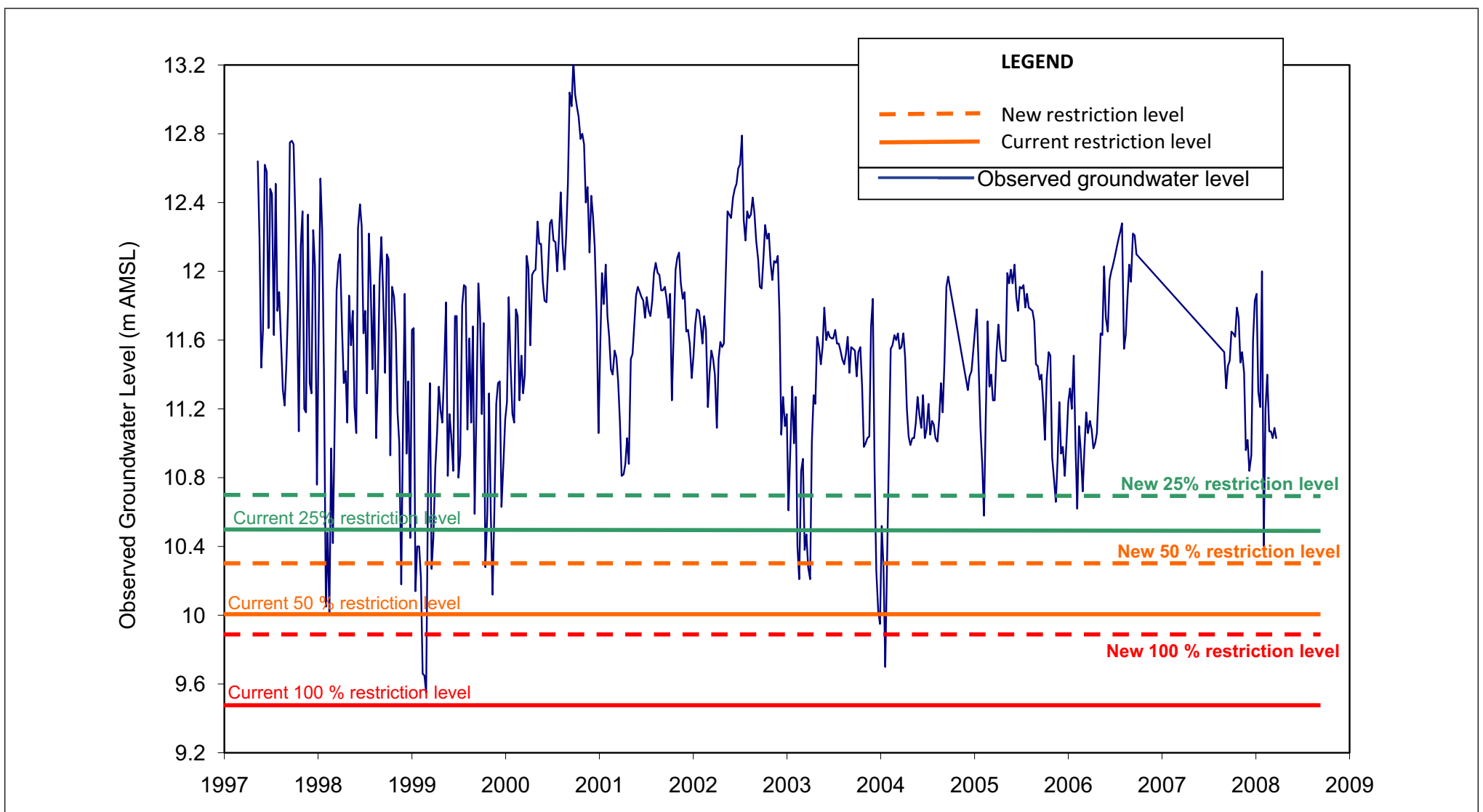


Figure 3. Groundwater levels observed in Harley Bore compared to suggested new restriction levels

The numerical model was also used to assess the possible impact of sea level rise on the groundwater system as the lower Taieri River and lakes are in the tidal range. By raising the sea level of the lower basin surface water bodies by 1.5 metres, adjoining groundwater levels also rise up to the same amount.

Providing that flood defences can be adapted and strengthened to hold back the surface waters, there should be no significant sea water intrusion of the Lower Taieri Basin aquifers as a consequence.

Further information on groundwater and monitoring is available on the ORC website:
www.orc.govt.nz

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