Chapter 27: Southern Valleys Catchments

Introduction

The Southern Valleys is a collective name for the tributary catchments on the southern fringes of the Wairau Plain that drain towards the Taylor or Opawa River systems.

The waterways which drain these valleys include the Waihopai River, Omaka River, Wards/Mill Stream, Fairhall River, Doctors Creek and the Taylor River. Associated with each river and occurring at varying depths below the surface, are a series of groundwater systems (Fig. 27.1).

The Lower Waihopai Aquifer is associated with the Waihopai River and also occurs on the elevated terraces surrounding the Delta Hill. As the name implies, the Omaka River Aquifer is closely linked to the Omaka River and extends as far downstream as the western boundary with Woodbourne.

In the neighbouring Omaka/Hawkesbury Valley to the east is situated the Omaka Aquifer. Further to the east and underlying the Fairhall-Brancott Valley is the Brancott Aquifer and the Fairhall River Gravels Aquifers; the Benmorven Aquifer underlies the Benmorven area. The Taylor River also forms part of the Southern Valleys catchments.

The Riverlands Aquifer is also now recognised as effectively an extension of the Southern Valleys Aquifer suite based on its similar hydrogeology and low yield.

The two features which distinguish the Southern Valleys Aquifers from groundwater systems further north beneath the Wairau Plain, are the ephemeral nature of the rivers draining these catchments and the impermeable nature of the sediments hosting aquifers. These factors mean the aquifers systems are poor natural reservoirs.

The rivers and streams which drain the Southern Valley Catchments naturally dry up during summer months. The lower reaches of the Fairhall River for example, are known to be dry for at least six months in an average year, and for longer during dry years. As a consequence, groundwater is important in these catchments because it represents the only reliable local source of freshwater, under normal summer conditions, for drinking and irrigation water. Although surface water is not a significant direct source of supply for irrigation water, it provides recharge water for groundwater. The shallow riparian type groundwater systems associated with the Omaka River, Taylor River, Wards/Mill Stream and the Fairhall River, rely directly on channel leakage for their recharge. Local rainfall is the only other source of groundwater recharge.

Distinctive spurs separate the individual Southern Valleys Aquifer systems. These ridgelines are formed of alluvium however, and don't present barriers to groundwater flow.

The Southern Valleys Catchments, together with their associated suite of aquifers, have been the focus of intensive water management and investigation since the early 1980s as the water resources in these catchments are heavily committed and close to natural sustainable limits in some summer seasons.

In order to overcome these allocation issues, the Southern Valleys Irrigation Scheme (SVIS) was developed in 2004 to augment local water resources.

Perhaps the Southern Valleys most significant feature is the dramatic variation in the availability of shallow groundwater through the drier summer months of January and February. While in some seasons water may be available in apparent abundance during late winter and early spring, it has generally drained away by February or March.

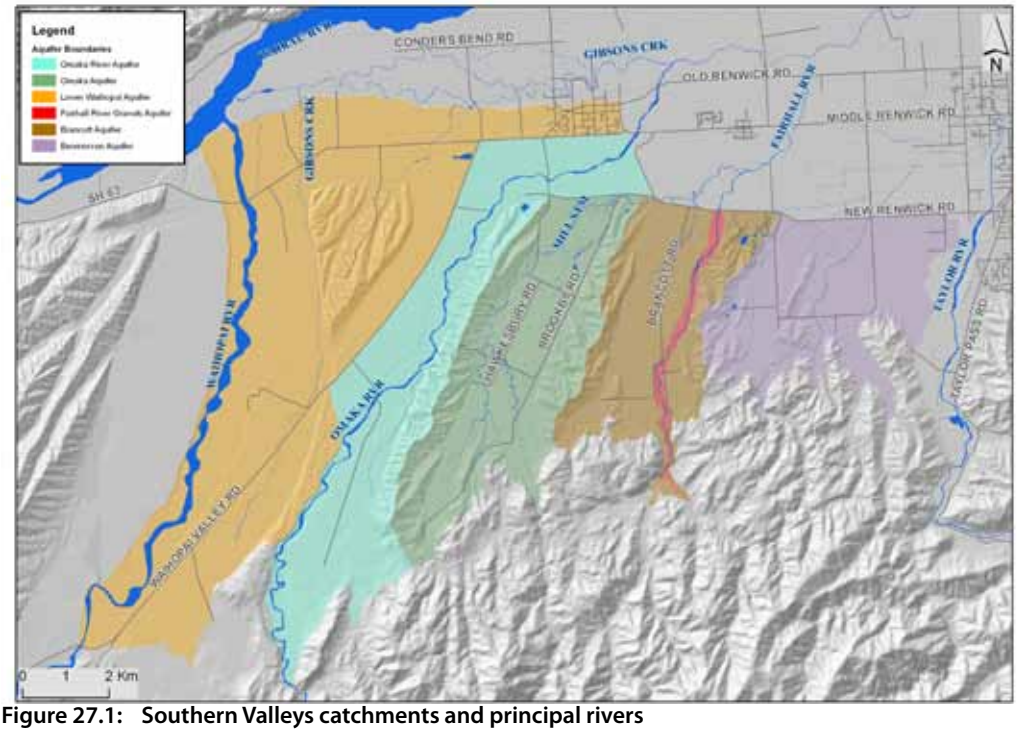

Figure 27.1: Southern Valleys catchments and principal rivers

Geology

The Southern Valleys are formed of glacial outwash material of varying ages. Most of the sediments making up the valley floors where wells are located, are mapped as Speargrass Formation. These sediments represent the remnants of glacial outwash material from the last glaciation. They consist of gravel with a high proportion of fines such as sands or clays, making them relatively impermeable, and as a consequence, poor aquifers. The sediments are generally found to decrease in permeability with depth.

The gravels are well rounded which shows they have originated from a relatively active fluvial environment. It is likely that the size of the ancient rivers that deposited the gravels were similar to the present day Taylor, Omaka and Fairhall Rivers.

Due to the stratified way in which the gravels forming the aquifers were deposited by local surface waterways, there is more horizontal than vertical continuity. This is reflected in differing groundwater flow rates in those directions. A consequence of the low energy environment in which the alluvium was deposited are poorly sorted gravels and characteristically small, dispersed water bearing layers (Fig. 27.2). This contrasts with the large, interconnected Wairau Aquifer formed of well sorted gravels sluiced by the more powerful Wairau River. This geology has consequences for the type of aquifers that are found in the Southern Valleys Catchments. Rather than a single discrete aquifer, groundwater systems are made up of many localised pockets of groundwater.

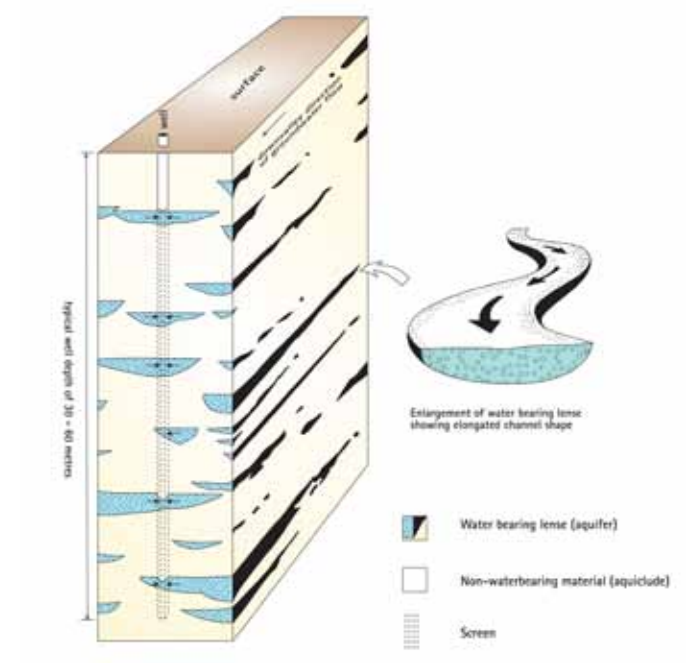

Figure 27.2: Typical Southern Valleys Aquifer structure

They are characterised by their low yield and unpredictable distribution. The water bearing layers are laterally and vertically discontinuous. Some water bearing layers are as small as 100 millimetres in thickness, and in isolation don't constitute a useful water supply.

To provide a viable water supply well drillers have commonly used long screens to connect multiple water bearing layers. This was common practice in the late 1980s to mid 1990s, and requires careful consideration and design to avoid potential problems that may arise from interconnecting many aquifers. Not only can wells tapping these aquifers potentially drain them relatively quickly, but they are by and large slow to recharge due to their isolation from surface sources of recharge.

At the surface, river or stream channels and their associated floodplain aquifers, are formed of more permeable material. While this makes it easier for rain to recharge these riparian aquifers and for wells to extract groundwater from them, their yield is ultimately limited by the reliability of the linked ephemeral source of recharge.

Groundwater systems

Southern Valley groundwater systems fall into two categories. Firstly, a series of shallow riparian type aquifers associated with local ephemeral rivers or streams. These systems are normally limited to supplying stock or domestic water supplies only. The second group consists of a series of deeply buried aquifers which underlie the riparian aquifers at depths of greater than 30 metres.

The Taylor River, Omaka River, Fairhall River and Wards/Mill Stream directly recharge the shallow channel type aquifers that exist in their respective floodplains. These permeable gravels make good aquifers while their associated streams are flowing, but have limited storage under typical summer conditions.

Away from the river channels, groundwater occurs throughout the gravels of the valley floors which have been mapped as the low yielding and claybound Speargrass Formation. The alluvium forming the Southern Valleys is relatively deep in the lower reaches, but form small groundwater reservoirs due to their low storage properties. These deep aquifers rely on indirect recharge from losses of surfacewater, which is a much slower process than for the riparian aquifers.

History of water use and exploration

It has been generally accepted since the 1970s that the Southern Valley Aquifer Systems are limited in their water supply capability. While wells do extract

Figure 27.3: Aerial view of Omaka-Hawkesbury and Brancott Valleys

groundwater for a range of uses including domestic or stock supply and crop irrigation, yields are much lower than for the Wairau Aquifer. Although the Southern Valleys had been settled long before 1980, it has been subsequent that the quest for groundwater has assumed a very high profile.

There is a large difference in the availability of water between the Southern Valleys Aquifers and those of the Wairau Aquifer. For example, during the establishment of a 20 hectare vineyard in the 1980s, in the Omaka-Hawkesbury Valley the owner drilled at least nine wells in an effort to find enough groundwater to irrigate his grape plants. Of the nine wells drilled, only four were successful in locating groundwater. These are pumped in tandem and only provide relatively small volumes of irrigation water. The successful wells varied in depth from 212 to 41 metres. This compares with a vineyard north-west of Renwick which required only two wells to water a 225 hectare area of vineyard.

The attractive growing climate and cheaper land were key factors in making the Southern Valleys appealing for horticultural development in the early 1980s with the unreliability of surfacewater reflected in the lower land values. The catalyst for horticultural development was the establishment of Montana Wines Limited Fairhall and Brancott Estate Vineyards during the early 1970s (Fig. 27.3).

From 1979 to 1983 a rapid escalation in the subdivision of larger rural holdings occurred in the area. Many new horticultural developments started with viticulture being the predominant crop. Initial drilling failed to find sufficient groundwater for viticultural irrigation.

In 1983 the member of parliament for Marlborough D.L. Kidd, promoted a proposed irrigation scheme for the area. The scheme was to pump water, previously diverted from the Wairau River, to these so called water-short areas. This scheme and variations of it came to a standstill for want of a coordinated community of interest amongst growers. Not satisfied with this state of affairs, Montana Wines continued with a groundwater exploration project. Groundwater Consultants New Zealand Ltd (GCNZ) were commissioned by Montana Wines to explore for groundwater resources on their Brancott and Fairhall Estate Vineyards. This and other exploratory work which flowed from it, greatly enhanced knowledge and understanding of the sub-surface strata in these valleys. The conceptual model that was developed at the time has largely remained valid to the present day.

The technique adopted in these exploratory investigations included a data review after which a preliminary hydrogeological assessment was made. Electrical resistivity surveys were carried out followed by exploratory drilling at selected target sites.

Some of the work carried out on behalf of private individuals was extended or complemented by resistivity surveys funded by the MCRWB or the MWD. During the summer of 1984-85 GCNZ carried out resistivity surveys in both the Omaka Valley and the Fairhall-Brancott Valley. This completed coverage of the entire valley floor (GCNZ - 1984).

GCNZ (1984) interpreted the electric resistivity survey results as showing an absence of high yielding aquifers. They concluded that the Southern Valleys were unlikely to be capable of supplying the water necessary to irrigate the entire overlying land area, although this would depend on crop type.

Recent comparisons between the resistivity results and actual drilling results show a relatively poor correlation. However, the method did contribute to our understanding of the local hydrogeology and nature of the sediments forming the aquifers.

Between the 1980s and 1995, privately funded drilling had explored the sediments beneath the Southern Valleys to a depth of several hundreds of metres below the surface. This drilling discovered economic quantities of groundwater albeit in small quantities and in discontinuous lenses. Little was known about what water resources lay beyond this depth however, so in 1995 the MDC drilled what remains the deepest water well in Marlborough to 405 metres below the surface.

The aim of the MDC exploratory well was to quantify the extent of natural water resources beneath the area and provide certainty to water users in terms of future water supplies. Unfortunately only marginally economic water bearing layers were found.

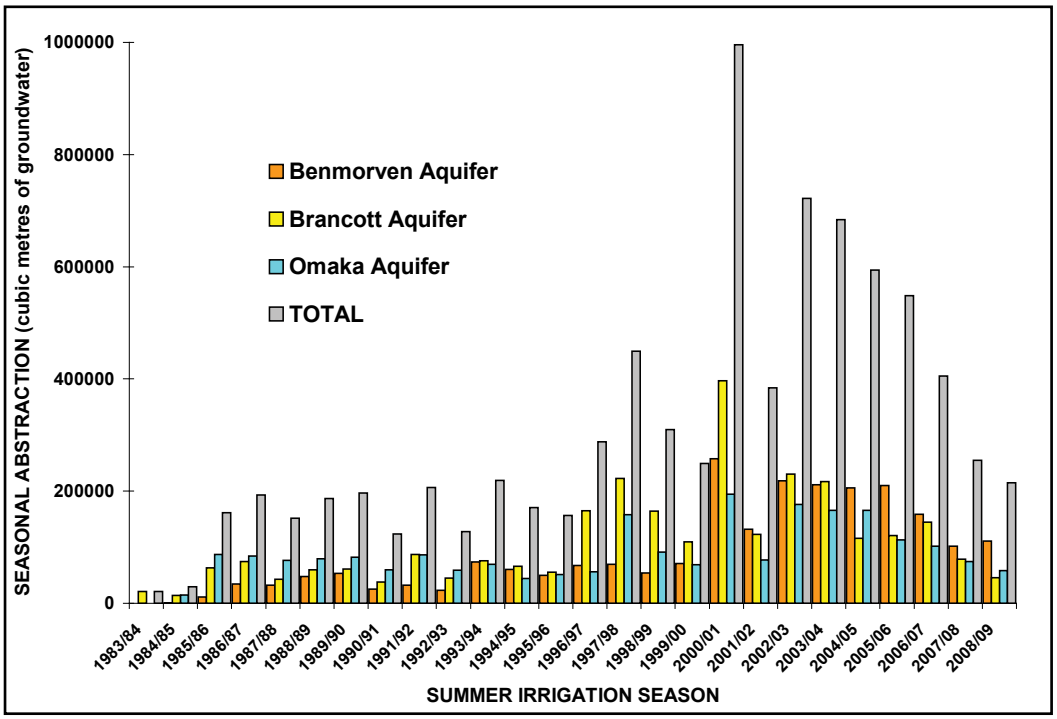

Figure 27.4: Metered water use 1984-2009

Groundwater resources across all of the Southern Valley Aquifers are now fully allocated with no new permits having been approved by the MDC since 2000. Irrigation for new vineyard plantings is now being supplied by the Southern Valleys Irrigation Scheme (SVIS), although this supply is only available when Wairau River flows are above 8 m^3/s at the SH1 bridge. Metered water use in the three deepest groundwater systems has grown steadily since 1984 (Fig. 27.4). Demand peaked during the 2000/01 summer drought. It is now generally accepted that this peak abstraction was unsustainable. Based on an analysis of metered groundwater consumption versus climate and aquifer response, a sustainable limit of around 500,000 m^3 per season was established.

Small quantities of groundwater for domestic or stock water may still be available depending on the individual status of each aquifer, although successful bores may not necessarily be found first time out. Stock water use has declined since the late 1980s following the replacement of pastoral holdings with vineyards. There has also been a corresponding increase in rural residential water demand throughout the Southern Valleys catchments.

Across a full year residential demand is of the same magnitude as the quantum used for crop irrigation.

References

Groundwater Consultants New Zealand Ltd, 1984. Marlborough Catchment Board and Regional Water Board Omaka/Brancott Valleys Groundwater Resource Assessment Resistivity Survey, Report No. 126