Hydrology of the Otaio River Catchment, South Canterbury

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The coastal South Canterbury area between the Hunter Hills and the coast is one of the most water deficient areas in NZ.

The mean annual rainfall ranges from 550 mm at the coast, to over 900 mm along the Hunter Hills.

Areas with 600 to 700 mm will have a seasonal water deficit as evaporation exceeds rainfall.

The Otaio River catchment is around 144 square km's, while the stream gage at the Otaio at Gorge (70303) has a catchment area of 47 Square km's and data is available from April 2001.

The basic flow statistics are:

7 day MALF is 117 L/s (MALF = Mean Annual Low Flow = lowest 7-day average flow)

Median flow is 315 L/s

Mean flow is 741 L/s (flows above this for around 25 % of time)

The Otaio at Gorge has permanent flow but recedes to very low flows in summer, as reflected in the 7DMALF of 117 L/s. The Otaio loses water between the Gorge recorder site and McAlwees Crossing (the first site that goes dry). With the flow at 117 L/s, the channel soon dries up

Below McAlwees Crossing there is a general recovery of flow (refer Figure 4.15, Ecan Report R06/20, 2006)

Factors affecting the Otaio River flow

(1) The Hunter Hills are a greywacke range, the rock has been deeply shattered by weathering and frost action in the Pleistocene (Ice Age). Slopes are mantled with a deep layer of shattered rock which provides excellent storage for water, and allows its movement down slope to the stream channels.
(2) Vegetation on the higher parts of the Hunter Hills is mainly tussock grasses. Tall snowgrass cover traps winter snow , which later melts and replenishes the groundwater, then feeds the stream channels over summer.
(3) Bore logs from wells upstream of Drinnans Bridge indicate gravel depths of 5 to 15 metres, which are really quite limited aquifers.
(4) The Ice-age history of this area is very relevant to the limited gravel aquifers.
    (i) During the Ice-age (say before 20,000 years BP) the sea-level was much lower and the coast line was around 25-30 km further east than at present.
    (ii) The river valleys were eroded down to make sizeable trenches, graded to the lower sea-level.

(iii) As the Ice-age ended (20,000 to 12,000 years BP), sea-level rose and the valleys were infilled with gravel deposits. These are the relatively "thin" gravel aquifers which the modern rivers flow across They also have quite limited areal extent within the valleys. Rainfall and river flow feed into the aquifers and in some reaches the aquifers add water to the river channels, especially towards SH 1 and the coast.

(5) A characteristic of river flows in dry climates is the very skewed distribution of flows. Streams and rivers have very long periods at low flows, 75 % of time below 741 L/s for the Otaio at Gorge. However, extreme rainfalls can produce very large floods. The 13 March 1986 flood for Otaio at Gorge is estimated to be around 220 cumecs (4.68 x 47 square kms) Shenley Weir 3 produced 6.28 cumecs from a 1.28 square km catchment, while the automatic raingauge at Rocky Gully recorded 148 mm in 12 hours, Blue Cliffs Station had even heavier rainfall in 8 hours.

(6) This storm had a return period of around 200-300 years, or in 1,000 years of record you would find 4 or 5 storms of this size or larger.

(7) With Climate Change you will see more of these extreme storms happening more often. The March 1986 flood in South Canterbury produced $60 million of damage in one day.

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