



STAFF REPORT

TO: Environment & Planning Subcommittee

FROM: Joseph Thomas – Resource Scientist Water/Special Projects

REFERENCE: W323

SUBJECT: **ASSESSMENT OF POTENTIAL GROUNDWATER AVAILABILITY
IN THE MOUTERE AQUIFERS – TECHNICAL REPORT
EP06/08/04** – Report prepared for 2 August 2006 Meeting

1. BACKGROUND

The Moutere Catchment has two aquifer zones delineated i.e. the Western and the Eastern Groundwater Zone (Figure 1). Both aquifer zones have allocation limits specified for them in the Tasman Resource Management Plan (previously also in the Moutere Water Management Plan). Allocation limits specified for the zones are fully subscribed and there is a waiting list to access deep Moutere aquifer groundwater.

Council with support from Agmardt carried out further deep (three bores) exploration drilling in the Moutere Valley in 2001/2002. These new bores were drilled in areas where not much was known about the deep aquifer. The three bores drilled with Agmardt support are the one in Upper Moutere (Sarau Village), Redwood Lane behind the Redwood Hall and another by Stringer Road. Figure 1 shows the Moutere Groundwater Zones, the distribution of permitted deep aquifer bores and the network of monitoring bores including the Council's Western Zone monitoring bore (Palmers) and Eastern Zone monitoring bore (Weka Road).

The deep drilling carried out in the new areas showed good quality but limited quantity of deep groundwater. Council has been monitoring these new deep bores since the completion of drilling and flow testing. This is to assess response mechanism of aquifer pressures (i.e. water levels) to various factors i.e. rainfall, barometric pressure, extraction and seasonality. Due to the complex nature and extent of the Deep Moutere Aquifers within the Moutere Gravel Formation the analysis of response mechanisms in combination with isotopic (age) and chemical analysis of deep groundwater offers a means to assess recharge which is important for setting of allocation limits.

2. PREVIOUS TECHNICAL WORK / REPORTS

The Tasman District Council and the Institute of Geological and Nuclear Sciences have previously completed a report on the groundwater sensitivity analysis and recharge mechanisms in the Moutere Aquifers i.e. GNS Report 2004/17. A report on the key aspects of that work was presented to Council last year (9 March 2005 Report EP05/03/13)

The next phase of work outlined in the previous technical report was assessing the range of volumetric water availability options for allocation from the Eastern zone aquifers. This was to be primarily being modelled for irrigation water use and patterns of usage over the irrigation months (i.e. primary pumping is in the summer only).

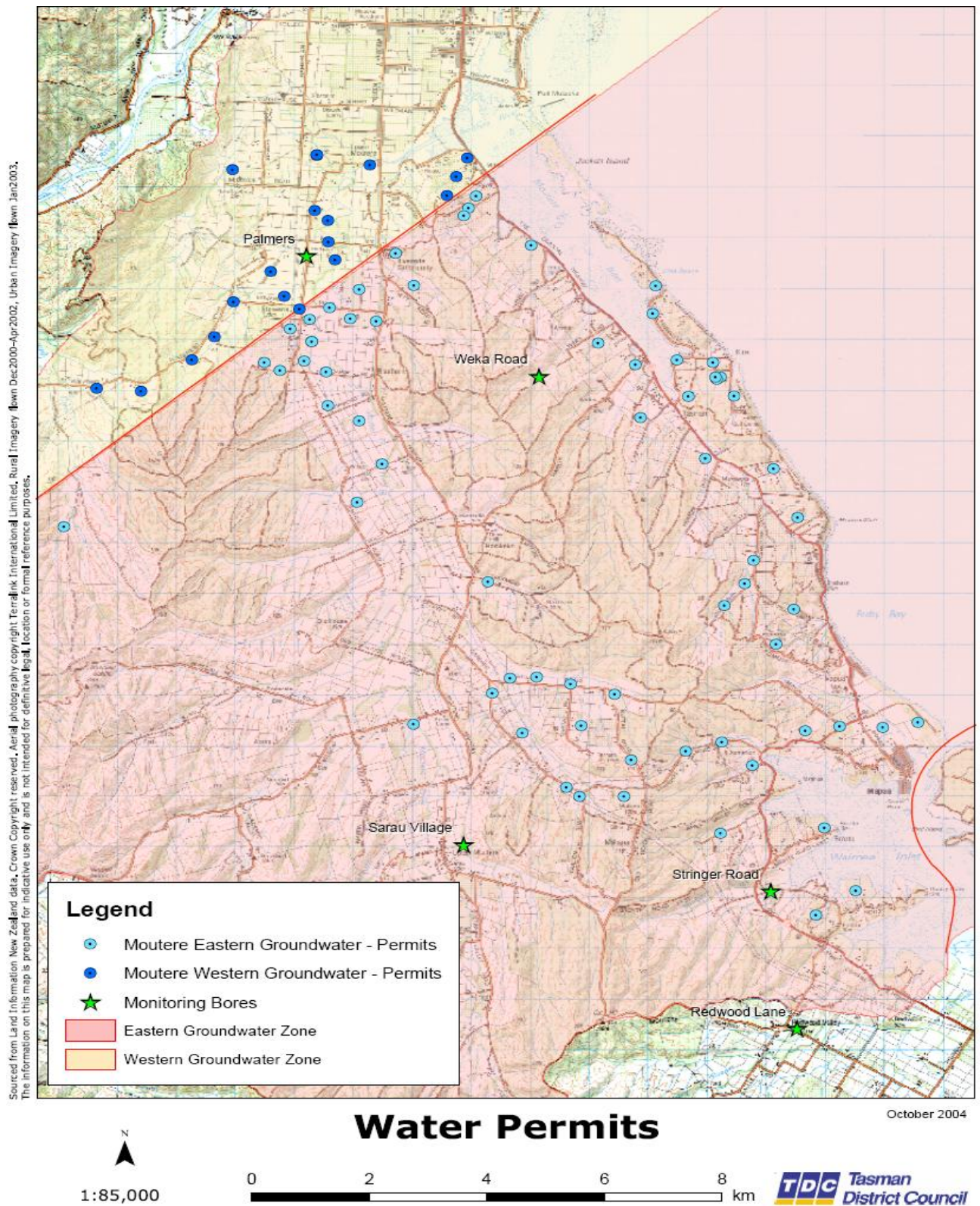


Figure 1: Groundwater Zones and Deep Groundwater Bores (i.e. with water permits) Moutere Catchment

It is essential that water use from the aquifers is optimised whilst also preserving the long term sustainability of the water resource. The next phase of work was to be completed in the 05/06 year. This report details the key aspects of the technical work in assessing further water availability from the deep Moutere Aquifers. Two further reports have been completed on aspects of these i.e. GNS Report 2005/185 and GNS Science Consultancy Report 2006.

3. GROUNDWATER ZONE ASSESSMENT

Work in the previous study showed the potential from a water management perspective to further subdivide the Eastern Zone into two subzones. Further hydrogeological and hydrological analysis and evaluation has been carried out which now results in the previous Eastern Zone proposed to be divided into three subzones. This provides a better tie between deep aquifer responses and practical water management areas. The zones proposed are the Western Zone (i.e. remaining as is) and the Eastern Zone being subzoned into three zones. The proposed four zones are listed below and the boundaries are shown in Figure 2.

- Moutere Southern Groundwater Zone (OMSG)
- Moutere Coastal Groundwater Zone (OMCG)
- Moutere Eastern Groundwater Zone (OMEG)
- Moutere Western Groundwater Zone (OMWG)

The key aspect of the new work was to determine the potential for further groundwater abstraction from the previous Eastern Groundwater Zone. The modelling and analysis undertaken to achieve the objectives included the following.

1. Determining a range of abstraction volumes for a range of given drawdowns in three new deep bores (Weka Road, Sarau Village, and Redwood Lane) by developing the dynamic neuro-fuzzy local modelling system based on Hong and Stewart (2004, data updated to December 2004). To also determine any further abstraction from the remnant Eastern Zone based on previous data (1994-2001) from the Eastern Zone Wilson Road bore (*Note: Wilson Road bore is not a monitoring bore anymore*);
2. The pattern of abstraction to be based on the data of actual metered usage (Hong and Stewart, 2004); this pattern of usage shall be incrementally varied to determine various allocation rates for given drawdowns; and
3. Evaluation shall also be made of the impact of groundwater use on groundwater level over an irrigation season through scenario simulation using the dynamic neuro-fuzzy local modelling system.

The data set used in the study was collected by TDC. Figure 3 shows groundwater and rainfall sites in the Moutere catchment. The list of variable used in the modelling work were:

- rainfall at Kellings Road (site No. 132010);
- rainfall at Waiwhero (site No. 132036);
- groundwater level at Stringer Road (site No. 1300109);
- groundwater level at Weka Road (site No. 1310110);

- groundwater level at Sarau Village (site No.1320107);
- groundwater level at Redwood Lane (site No. 1330108);
- groundwater level at Wilson Road (site No: 1219050);
- barometric pressure at Little Kaiteriteri (site No. 56897);
- total abstraction data in Moutere Eastern Groundwater Zone (OMEG in water meter database of Tasman District Council).

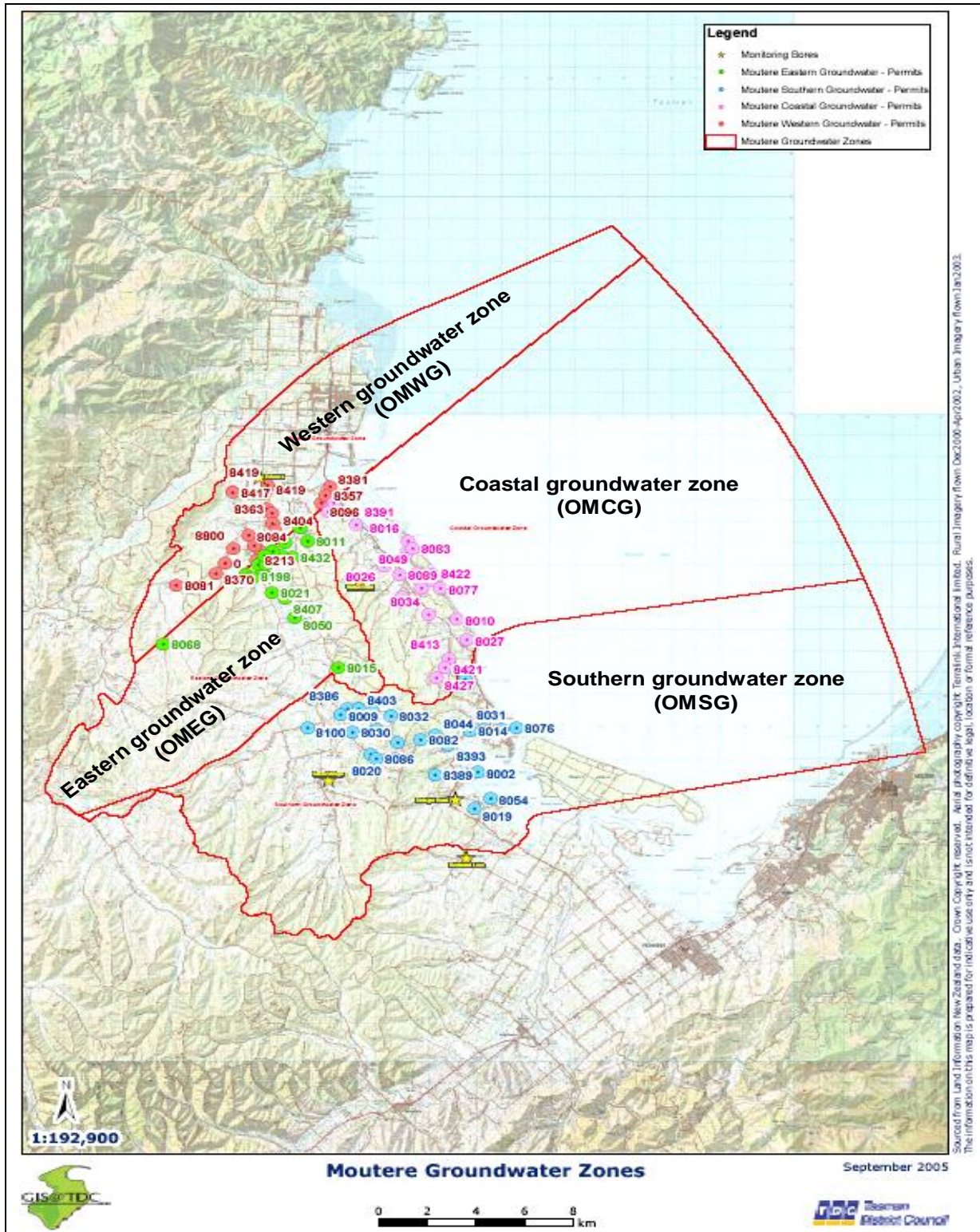
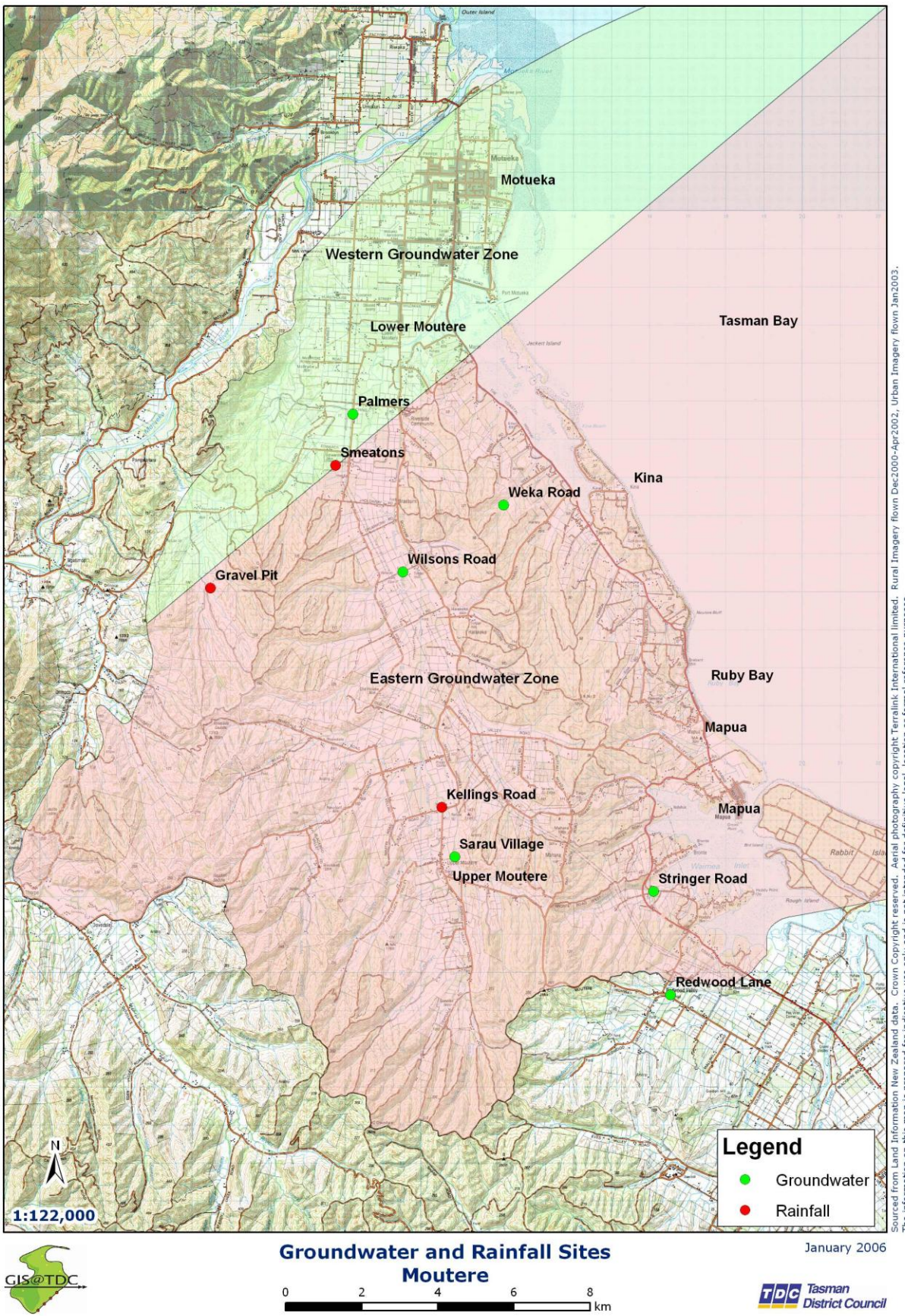


Figure 2: Proposed Moutere Groundwater Management Zones



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Figure 3: Rainfall and groundwater monitoring sites in the Moutere Catchment

4. MODELLING

The model was calibrated i.e. observed groundwater level in the deep bores to all input variables available (rainfall, pressure and groundwater abstraction). Good calibration results were obtained. Figure 4 below shows just one of the calibration results for the deep bore in Sarau Village - Upper Moutere.

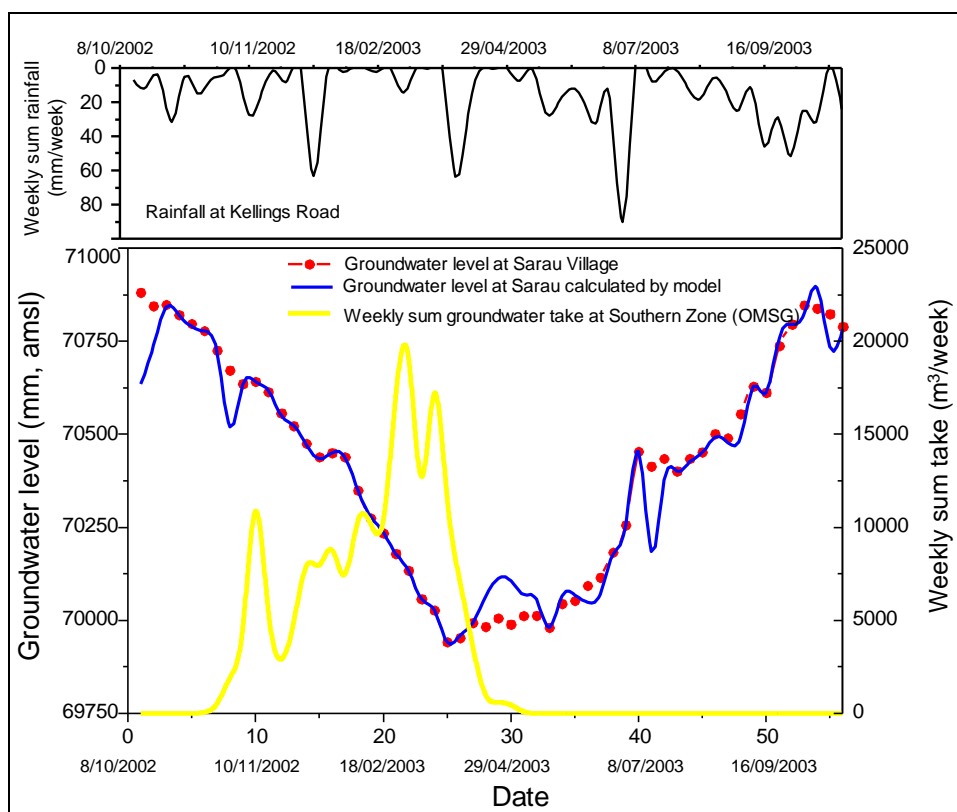


Figure 4: Calibration result of the dynamic neuro-fuzzy local modelling system (DNFLMS) with observed groundwater levels at Sarau Village.

5. IMPACTS OF GROUNDWATER USE ON GROUNDWATER LEVEL

The calibrated model is used to: (1) determine a range of abstraction volumes for a range of drawdowns in the three new deep bores (Weka Road, Sarau Village, and Redwood Lane); and (2) evaluate the impact of various usage scenarios on groundwater levels over an irrigation season.

The abstraction scenarios that are used in this simulation have groundwater pumpage greater than actual pumpage:

- Scenario 1 - 30% more pumpage in the irrigation season (November 2002 – April 2003),
- Scenario 2 - 60% more pumpage in the irrigation season (November 2002 – April 2003),
- Scenario 3 - 100% more pumpage in the irrigation season (November 2002 – April 2003).

In the case of the remnant Eastern Zone as we only have data from the time the recorder was operating only two scenarios i.e. 70 % and 120 % more pumpage in the irrigation season has been used.

Figure 5 shows model calculations for groundwater levels in Sarau Village for the different abstraction scenarios. Similar plots have been developed for all the other sites.

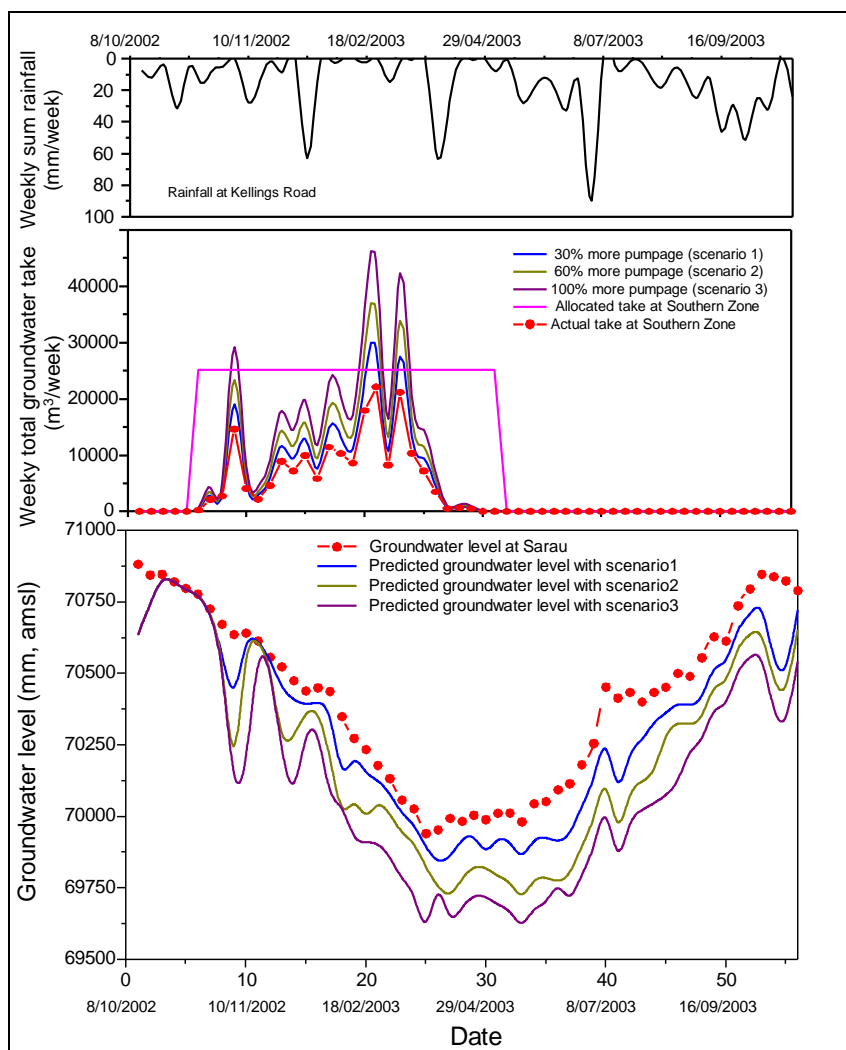


Figure 5: Model calculations of groundwater levels at Sarau Village (Upper Moutere)

6. SUMMARY

- Groundwater levels at Redwood Lane are less sensitive to pumpage of the Southern Zone of Moutere Eastern Groundwater Zone (OMEG), compared to Sarau Village in the Southern Zone and Weka Road in the Coastal Zone.
- Model calculations suggest the groundwater levels at Redwood Lane are not likely to drop significantly and will recover during the winter by the rainfall recharge process, even with greater pumpage than present.

- The model calculates that the groundwater levels at Sarau Village are sensitive to pumpage in the Southern Zone. Observation data and simulations show that increased groundwater levels at Sarau Village are associated with rainfall. Groundwater levels at Sarau Village are likely to recover after the irrigation season in all pumpage scenarios. Rainfall recharge in summer prevents significant decline of groundwater levels at Sarau Village and Redwood Lane in all pumpage scenarios.
- These results suggest that groundwater allocation at Sarau Village and Redwood Lane could be increased. The model prediction shows that 20-30% more abstraction allocation at Redwood Lane and Sarau Village in the Southern Zone would not cause significant decline of groundwater levels. However, the groundwater allocation for the abstraction in the Southern Zone (OMSG) is dependent on the rainfall during the irrigation period.
- Model calculations shows that the groundwater levels at Wilson Road drop significantly with a very high abstraction rate during the irrigation season. The model predicts that increase in the rainfall increases the groundwater levels at Wilson Road and the groundwater levels at Wilson Road are likely to recover when the abstraction period is finished during the winter. This result suggests that more groundwater at Wilson Road can be available and allocated in this area. The model prediction shows that 15-20% more abstraction allocation in the remnant Eastern Zone. Whilst groundwater levels decline in the irrigation season the rainfall recharge causes recovery in the groundwater levels. Groundwater allocation for the abstraction in this Eastern Zone of Moutere Eastern Groundwater Zone (OMEG) is dependent on the rainfall during/after the abstraction period.
- The model predicts that groundwater levels at Weka Road are more sensitive to abstraction in the Coastal Zone compared to groundwater levels at Sarau Village and Redwood Lane. Observation data and model calculations indicate that groundwater levels at Weka Road are not clearly related to rainfall. Groundwater levels at Weka Road are not likely to recover after the irrigation period. Therefore pumpage in the Coastal Zone is probably the major factor determining the groundwater levels at Weka Road. A cautious approach to any upwards revision of groundwater allocation in the Coastal Zone is therefore recommended.

7. RECOMMENDATION

- 1. Council receives this report.**
- 2. Council directs staff to prepare a policy options paper with a range of options for consideration of any further allocation and management of the deep Moutere Aquifer Groundwater.**

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