

MANAGED AQUIFER RECHARGE IN THE POVERTY BAY FLATS

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Groundwater in the Poverty Bay flats

In 2012 a report was commissioned by the Gisborne District Council (GDC) to examine groundwater resources in the Poverty Bay flats. This report found that groundwater elevations within the Makauri Gravel aquifer (the aquifer subject to the greatest groundwater abstractions), were declining at statistically significant rates, probably due to groundwater abstractions (White et al., 2012). As a result, the GDC is investigating whether managed aquifer recharge (MAR) can be used to help achieve the sustainable management of groundwater resources within the Poverty Bay flats. MAR is “*the purposeful recharge of water to aquifers for subsequent recovery or environmental benefit*” (Dillon et al., 2013, p. 2). Though MAR is uncommon in New Zealand, increasing pressures on groundwater may change this. GDC is investigating two different methods of MAR, well-injection (in conjunction with Golder Associates), and infiltration basins, which is the focus of this study.

Methods and Results

Rainfall (1938-2014), river flow (1966-2014), and groundwater elevation data (1982-2014) was obtained and analysed to help characterise the groundwater system and update the work undertaken by Gordon (2001) and White et al. (2012). No statistically significant trends were present in rainfall or river flow data. Trends in groundwater level in 31 Makauri Gravel aquifer bores were analysed. Nine bores exhibited statistically significant declines in groundwater elevations ranging from -0.024 to -0.114 m/year, while two bores exhibited statistically significant increases in groundwater elevations ranging from 0.017 to 0.020 m/year.

Two sites were then identified within the Poverty Bay flats for MAR using infiltration basins using the “HIGGS Index”, which was developed to evaluate a site’s infiltration basin potential against other sites. While the two sites showed initial promise via a desktop study, infiltrations tests at each site indicated low rates of saturated hydraulic conductivity (6.12 cm/day at one site, less than one cm/day at the other site) due to the presence of sediments with low permeability. Hydrogeological modelling is presently being undertaken to ascertain whether an infiltration basin could be used as a tool to artificially recharge the Makauri Gravel aquifer.

Conclusion

An update of the work undertaken by White et al. (2012) found that groundwater elevations are declining at statistically significant rates within the Makauri Gravel aquifer where groundwater abstractions are greatest. Conversely, where pumping is negligible in the northern reaches of the Poverty Bay flats statistically significant increases in groundwater elevations have been observed. Therefore, it is likely that decreases in groundwater elevations, where observed, are due to groundwater abstractions, the same conclusion as White et al. (2012). If the modelling does indicate that an infiltration basin can be successfully used to artificially recharge the Makauri Gravel aquifer, given the low rates of saturated hydraulic conductivity found at the two identified sites, removal of near-surface layers of sediments of low permeability is likely to be necessary given their prevalence across the Poverty Bay flats.

References

- Dillon, P., Pavelic, P., Page, D., Beringen, H., & Ward, J. 2013, *Managed aquifer recharge: An Introduction. Waterlines Report Series No. 13*, National Water Commission, ACT, Australia.
- Gordon, D. 2001, ‘Gisborne’, in M. Rosen & P. White (eds), *Groundwaters of New Zealand*, New Zealand Hydrological Society Inc, Wellington, New Zealand, pp. 355-366.
- White, P., Moreau-Fournier, M., Tschritter, C., & Murphy, P. 2012, *Groundwater in the Poverty Bay Flats*, GNS Science Consultancy Report 2012/106, Prepared for Gisborne District Council, GNS, New Zealand.