

Bay of Plenty Regional Council

Community Report on the Sustainable Management of the Kawerau Geothermal System

Based on 2018 Annual Reports (reported in May 2019)

Introduction

Bay of Plenty Regional Council (BOPRC) manages the Kawerau Geothermal System under the Resource Management Act 1991 (RMA), through resource consents for the taking of geothermal water and heat, and geothermal discharges.

As per the Kawerau System Management Plan, Bay of Plenty Regional Council (BOPRC) has agreed to report annually to the community on the overall state of the Kawerau Geothermal System. This report summarises the 2018 Annual Reports which cover activities from 1 January to 31 December 2018, submitted to BOPRC by the four consent holders. These reports were subsequently reviewed by the Peer Review Panel (PRP), consisting of three independent technical experts, and further questions were covered during a meeting between the consent holder's technical experts and the PRP.

Detailed information on the Kawerau Geothermal System and its management can be found in the Kawerau System Management Plan on Council's website <https://www.boprc.govt.nz>

Geothermal Takes from the Kawerau Geothermal System for 2018

Four consent holders, Mercury, Ngāti Tūwharetoa Geothermal Assets (NTGA), Te Ahi O Māui (TAOM) and Geothermal Developments Limited (GDL) together extracted a total of around 42 million tonnes¹ of geothermal fluid from the Kawerau reservoir during 2018. This equates to a total average daily take of around 115,000 tonnes still short of the total consented take of 174,680 tonnes per day. As more business is attracted to the region, users currently abstracting less than their consented volume of fluid will be able to increase their take to meet the increased demand.

Individual Users 2018 Program

Te Ahi O Māui (TAOM): A 25 MW(e) Ormat plant was commissioned October/November 2018. Due to the shallower than usual production depth, a programme of supplementary monitoring was instigated to monitor possible adverse effects on the reservoir. The additional monitoring includes additional sampling and chemical analysis of geothermal fluids and pressure/temperature runs. This data has since been used to update the numerical reservoir model with information on the western half of the field.

During the initial stages of production there were a number of exceedances in take volume by TAOM. Since that time, BOPRC has been focussing on working with TAOM to ensure this doesn't reoccur.

Mercury: Achieved the highest quarterly gigawatt hours since the plant was commissioned in 2008. During 2019, Mercury will instigate strategies to mitigate reinjection issues due to silicification of bores.

¹ 1 tonne ~ 1000 litres

Geothermal Development Ltd (GDL): Completed drilling of a new reinjection well and decommissioned another due to declining performance.

Ngāti Tūwharetoa Geothermal Assets (NTGA): A pump system to facilitate reinjection was installed 2018 and commissioned in 2019 this will reduce the need to discharge spent fluid to the Tarawera River by increasing the reinjection capacity of the current reinjection wells. A new production well is planned for 2019. This is needed to meet the continued increase in demand including that of the new Waiū milk factory currently being constructed in Kawerau. The factory will use high pressure clean steam supplied by NTGA. The expansion of NTGA's cascading usage program will also require an increased supply of geothermal fluid.

Field Wide

Pressure

The taking of fluid from a geothermal system generally results in a pressure drop within the reservoir. In the case of the Kawerau system, the change in reservoir pressure over time is consistent with that forecast from numerical reservoir modelling.

Enthalpy

The change in enthalpy (or decrease in heat energy of the produced geothermal fluids) for the Kawerau reservoir during 2018 was consistent with a long-term average decline rate of less than 1% per year.

Chemistry

Geothermal fluid contains dissolved chemicals, the result of interaction between hot rock and deeply circulating groundwater over the long period of time it takes for a geothermal reservoir to develop. Some of these, because they do not react with the reservoir host rock, are useful for interpreting processes that occur within the reservoir during production, including sources of fluid recharge to the system. The fluid chemistry also determines the potential for the deposition of minerals in pipelines and in reinjection wells. In this regard, the chemistry of the Kawerau field indicates that the main influence is fluids recharging the reservoir including reinjected fluid which is supersaturated with respect to silica.

Data

BOPRC will commission an independent geothermal engineering firm to review all operators' flow monitoring systems in 2019. This will cover flow data from both their production and reinjection wells, to ensure that they are all working within consented limits.

Groundwater

Ground water is monitored by all consent holders. This is to determine whether reinjected geothermal fluids are entering local groundwater aquifers. This would be indicated by an increased in the concentration of dissolved salts in the groundwater. Nothing of note was observed during the 2018 period.

Surface Features

Surface thermal features and geothermal specific vegetation are monitored at Kawerau on a two-yearly cycle by all consent holders. The monitoring includes hot pools, fumaroles, heated ground and seeps via photographic surveys and temperature measurements. It includes also, ecological surveys of geothermally influenced vegetation to establish any changes including extent and species diversity that may have occurred. The 2018 year was outside the survey cycle. It is proposed that in 2019, all users meet to both align the survey cycle across the field and ensure that the data collected adds value to our understanding of this tāonga.

Subsidence

Consent holders are required to carry out levelling surveys yearly to determine possible effects from the extraction of geothermal fluid on deformation of the ground surface, including tilt (differential subsidence) which can be an issue for sensitive plant located above the reservoir. Surveys (which are done jointly by all consent holders) have shown a relatively large bowl of slowly subsiding ground above the reservoir, with five localised areas within the main bowl. These are areas where the ground is subsiding at higher yet still relatively modest rates. The 2018 survey period showed a general increase in subsidence rates. This is consistent with the modelled (predicted) rates and monitoring will continue. Some additional survey points may be added to study new areas of localised subsidence.

Field Development

No new production wells were drilled during the reporting period although maintenance of existing wells was carried out by all the consent holders. Infrastructure for the development of the Te Ahi O Māui Power Station has been completed along with the drilling of a groundwater monitoring well and abandonment of the lower section of a production well.

Numerical Reservoir Modelling

Mercury maintains a numerical reservoir model of the Kawerau geothermal field on behalf of all Users. On the 14 September 2018, the Kawerau Peer Review Panel submitted an interim report to BOPRC on its review of a revised numerical reservoir model for Kawerau, known as KRMv4. The Panel recommended that KRMv4 replace KRMv3 as the official model for the Kawerau geothermal field. The revised model incorporates data from TAOM, Mercury and NTGA wells drilled since the KRMv3 was developed. BOPRC adopted the revised model March 2019.

The Kawerau Peer Review Panel, 19 December 2018, recommended to BOPRC, that the Users be requested to undertake an exploration of reinjection options for Kawerau, initially in a conceptual way, with a view to optimising future injection strategy, particularly with respect to the potential for ongoing marginal recharge and associated cooling effects. Reinjection and its relationship to production is considered one of the most important aspects in the sustainable management of the Kawerau field by all concerned. The Panel recommendation was adopted by BOPRC.

The geothermal user work programme for 2019 calls for computer simulation of a range of reinjection options using an updated version of KRMv4. The options will consider such factors as optimum reinjection rate and the distribution and reinjection depth(s).

Key Recommendations of the PRP and Actions Required of Consent Holders by BOPRC

One of the overarching comments of the Peer Review Panel, resulting from its review of the Annual Report for 2018, concerned the need to collate data from the various surface surveys, including those of surface thermal features and thermotolerant vegetation and data for the Thermal Infrared (TIR) survey to determine whether the data provide any consistent evidence that near surface ground temperatures have changed over time at Kawerau. The Panel envisages that the review would also identify aspects of the surveys that could be improved such as reducing the risk that data for future surveys will be compromised by adverse weather. There was also support for the use of drones as an approach to monitoring surface features that cannot be readily accessed on foot.

The Peer Review Panel recommendation for the review was supported by BOPRC and the Users.

Issues with flow metering are to be resolved so there is confidence in the data being collected. In this regard, NTGA expects that injection pumps installed in 2018 for shallow injection will address the metering issue.