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MOKAI GEOTHERMAL POWER DEVELOPMENT : ENVIRONMENTAL STUDIES

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ABSTRACT

In the 1985 report of the Electricity Sector Planning Committee, the Mokai geothermal field is proposed for a staged development. The first stage of 25 MWe is due to be commissioned in October 1989. Subsequent stages are proposed *for* 1992-1994-1996.

Allowing time to obtain statutory approvals and time needed for manufacturing. construction, erection and commissioning, the Environmental Impact Report (EIR) has to be completed by March 1987. The first study was initiated in November 1985. This paper describes the preproposed development and the environmental studies carried out.

INTRODUCTION

The Mokai geothermal field lies about 25 km north-west of Taupo. The area of low resistivety covers around 12-16 km^2.[1] To date 6 wells have been drilled, three of these being good to very good producers (i.e. 10 to 25 MWe).[2],[3],[4] MK4 is well suited for reinjection purposes.[5] So far, the field has not undergone any sustained draw-down. One of the advantages of a staged development concept is that the draw-down test is accompanied by electricity generation via the first unit. At present (despite there being no "proof" by a draw-down test) the general opinion is that 50 MW could be generated without such a test while a figure as high as 200 MWe is being suggested as being probable.[6]

For the first unit 25 MWe was chosen because:

- There is little doubt that the field can sustain this size. and
- the present wells have a production/reinjection capacity for 25 MWe.
- The maximum modular size available from manufacturers is a 25 MW unit.

The Electricity Division also wanted to show that the concept of staged development is viable. Some of the advantages of staged development are:

Generating capacity can be added if the field proves itself to be capable of sustaining the increased output.

Units can be added when there is a demand for additional power.

Units can be situated such that the pipeline runs are minimised (a number of wells grouped together to supply 1 or 2 units).

- A smaller workforce is required but engaged over a longer period, i.e. generating a fairly constant workforce requirement.
- Impacts can be assessed during the initial development period and remedial action be taken if and when required for the next stage.

Disadvantages:

- No "economy of scale" benefits.
- Prolonged construction period (one unit after another).

A staged development concept is eminently suited for modular development. Additional advantages of modular development are:

- Short manufacture and construction times.
- Spare part investments can be kept to a minimum.

Environmental Studies

Baseline studies towards the EIR were commenced in November 1985 and are described below.

Biological Studies

Terrestrial botany carried out by the DSIR Botany Division.[7] Areas with thermal activity were examined in detail, while the rest of the field was covered by a reconnaissance survey. Most of the field is pasture, while to the eastern side there is a large NZ Forest Products production pine forest.

Two species were identified as most important, Christella sp (fern) and prostrate Manuka. Both species are restricted to thermal soils. Neither is threatened by immediate extinction, but the limited availability of their habitat makes them of regional/ national significance.

Fish and fisheries study, carried out by Wildlife Service. The Lake Whakamaru fishery is considered to be of regional importance and its viability depends on the spawning in the contributaries. The study aimed to establish the fish distribution and whether the existing natural geothermal seepage into the Waipapa/Mokauteure streams presented a natural migration barrier (see figure 1).

The existence of such a barrier would decrease the value of the Waipapa/Mokauteure streams as spawning streams for the Lake Whakamaru.

Preliminary results indicate that the natural seepage does form a migration barrier although the headwaters of the Hokauteure appears to be of good quality. However, in freshes trout may be able to cross the barrier.

Mercury levels in fish are being established. The absence of bullies and smelt in the stream indicate that the existing trout will be insect fed, possibly reducing the accumulation of mercury.

Aquatic flora, carried out by Electricity Division, Ministry of Energy, Hamilton district.[8] The main purpose of the research was to establish baseline data on the influence of the natural occurring geothermal seepage on aquatic flora. The survey of Lake Whakamaru and the Waipapa. Hokauteure streams did reveal one unusual species, a red algae, which is indictative of good quality water. The occurrence of

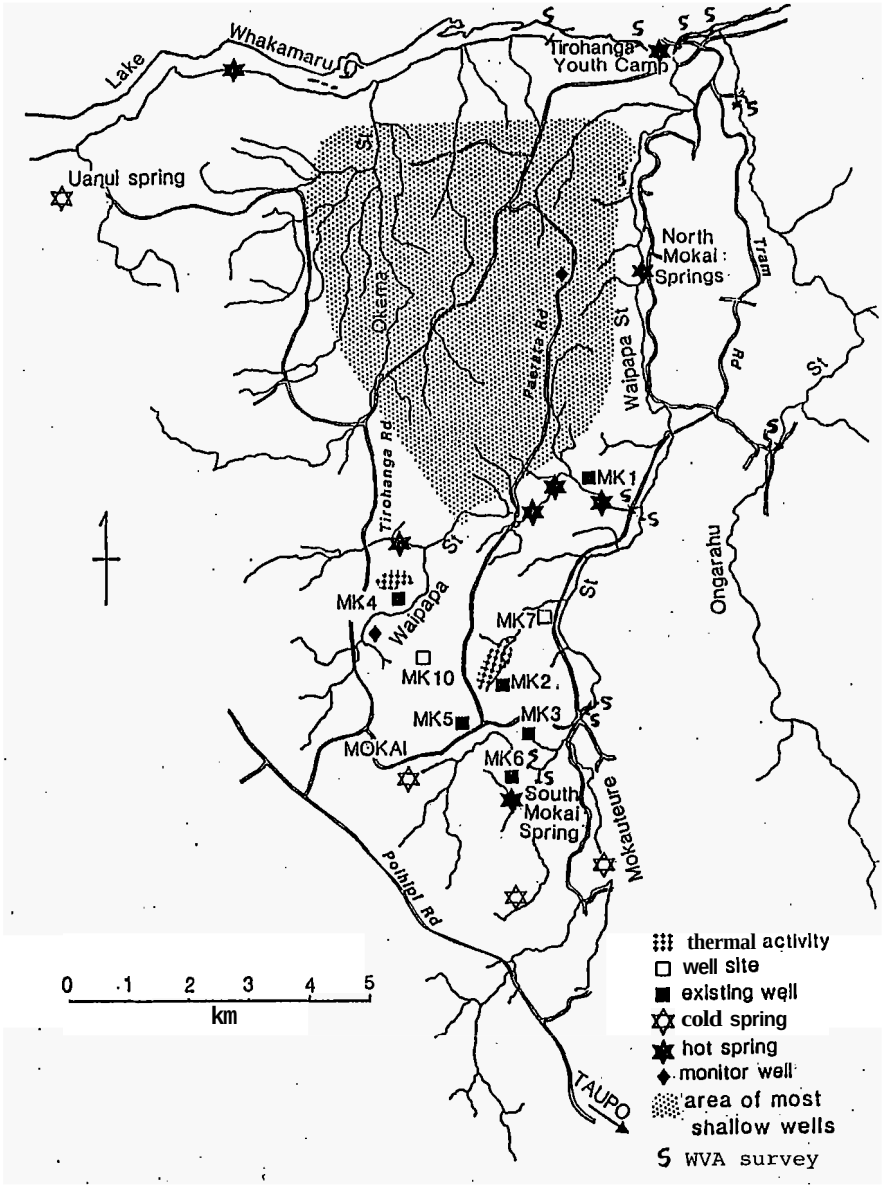

Figure 1 : Aquatic freatures of the Mokai area

submergent plants was not so much dominated by the influence of geothermal seepage as by the occurrence of pumice in the substrate.

Terrestrial fauna. The main part of the field is pasture. The Wildlife Service survey of the Mokai area [9] did not reveal any species of interest.

Aauatic invertebrates study, carried out by the Waikato Valley Authority.[10] The purpose was to establish baseline data and to identify differences between the invertebrate communities in areas affected by natural geothermal discharges and those in unaffected areas. Different species occurred in the geothermal (temperature) affected areas, while the diversity was less as well.

Physical Studies

Surface water hydrogology survey, carried out by the Ministry of Works and Development, Water and Soil Directorate.[11] This involved establishing background data, i.e. stream flow and temperature monitoring, suspended solids measurements, etc.

Existing and potential water uses, carried out by Ministry of Works and Development, Water and Soil Directorate.[12] This study identified the existing water uses and water resources. The Tirohanga Rural Water Supply Scheme (TRWSS) uses the main cold water spring (500 l/s). An expected 40% water usage increase over the next 20 years can be accommodated within the existing scheme.

An expected increase of 20% in usage from ground water bores is likely to be feasible, but a detailed study is being undertaken at the moment.

The proposed power station would take its water from the nearby Mokauteure Stream which has a constant flow rate of around 500 l/s. The power station abstraction rate will be around 100 l/s.

Shallow pround water wells monitoring carried out by the Department of Scientific and Industrial Research. [13] Many people use their own ground water well as a back-up for the TRWSS and for stock water. Concerns were expressed that the reinjection of the waste fluid could contaminate the existing ground water wells. This study was undertaken to establish the existing quality of the groundwater and to set up a monitoring system. It will allow detection of changes in the quality of the ground water, due to a change in the flow of geothermal fluids. Of all the wells investigated. only one well was geothermally affected, the warm well at the Maori Christian Youth Camp. All other (cold) wells contained "baseline", unaffected water.

Surface Water Quality carried out by the DSIR. [14] This survey was to establish the existing surface water quality from a chemical point of view.

All the above studies, relating to the aquatic environment were taken into account when the proposed development [15] impact was evaluated (DSIR).

The most important result was that, in the case of an emergency discharge to the surface water, all life in the Waipapa stream would cease. This would be caused by the increased water temperature, not by the chemical contents of the geothermal Pluid.

The headwaters of the Mokauteure however would provide a source of rehabilitation of the streams.

This is not to say that emergency discharges should be promoted, but it indicates that a certain level of risk of emergency discharge may be acceptable.

Landscape assessment by Boffa, Miskell Partners Ltd. An assessment of the existing landscape values was carried out. [16] The visual impact of the development was contained as much as possible within the constraints dictated by the geotechnical survey results.

Geotechnical surveys carried out by MWD, Power Directorate. [17] The Pirst survey indicated the areas which might be able to carry to expected Poundation loads. After selection of a number of suitable locations (in conjunction with the designers and the landscape architect) a second survey was carried out to obtain more detailed information and selection of specific sites.

Noise study, by Hegley Accoustic Consultants Ltd. The brief Por this study was to establish the existing background noise levels, and to predict the noise levels during construction and operation.

Measures to contain the operation and constructions noises are to be outlined.

Gas dispersion modelling. The non condensable gases will be dispersed via the forced draught cooling tower plume. The Meteorological Service carried out H_2S dispersion modelling. Modelling provided predictions of ground level H_2S concentrations.

Transport study, carried out by Ministry of Works and Development, Power Directorate. This study was initiated to assess the need Por project roading and upgrading of existing roads in terms of traffic volumes and heavy loads. An assessment is to be made of the expected change in traffic patterns due to construction and operation of the power station. One of the conditions of the zoning of the Mokai area Por geothermal power generation is. that a satisfactory agreement is to be reached with the Taupo County Council on the subject of roading.

This study will supply the necessary background information Por negotiations.

SOCIAL STUDIES

Historical Commentary.

The New Zealand Historic Places Trust have no knowledge of any historical sites in the proposed development area. Further inquiry with the Taupo County Council and the Tuaropaki Trust revealed two Maori burial sites close to Mokai.

Dr Evelyn Stokes of Waikato University was engaged to compile a historical commentary on the Mokai area. This had two objectives:

. To uncover any potential archeological sites looking from a historical perspective.

Compile background information on historical Maori values, needed in land lease negotiations with the Tuaropaki Trust.

Social Impact Assessment (SIA). A SIA group was set up, consisting of Ministry of Works and Development, Town and Country Planning. Hamilton district, Taupo County Council, the Tuaropaki Trust and Electricity Division. The Pirst phase of the study was a key-informant study in which key people of the local and greater community were approached about the proposed development. A profile of the Mokai/Tirohanga district community is compiled and a list of the social and cultural issues raised by the key informants. [18]

The second phase was to study in more detail the issues and concerns Put Porward by the key-inpornants.

Due to the uncertainty of who is actually going to develop the steam Pield this second phase of the study is put on hold.

Environmental Impact Report

In the early stages of the Mokai geothermal resource development,, it was thought that a joint venture between the then Oil and Gas Division and the Electricity Division. both of the Ministry of Energy, would be set up. The proposed joint venture would develop the field and supply steam to the Electricity Division Por a power station. However, Por various reasons this proposal has not proceeded with and the Oil and Gas Division called Por "expressions of interest" Prom other possible parties.

A Joint venture was Pormed with a private group. About that time the Gas and Geothermal Trading Group (GGTG) was formed, and as its name implies this group was to become the trading arm of the Ministry of Energy's geothermal interests. The regulatory Punctions were placed under the Policy and Regulations Division of the Ministry of Energy. As a trading group the GGTG had no prior claim to geothermal energy at Mokai or any other Pield.

Parallel to this these events, the Electricity Division decided to seek to develop the steam field in combination with electricity generation.

At the time of writing no decision has been made about who will be allowed to develop the Pield or how such competition will be resolved. In the mean time the Electricity Division continues with the compilation of the Environmental Impact Report.

A consultancy, KRTA. was engaged to carry out an EIR scoping exercise. Their brief was to review all the environmental and social studies carried out so Par and to identify if additional studies were needed or the existing studies needed supplementing.

The results of this study are being implemented at the moment. The compilation of the actual EIR is scheduled to start early October and be Pinished by the end of February 1987. The total duration of the production of the EIR is hence about 16 months, while the total costs of investigations and the production of the EIR amount to about $600.000.

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