Project 3: Ground Subsidence

Background
Subsidence refers to a decrease in ground surface level, and can occur when the pressure of groundwater is lowered over time. Declining pressure in geothermal fields has been associated with development of substantial regions of subsidence.

Problem
It has been observed that pressure in a local geothermal reservoir has been declining since the 1950s but this decline was observed to plateau in the1970s. In line with this were records of increased water extraction rates since the 1950s that only reduced in the early 1970s. In 1960 the ground was measured to have subsided by 0.1m relative to 1953, and in 1965 the ground had subsided by 0.5m relative to 1953. More recently in 2012, the ground was measured to have subsided by 0.55m relative to 1953 so there has been some stabilisation. The reservoir is also recharged from surrounding sources.

Stakeholders
The local geothermal company have proposed increasing their mass take from the reservoir from its current value of 900 kg/s to a higher value of 1250 kg/s due to increased demands on power. Local homeowners oppose any further increase as they notice substantial subsidence in their homes. Local iwi wish to reduce extraction due to effects on geothermal features affecting cultural landmarks and local tourism. The local council wish to maintain economic activity but are concerned by the effects on the environment, culture, and local homeowners. They want a measured extraction rate that will respect local stakeholders and will allow the ground pressure to return to values seen in 1960 when subsidence was relatively small.

Project
You have been retained by the local council to conduct a modelling study and provide a recommendation that accounts for all stakeholders concerned. This will be used as part of the resource consent hearing. To assist you with your project you have been provided with:

- Average water extraction rates from the geothermal reservoir since the 1950s.
- Measurements of average water pressure in the geothermal reservoir since the 1950s.
- You should note the relationship between pressure and ground subsidence.

You should undertake a computer modelling study that will assist decision-making during the resource consent hearing, in particular addressing the noted concerns of ALL stakeholders. The model you develop should be defensible, reflective of reality, and take appropriate account of uncertainty. You will be required to communicate the model findings in both oral and written formats.