

## Hydrogeology Exploration for Groundwater Management in Sawathi Subdistrict, Muang Khon Kaen District, Khon Kaen Province, Northeast Thailand.

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Northeast Thailand has frequently suffered from water shortages and experienced prolonged drought for decades, especially in Sawathi Subdistrict, Khon Kaen Province. This area is geographically located on a high terrain with fewer surface-water reservoirs and little rainfall. Hence, water is essential, and the demand for freshwater is likely to increase, while water supplies will be barely sufficient year-round. The Department of Groundwater Resources (DGR) had been aware of water consumption issues in this area and decided to explore new groundwater resources to resolve these problems and manage water resources.

To discover groundwater resources, the initial phase of field investigation started with a detailed geological survey. Then, hydrological, and geophysical investigations were conducted to locate a suitable location for the drilling operation. It is followed by drilling a 1000-m-deep well, then using borehole logging tools to determine the aquifer's physical properties and the quality of groundwater, and ultimately selecting water-bearing depths for groundwater development. A pumping test was conducted subsequently to evaluate the aquifer's hydraulic properties. According to drilling data, the well was developed in two aquifers. Firstly, groundwater is occupied in the water-bearing fracture zones and bedding planes of the Phu Phan Formation at a depth of 40-60 meters. The water quality is good, with the total dissolved solids (TDS) within the limit of WHO and DGR standards (less than 500 mg/L). For the hydraulic properties, the transmissivity (T) is 3.66 m<sup>2</sup>/day with a maximum well yield of approximately 13 m<sup>3</sup>/hour. According to hydrochemical analysis, groundwater is classified as a calcium bicarbonate type (Ca-HCO<sub>3</sub>) and its source could possibly be recent rainfall. Besides, this study applied radiocarbon dating to determine the age of groundwater and the analysis revealed that the water age is less than 200 years before present. Secondly, groundwater was developed at 560-600 meters deep, and its source was interpreted as connate water trapped in deep fracture zones and contact boundary between siltstone and sandstone of the Phu Kradung and Phra Wihan formations. The water quality is similar to the first aquifer, which is safe and suitable for consumption. The study of hydraulic properties found that the transmissivity is 0.40 m<sup>2</sup>/day, and the maximum well yield is 9 m<sup>3</sup>/hour. The water type of the deeper aquifer was determined as a sodium-potassium bicarbonate (Na-K-HCO<sub>3</sub>) type. The radiocarbon dating analysis showed that the water was very old, ranging from around 19,487 to 20,847 years before present.

For the groundwater management in this area, the first aquifer should be developed at a depth of 50-100 meters and drilling more than five wells to meet a demand of around 4,000 m<sup>3</sup>/day together with the construction of a large-scale water supply distribution infrastructure for domestic and agricultural purposes. Furthermore, the industrial sector is another major water user, water demand is projected to increase, and hence groundwater resources will become the primary source of water for the manufacturing industry. To avoid problems with water consumption and agriculture, the groundwater in the second aquifer will be available for future use.

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