# Groundwater Development in Weathered Hard Rock Aquifer of Mueang Sakon Nakhon District, Sakon Nakhon Province, Northeast Thailand

Kadsarin Siri[1]; Supanun Boonarkard[1]; Winit Jantranon[1, ] Bureau of Groundwater Region 10 Udonthani, Department of Groundwater Resources, Thailand

## Introduction

Mueang Sakon Nakhon district is located in the Sakon Nakhon basin, Sakon Nakhon Province, Northeast Thailand, where surface water is mainly used for water supplies and agricultural purposes. However, due to water shortage susceptibility during the dry season is a serious issue causing local peoples looking for increasingly groundwater for water supply. Area underlain by low permeability rock (such as sandstones and siltstones) and salinity aquifer deeper are particularly difficult to develop groundwater resources. In response to these difficulties, this study was aimed at assess both the groundwater potential and methods for exploration groundwater and boreholes drilling in hard rock.

## Methodology

**Data collection**
(geological data, hydrological data, existing groundwater well data)

**Field investigation** (to determine for siting wells and boreholes, to assess the groundwater potential by geophysics survey)

**Data analysis**
(Resistivity Cross Section, Hydrogeological Cross Section)

**Well drilling and Well Development**
(8-groundwater production well and 2-monitoring well)

## Objective

1. To solve the water shortage
2. To explore the appropriate aquifer in term of quality and quantity

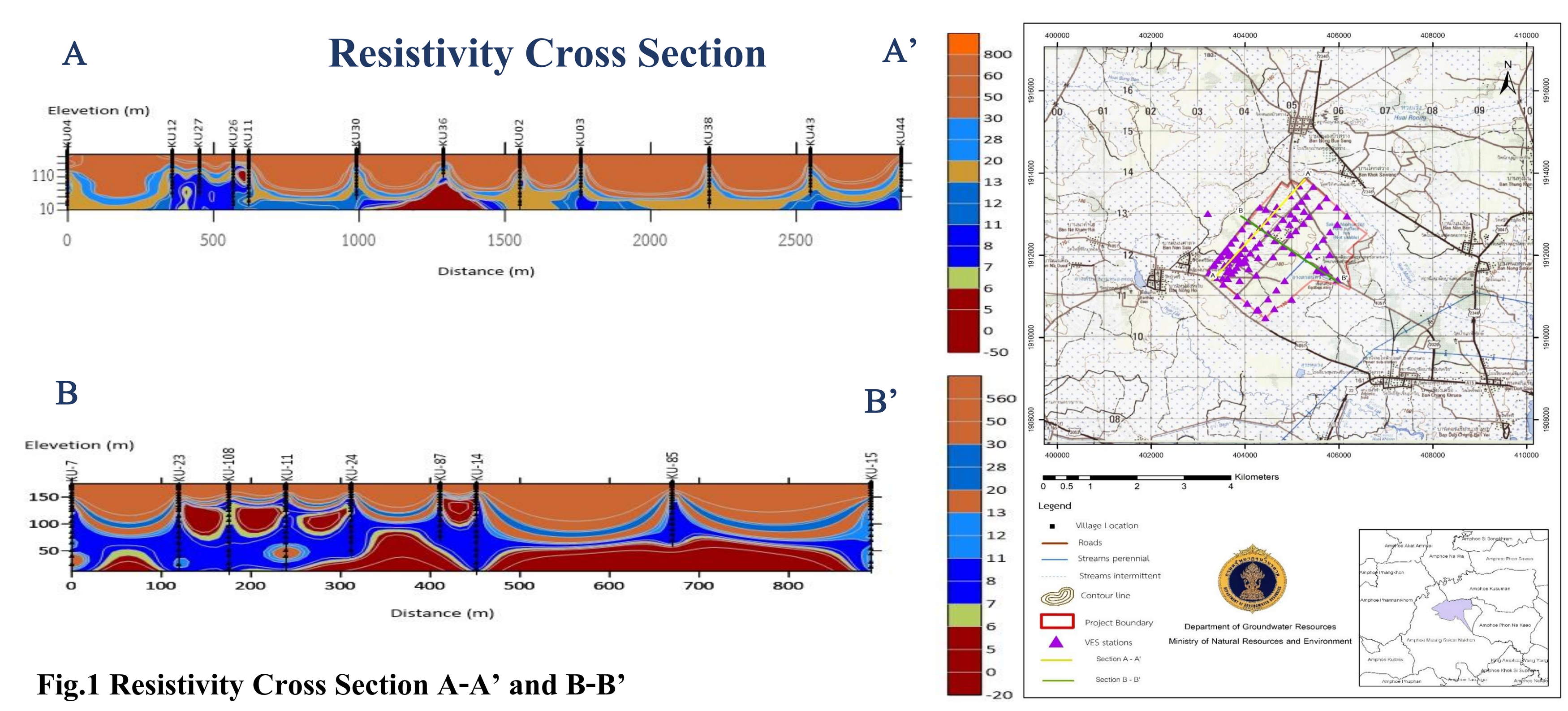


**Fig.1 Resistivity Cross Section A-A' and B-B'**

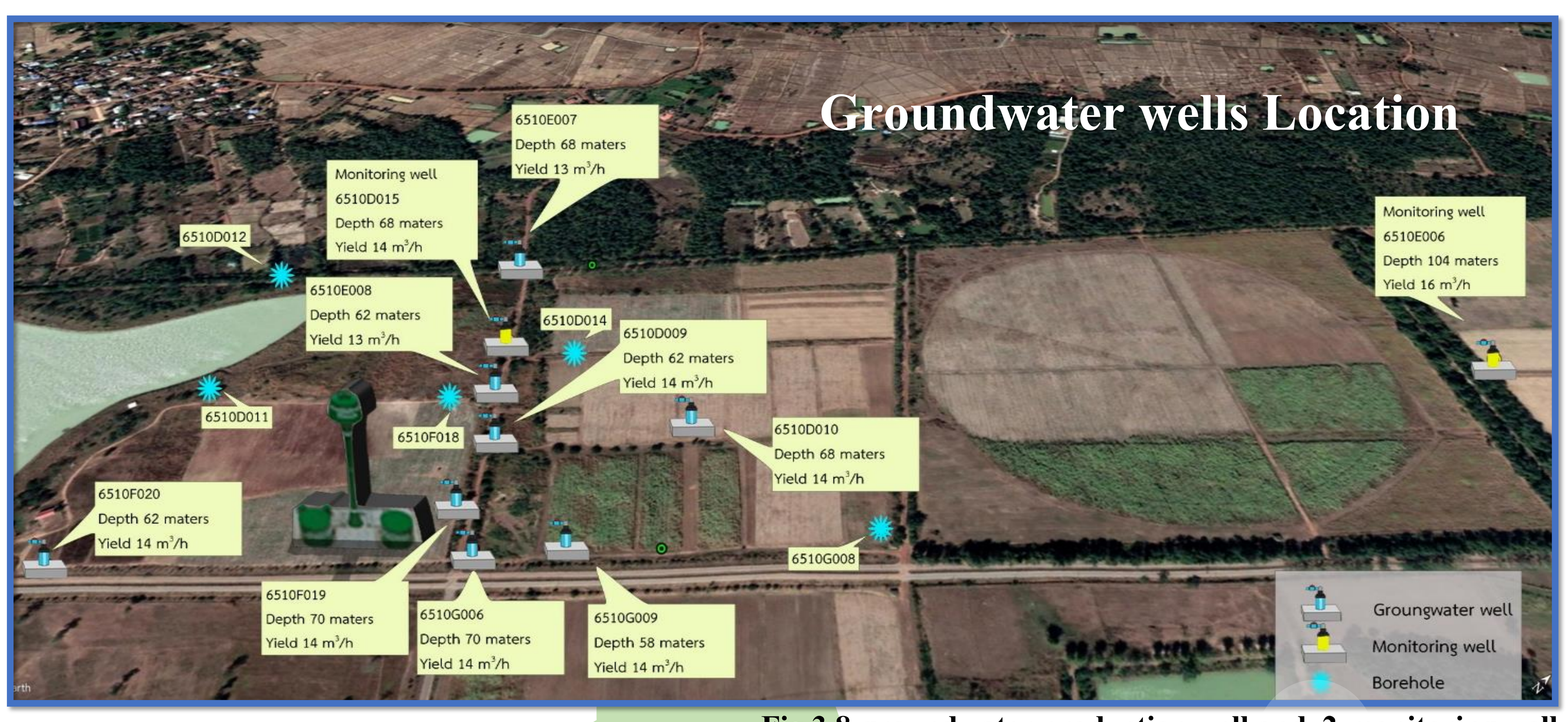


**Fig.3 8-groundwater production well and 2-monitoring well**

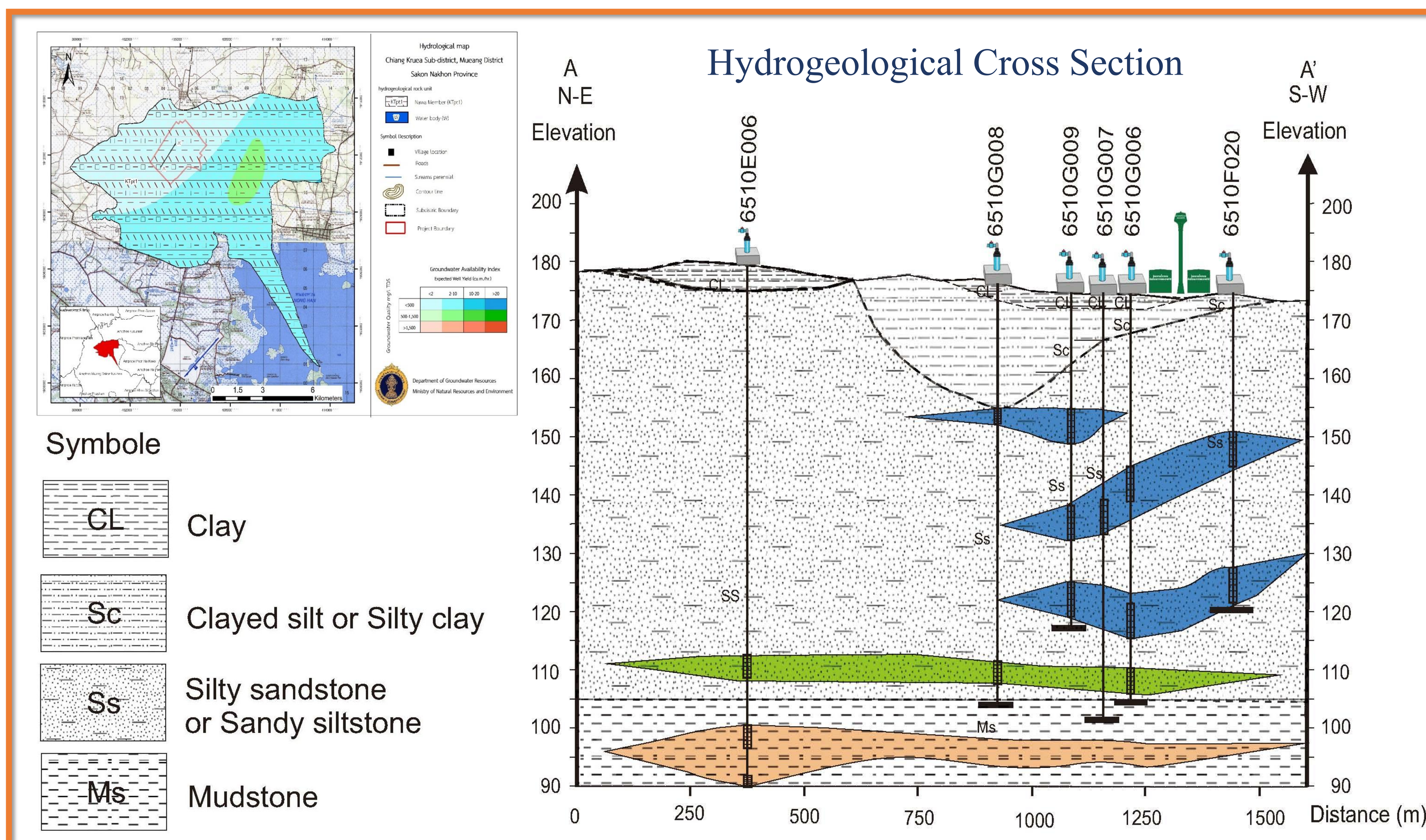


**Fig.2 Hydrogeological Cross Section**

## Result

This area was studied in detail using a combination of resistivity surveys, exploratory drilling of the characteristic geophysical anomalies identified, pumping test and water analysis from borehole. The aquifer was classified by analyze geophysical data and lithological data and were divided into three aquifers.

**The fist aquifer,** which includes clay lateritic and silty clay sediment has an average depth of 5 to 25 meters below the surface. Resistivity value ranging from 400 to 30 ohms/m. The groundwater yield was found in wide range between 2 to 10 $m^3$/hr.

**The second aquifer,** there are three layers which includes reddish brown siltstone and sandstone and good water quality. The first layer range between 20 to 25 meter deep, second layers between 30 to 40 meter deep and the third layers between 50 to 68 meter deep. Resistivity value from 30 to 60 ohms/m. This aquifer can produce efficiency groundwater yields average 12-16 $m^3$/hr. and good water quality (less than 500 mg/l) in terms of total dissolved solids(TDS).

**The third aquifer,** which includes mudstone below 70 meters depth. Resistivity value less than 6 ohms/m. Poorly water quality aquifer (> 1,200 mg/l) in terms of total dissolved solids.

Consequently, the second aquifer is the best according to a potential quality and quantity when comparing with another aquifer in this area. Boreholes were drilled in weathered sandstone aquifer an average depth of 20 to 70 meters. As the result from pumping test was carried out from 8-groundwater production wells, each of groundwater well has a sufficiently high yield (approximately 14 cubic meter per hour) and total yield is calculated approximately 1,760 cubic meter per day. Moreover, 2-monitoring well was constructed in this area for observe groundwater level and groundwater quality in the further.

## Conclusion

The aquifer classification was divided into three aquifers. Good groundwater quality has been developed in second aquifer that total yield from eight groundwater production wells are calculated approximately 1,760 m3/day /or 642,400 m3 /year. Water quality from the groundwater wells was suitable for usage within the World Health Organization (WHO) was determined limits for drinking water. However, borehole testing depth below 70 was found gypsum represent salinity aquifer. In worst case is the exceeding number of $Soa_4^{2-}$ and $CaCo_3$ must be reduced to meet the standard of drinking water quality to be safe.