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An Observation of Groundwater in Rapid Urbanization Area

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Abstract: The objective of this study was to monitor groundwater in the Mahasarakham University, Khmriang Campus, Thailand where rapidly urbanization area. A contour map was constructed for evaluating ground level and water table level of the study area. The observed wells were installed cover the study area for 9 wells. Soil properties of the wells were investigated. The water level and water quality of the observed wells were weekly recorded from April 2006-April 2008. The results showed that the water table varied during 3-4 m below the land surface. The groundwater levels were 2-4 m during January to May, 1-2 m during May to October and 2-3 m during November to December. Soil properties along the observed wells from land surface were sand loam, silty loam, sandy clay and clayed silty. NaCl of each well during the study varied about 50 to 150 ppm.

Key words: Groundwater, soil properties, chloride, permeability

INTRODUCTION

Mahasarakham University, Khmriang Campus located in Takhonyang and Khmriang districts, Maha sarakham Province, Thailand has the area of 208 ha. It located in the Northeast region of Thailand (Fig. 1) where rapidly urbanization area. Nowadays, there are 18 faculties with the student more than 29,000 persons. The areas around this campus are changed from the field to the commercial zone. Many activities of water use led to the impact of groundwater quality. There are 49 buildings that have been constructed in this area. Hence, more than 20,000 foundation piles were driven in this area over 7 m per column.

In previous study, there are 8 buildings and the record of water table varied below ground level about 3-4 m (Anongrit *et al*., 2002). Then, the buildings have been constructed. For this reason, most of foundation piles were submerged under water table about 3- 4 m. The mainly impacts of water table include rain over surface area, soil properties, interflow, infiltration etc. (Helalia, 1993; Lashkaripour, 2003; Nouri and Malmasi, 2005; Johnson and Simon, 2007). However, soil properties and rain over surface are attracted to study in this area because of their easy to record.

Generally, the column is failed by a chloride that permeated into iron of reinforce concrete (Erdog du and Turker, 1998; Chindaprasirt *et al*., 2005). However, the progressive process of this reaction is based on chloride concentration and the submerged time. There are several forms of chloride in groundwater such as sodium chloride (NaCl), potassium chloride (KCl) etc. (Islam *et al*., 2003; Kulabako *et al*., 2007; van der Grift and Griffioen, 2008). Most chlorides are recorded in the term of NaCl and KCl because there are simple methods.

Fig. 1: Location of Mahasarakham University

This research thus monitors groundwater in the Mahasarakham University, Khmriang Campus, Thailand by constructed the observed wells cover the study area. The water table and water quality of the observed wells were weekly recorded. The chloride concentration was recorded in the term of NaCl. Soil properties of the wells were investigated.

MATERIALS AND METHODS

The observed wells were installed over the study area of 9 wells using the standard method (USEPA, 1995). The

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Fig. 2: Location of the observed wells

locations of each well are shown in Fig. 2 It indicated that most wells are drilled around the building zone because of nearly foundation piles. The method of drilling is Standard Penetration Test (ASTM D1586-08, 2008). Each observed well is drill along soil from surface area until the rock zone is met. The PVC pipe of 4 inches diameter was put into the well for protecting soil wall. Soil samples from the wells were analyzed for classifying soil type.

A contour map area was constructed for evaluating ground level and water table level of the study area using 0.50 m of contour interval. This map based on mean sea level (MSL) system. A bench mark was transferred to the observed well. The fluctuated water level of each well is monitored during the study using MSL system.

Water sample of each well were carried out to laboratory for analysis water quality. The water qualities (such as pH, temperature, NaCl and DO) in the observed wells were carried out weekly. The results will be shown in the fallowing.

RESULTS AND DISCUSSION

Figure 3 shows the fluctuate water table in the observed wells. It indicates that water table in the wells are different about 3-4 m. The lowest level is in the BH-6 located behind the building of demonstrative school and the highest level is in the BH-3 at the zone of dormitory. The water tables of each well are varying about 0.5 to 1.5 m, the lowest level occurring in April and the highest level appearing in August.

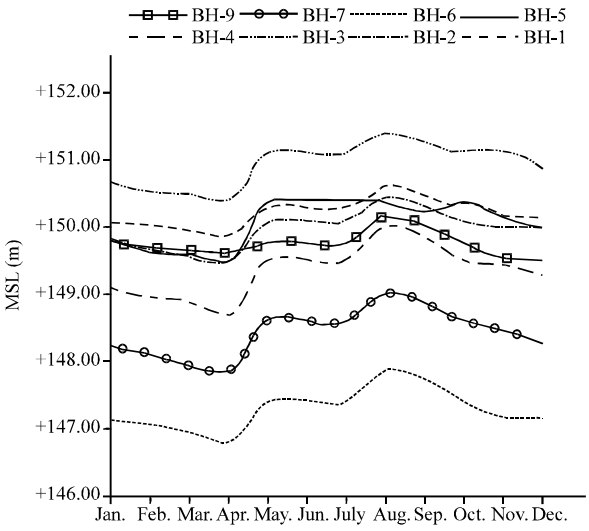

Fig. 3: A fluctuate water table

The groundwater level is proportional to quantity of surface water and more increasing during rainy season due to water infiltration and interflow according with the study of Nouri and Malmasi (2005).

Figure 4 presents the soil properties along the observed wells. It indicates that the deepest well are BH-3, BH-4, BH-10 and BH-11 of 8 meters from ground surface. The shortest well is BH-8 at the zone of fallow area, because this area is low level than surrounding area. There are 4 types of soil type including sand loam, silty loam, sandy clay and clayed silty. The thick zones of each

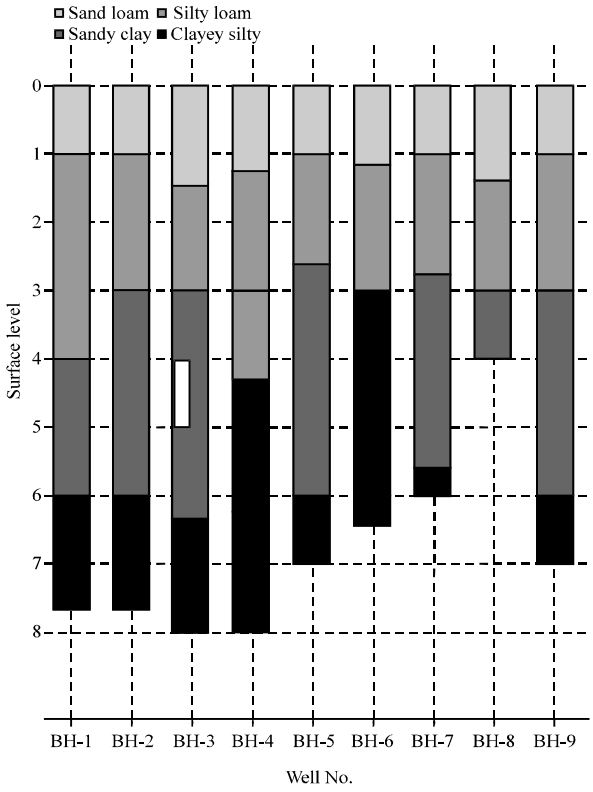

Fig. 4: Soil properties along the observes wells

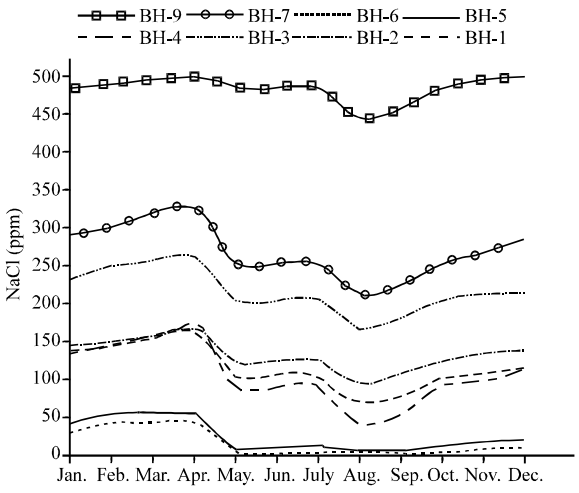

Fig. 5: A fluctuate water quality in the observed wells

type are present in the Fig. 4. The top of surface are is sand loam around 1.0 m and following with the silty loam of 2-3 m and sandy clay of 2-3 m, respectively. The deepest zone is clayey silty from 5-8 m below the ground surface.

Figure 5 shows the water quality of NaCl during the study. It presents that NaCl in the BH-9 at the zone nearby the faculty of Humanities and Social Sciences is the highest value. The lowest concentration of NaCl is in the BH-6 at the area behind the building of administration. Further, the NaCl of each well are varying during the study about 50 to 150 ppm. This NaCl was used to describe chloride in groundwater. However, the difference of NaCl in each well is upon the water infiltration from the surface area and the activities of water use. The groundwater was slightly acidic to neutral. The rapid urbanization area does not affect to the groundwater quality in term of NaCl. However, this issue is required to monitor for the long time record.

CONCLUSIONS

This research proposes a monitoring groundwater in the Mahasarakham University, Khmriang Campus (the northeast region of Thailand). A contour map of the study area was constructed for evaluating land level and transferring the MSL system for well reference. The observed wells were installed over the study area of 9 wells. The shallowest well is 4.0 m depth and the deepest well is 8.0 m. Soil properties of the wells were investigated to classify soil type. The water table and water quality of the observed wells were weekly recorded from April 2006-April 2008. The results have shown that the water table varied during 3 to 4 meters below the land surface. The groundwater levels were 2-4 m during January to May, 1-2 m during May to October and 2-3 m during November to December. Soil properties along the wells from land surface were sand loam, silty loam, sandy clay and clayed silty respectively. NaCl of each well during the study varied about 50 to 150 ppm. The groundwater was slightly acidic to neutral. The rapid urbanization area does not affect to the groundwater quality in term of NaCl.

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