Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


AHW27-01 Room:102A Time:May 22 09:00-09:24

# A study on water pollution and health impact in Kathmandu Valley, Nepal

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A study on water pollution and health impact in Kathmandu Valley, Nepal

Keywords: Kathmandu, water borne disease

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# A preliminary study on origins of sulfate ion in shallow groundwater in the highly-urbanized Musashino Plateau, Tokyo, J

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Sulfate concentration of shallow groundwater in the highly-urbanized Musashino Plateau, Tokyo, Japan shows high spatial variability in the range between 7-135 mg/L. In addition, the long-term change in sulfate concentration over the past 75 years proved to be different from those of chloride and nitrate-N & nitrite-N concentrations. To discuss possible origins of sulfate ion in groundwater, a sulfur isotope study was carried out on the basis of seven water samples in October 2012. Although a limited number of samples, sulfur isotope measurements (+2.3 to 6.2 per mil delta-34S) suggest contribution of chemical fertilizers once used in field cropping and/or leaking sewage from aging, deteriorated sewer pipes, accounting for high sulfate concentration in shallow groundwater in the Musashino Plateau.

Keywords: Musashino Plateau, urban shallow groundwater, groundwater chemistry, sulfate ion, origins of sulfur, sulfur isotope

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# The distribution of the flowing artesian well and the change of flowing artesian well area in the Ashigara Plain.

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Introduction

Many of cities are located in the alluvial plain of an area along the shore for our country which is an island country. In the alluvial plain, the confined groundwater cultivated in an upside fan or mountain area is used as the source of industrial water, or a source of tap water with river water. Overuse of groundwater in the city region in period of high economic growth caused groundwater obstacles, such as ground subsidence as one of the seven typical pollution and depleted of springwater.

Also in the flowing artesian well area from which is distributed in the Ashigara plain in the western area of Kanagawa prefecture decline has been reported after the 1960s. However, about neither the number of the flowing artesian wells which will be estimated if there are 1,000 or more points in the whole Ashigara plain, nor the actual conditions, such as the amount of natural flows, it is fully solved yet. In this study, exhaustive survey was performed about the flowing artesian well distributed in the Ashigara plain in the western area of Kanagawa prefecture, and distribution of the flowing well area and its secular variation were clarified.

Results of an investigation and consideration

Investigation of the flowing well was conducted in the 2011 to 2012. In the investigation in the 2011, about distribution, the amount of flowing water from the flowing artesian well, and main dissolved components of the flowing well, the flowing artesian well of 1,096 wells was investigated and estimation of the amount of springwater from the flowing artesian well in the whole Ashigara plain, specification of the range of a flowing well, etc. were performed. Moreover, in the investigation in the 2012, one investigation was conducted for the flowing artesian well of 200 wells every month, and seasonal variation of the amount of natural flows was clarified.

1,096 flowing wells were investigated in the investigation in 2011. The well which was carrying out the natural flow among the investigated flowing wells were 749 wells. Moreover, the amount of natural flows was measured by 648 wells, and the amount of sum total natural flows was 26,738 mˆ3 / day (9,760,000 tons / year). On the other hand, since the flowing well it became impossible that is investigated by this investigation checked 687 wells in the region, the amount of natural flows which gushes from the flowing well in the Ashigara plain was estimated at 50,262 mˆ3/day (18,350,000 tons / year). This amount of natural flows was equivalent to 25% of the amount of sum totals of the amount of groundwater withdrawals of the whole plain and the amount of natural flows in 2003.

Moreover, the area of the flowing artesian well in the Ashigara plain was 13.49kmˆ2. As for the area of the flowing artesian well region in the Ashigara plain, past five investigations were conducted. The area of the region was 18.79km2 in 1961. And these results of an investigation were about 70 percent of the area in 1961. The area of the flowing artesian well region showed the downward tendency till the 1980s, and was changing at around 13 kmˆ2 in general after the 1990s. This changing trend was similar with the long-term variable trend of the groundwater level in the upper area of Ashigara plain, and a possibility that a quantitive relation between change of the flowing artesian well region and the groundwater level of the upper arewa of Ashigara plain located in the cultivation region of flowing well groundwater was was suggested.

Keywords: flowing artesian well, Ashigara Plain, change of the flowing artesian well region

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# Regional mapping of vertical hydraulic gradient in urbanized alluvial fan: the case study of the Toyohira alluvial fan

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1. Introduction

An alluvial fan is representative of three-dimensional flow systems of groundwater owing to topographical, hydrological, and hydrogeological factors. As often seen in Japan and around the world, its groundwater flow system becomes more complex as a result of excessive withdrawal and numerous understructures. Areal information on vertical groundwater flows is no less critical than horizontal flows for interpreting actual 3D groundwater flow systems. The purpose of this study is to propose a quasi-3D approach: mapping vertical hydraulic gradient (VHG) based on groundwater table elevation (GTE).

2. Materials and methods

The regional mapping is constructed in the Toyohira alluvial fan, Sapporo, Japan. Over one thousand of well data in the site are gleaned from the publications and website of public agencies and private companies. First, a filtering process in the well data is performed because uncertainty generally arises from differing measurement times. Annual mean variations and daily fluctuations of water level in 30 observation wells are shown, and a nonparametric trend analysis is also performed. Next, the extracted water levels obtained since 1988 are divided into two categories: shallow wells of up to 20 m deep (n = 216), and deep wells of greater than 20 m deep (n = 203). The dataset is input into a geographical information system with geostatistical interpolation procedure. A GTE map of shallow well data is generated as topographic drift added to residuals interpolated by ordinary kriging. Then, each individual VHG value of the deep wells is calculated from its water level and estimated GTE at the location, and a VHG map is interpolated by moving neighborhood kriging. It is often hesitating in VHG calculation whether screen depths of deep wells are used for VHG calculation. For addressing the uncertainty, three cases, i.e., the top, middle, and bottom elevations of the screen depths, are used for VHG mapping, and cross-validation is applied to determine most reasonable VHG map.

3. Results and discussion

The annual water variations show that dewatering by the subway construction occurs before 1988, but thereafter daily fluctuations statistically range within a few meters. Also positive trends are seen in an area of the distal part, and negative trends in an area of the apex. Positive trends likely indicate a change of water intake, while negative trends indicate decreasing total water storage in the fan. The resulting GTE map shows that a GTE mound appears the focused recharge zone along the river. The groundwater table in the center of the city is about 5 m deeper than the previous table before subway construction. Cross-validation shows adequacy of the VHG map of the bottom screen depths. The VHG map better visualizes that downward flows of groundwater are predominant over the fan, owing to a basement depression at the head, seepage loss from the river in the middle, and artificial dewatering in the distal part.

Keywords: alluvial fan, groundwater, trend analysis, kriging, hydraulic gradient, urbanization

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# Study on Proposal and Application of Simple Evaluation Technique for Geothermal Potential Based on Geological Informatio

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After the Fukushima nuclear power plant accident caused by the 2011 off the Pacific coast of Tohoku Earthquake and Tsunami, we have been having various discussions about new electric power development. And furthermore, renewable energy attracts our attention. Ground Source Heat Pump (GSHP) system, which is the technology of using characteristics of geothermal and groundwater flow, can satisfy all the demands. This technology can realize energy saving. It is important for the spread of GSHP system to evaluate the land suitability. However, it is difficult to quantitative modeling for groundwater and geological information. Since, method of evaluating geothermal potential, that can be useful for assessment of land suitability for installing GSHP system, is not generalized. In this research, we propose the method of using hydrogeological information which is easy to collect, and apply to the model areas. Thermal conductivity, saturated or unsaturated, and groundwater flow are mainly related to the efficiency of GSHP system. It is thought that the difference is defined by topographical condition and hydrogeological settings of the area. For the purpose of expressing the difference precisely, we collect information of borehole loggings, geological maps, land use and formed the information into GIS data. Secondly, the planar distribution of groundwater level, thickness of aquifer, hydraulic conductivity, thermal conductivity, volumetric heat capacity, Darcy velocity are analysed by GIS. The analysed data contribute to a understanding of phenomenon of heat conduction or advection by groundwater flow. Furthermore, we use software 'Ground Club' which

can estimate heat exchange of unit length of borehole by using 2 parameters, thermal conductivity and volumetric heat capacity, and evaluated the number of borehole heat exchangers and the initial cost. The proposed method is applied to the model areas and the potential maps which can be useful for installing the GSHP system are made.

Keywords: ground source heat pump system, hydrogeological information, geothermal potential map

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# Effects of groundwater development on subsurface temperature distribution in the northern Kanto Plain

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Since 1999, our group has been conducting a survey to evaluate the subsurface temperature environment in the Kanto Plain, Japan. Takahashi (1967) pointed out that high temperatures have been observed beneath the northern Kanto Plain. High temperature area has been also observed in our study (Miyakoshi et al., 2003). However, the reason why the high temperature area is formed has not been explained. Taken in the light of the progression of land subsidence caused by groundwater development in this area, the distribution of subsurface temperature is considered to be affected by groundwater flow change caused by effects of groundwater pumping. To make clear a distribution of subsurface temperatures and its change in the northern plain, we conducted the measurement of temperature-depth profiles at 66 observation wells in Gunma and Tochigi Prefectures in 2011. This paper provides the evaluation result of observed data in 30 wells in the eastern part of Gunma prefecture and the southern part of Tochigi prefecture.

High temperature area was observed in the lowland along the Tone River and the Watarasegawa River. At the depth of 100m, relative low temperatures were found in the central part of this area. Wells close to rivers showed especially low temperature. Low hydraulic heads are observed at the depth from 100 to 200 m in this area. The distribution of hydraulic heads suggests that groundwater flow concentrates to the part of low heads. This accords the main depth of groundwater development in this area. It suggests that low temperatures were formed by induced groundwater recharge caused by groundwater pumping. In contrast, thermal gradients increase at the depth of low heads in the high temperature area. The distribution of thermal gradients shows effects of upward groundwater flow toward the part of low heads. Accordingly, distribution of subsurface temperatures is considered to be affected by not only regional groundwater flow system but also groundwater flow change caused by groundwater development in the north of Kanto Plain.

Keywords: groundwater development, subsurface temperature, grounwater flow, urbanization, Kanto Plain