CONTROL OF GEOLOGY STRUCTURE ON GEOMETRY AQUIFER of groundwater in “non-groundwater basin” area in GEDANCSARI, GUNUNGKIDUL, D1Y

by Puji Pratiknyo

CONTROL OF GEOLOGY STRUCTURE ON GEOMETRY AQUIFER OF GROUNDWATER IN "NON-GROUNDWATER BASIN" AREA IN GEDANGSARI, GUNUNGKIDUL, DIY

Bambang Prastistho*) Puji Pratiknyo*) Achmad Rodhi*) C. Prasetyadi *)

*) Geological Engineering, Universitas Pembangunan Nasional "Veteran" Yogyakarta. SWK St. 104, Condongcatur, Depok, Sleman, D.I. Yogyakarta, Postal Code 55283, E-mail: *bprastistho@yahoo.com*

ABSTRACT

Ground water is one of natural resources that serves to support life and development activities. Until now, groundwater is still the main source to meet the water needs for the population, both for drinking water, households, irrigation water and industrial water, so that groundwater is a natural wealth that fulfills the livelihood of many people. Efforts for the effectiveness and efficiency of groundwater use need to be done continuously and continuously, especially to meet basic daily needs, followed by the use of groundwater for other purposes, such as agriculture, environmental sanitation, industry, tourism etc.

The existing "non-groundwater basin" zone in Gunungkidul Regency, especially in Gedangsari sub-district is controlled by a fracture system that can be divided into two systems, such as fractures as tunnel or tract or fracture as a trapped water or in other words as a groundwater aquifer. The method applied in this research is geological and hydrogeological loading. Hydrogeological mapping includes the research of dug wells, boreholes, springs, supported by geoelectric measurements of the Sounding Schlumberger and Dipole-Dipole methods.

Distribution of groundwater based on dug wells, springs, and geoelectric data was found in the valley where the valleys found more geological structures and complexes. Based on geoelectric measurements, the aquifer system is controlled by a geological structure as a secondary porosity (fracture) in which groundwater trapped, which is configured with surface geological data as a fault zone and a water-saturated layer of rock and weathering zones. Geometry of groundwater aquifers horizontally spread over the valleys of the E-W Baturagung Mountains with aquifer depths of 10-200 meters

Keywords: groundwater, geological structure, groundwater basin.

1. INTRODUCTION

Groundwater is one of natural resources that serves to support life and development activities. Until now, ground water in the Gunungkidul area is still the main source to meet the raw water demand for the population, whether for drinking water, households, irrigation water and industrial water, so that ground water is a natural wealth that fulfills the livelihood of many people. The important role of ground water, when over-exploited exceeds the available potential, would have a negative impact on the quantity and quality of the groundwater itself and the environment.

Groundwater basins are naturally constrained by hydraulic borders controlled by local geological and hydrogeological conditions. The northern Gunungkidul area is classified as "non-groundwater basin" (ESDM, 2008) controlled by volcanic clastic product which have been solid and unfavorable as aquifer with primary porosity. Therefore, it is necessary to have a structural study as a secondary prosity discourse to determine the boundaries of groundwater zone that can be used in the region as a supporting tool for the region and the community in the framework of groundwater management.

To that end, the authors conducted research related to the geometry of the aquifer based on the geological structure symmetry configured with geological and hydrogeological mapping data and geoelectric survey to technically determine the boundaries of the groundwater zone in the northern Gunungkidul region, either horizontally or vertically by determining detailed hydrogeological configuration of the groundwater zone.

2. RESEARCH METHODS

The research method used is mapping of surface geology both geomorphological observation, geological structure and stratigraphy; as well as hydrogeological mapping in the form of measurement of dug wells, springs and geoelectric surveys of Schlumberger and Dipole-Dipole sounding methods. Groundwater level mapping through measurement of dug wells and springs as a basis for making groundwater maps and groundwater flow maps. While the surface geology data used as a reference as the basics of groundwater zone determination are correlated with the geoelectric survey results. Groundwater with different hydraulic conductivity values can be affected by evolving geological structures characterized by the discovery of dug wells with groundwater elevations close to topography. While springs appearing on geological structures can indicate that the geological structure acts as a channel where groundwater flows onto the surface.

Geological and hydrogeological mapping conducted by Gedangsari Sub-district and surrounding areas were found 9 geological structure observation stations, 76 measurement points of dug well, 11 measurement points of springs, correlated with 9 points of Sounding Schlumberger, 3 lines of Dipole-Dipole, and 1 wellbore point in the groundwater maps and geological structures (**Fig. 1**).

3. RESULTS

Geology of research areas based on stratigraphic state and geological structure shows the layering of rock in general has a relative slope to the south, with the dominant lithology of clastic volcanic rock. Systematic fractures are heavily controlled by the fault as a form of secondary porosity. The fault distribution can be grouped into 3 general direction patterns such as N-S, NE-SW and NW-SE. The NE-SW and NW-SE direction is the pattern that controls the aquifer's spread of the research area. Among these faults is an important fault because it controls the geomorphology of the fault valleys, the emergence of springs and is the controller of a groundwater geometry system (aquifer system). While the N-S pattern is a fault pattern perpendicular to the direction of the morphology of homoclin hills that act as groundwater channels out as run-off.

Hydrogeological mapping includes the mapping of wells, springs and supported by geoelectric mapping Sounding Schlumberger and Dipole-Dipole methods. Distribution of dug wells are mostly in the valleys and lowlands, while the springs are on a slope bend between the morphology of the hills and valleys. Based on the mapping, the groundwater pattern can be known to the central part of the valley Gedangsari precisely in Hargomulyo. The direction of this flow is the indicator that the hills are an affixed area, while the valley of "Baturagung depression" is a discharge area with Juwerand Ngalang rivers as the channel of groundwater flow collected in this "Baturagung depression" becomes run-off.

Based on geoelectric measurements, it is shown that the aquifer system is controlled by the geological structure as the secondary porosity of groundwater trapped, indicated by a low resistivity value. The result of the geoelectric measurement of the Sounding Schlumberger method, resistivity shows the stratigraphic distribution of both water-saturated and non-saturated (**Fig. 2**). Based on the measurement point indicated the saturated zone has a resistivity value ranging from 2-32 ohm.m, and the unsaturated zone between 44-55 ohm.m. While the geometrical measurements of the Dipole-Dipole method show the resistivity anomaly indicated as the fault zone and rock bedding (**Fig. 2**). On the lines of Dipole-Dipole shows an anomalous pattern tilted to the north as a fault and anomalous patterns tilted to the south as layers of rock. The aquifer distribution of this path is controlled by a fault structure indicated by a resistivity value <35 ohm.m, while the groundwater aquifer basement is indicated by a resistivity value> 35 ohm.m.

Geological measurements, the hydrogeology is configured into several block diagrams and cross-sections resulting in vertical dispersion orientation, then geophysical data as interpretation controllers and basic drawings of configuration and hydrostratigraphic cross-sections (**Fig. 3** and **Fig. 4**).

4. CONCLUSION

Research indicates that the geological structure of the study area controls both vertical and horizontal exploitation as well as the abundance of groundwater in the Gedangsari aquifer geometry, Gunungkidul.

The geomorphological observations show the relative distribution of a relatively E-W elongated fault valve which is flanked by homoclin hills in the direction of the stocky and cesarean distribution as a fault zone and fracture with high intensity forming as a secondary porosity in the aquifer of the study area. Systematic fractures are controlled by the formation of faults that are grouped into three general directions. Geometry of groundwater aquifer is horizontally related to the distribution pattern of geologic structure of NE-SW and NW-SE direction including Terbah, Hargomulyo and Mertelu.

Hydrogeological mapping shows dug wells spread over the valleys and lows, while the springs are on a slope bend between the morphology of the hills and valleys. A vertical geometry based on geoelectric measurements shows that the aquifer is at a depth between 2-200 meters, indicated by a resistivity value ranging from 2-32 ohm.m.

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ATTACHMENT

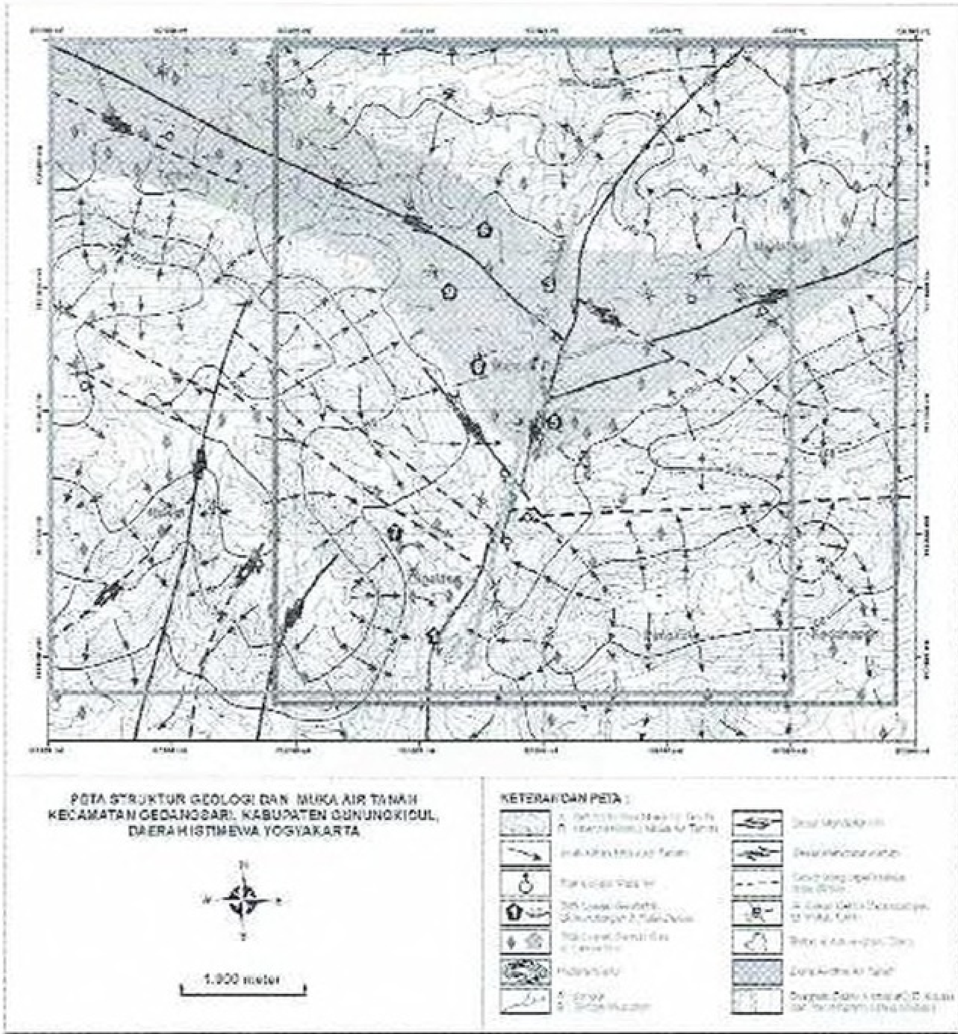

Figure 1. Map of geological structures and groundwater table, dispersion of geoelectric survey points of the Sounding Schlumberger and Dipole-Dipole methods and the calibration of faults geological structures based on field data (outline) and estimated faults (dashed lines)

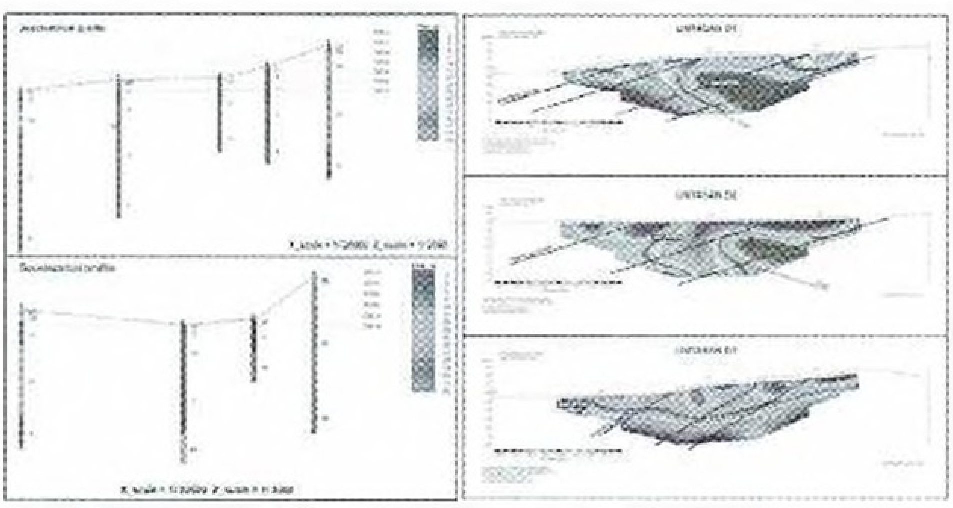

Figure 2. Results of Geoelectric Survey Measurement in Hargomulyo, Sounding Schlumberger method (left) and Dipole-Dipole method (right)

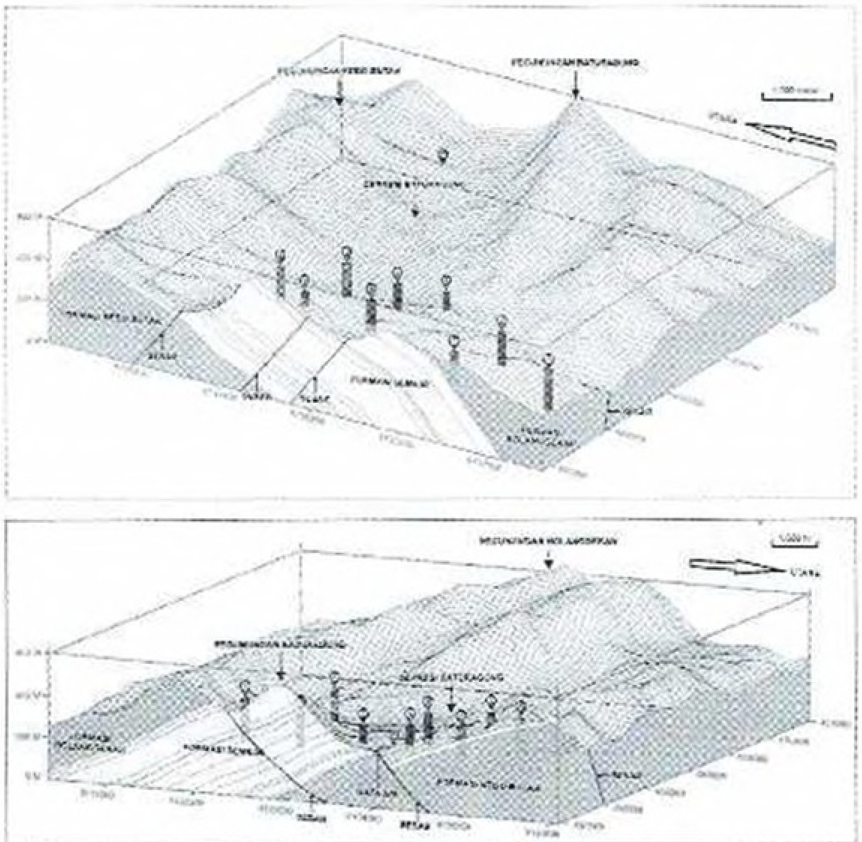

Figure 3. Block diagram of rocks units on research area based on geological surface mapping and geoelectric resistivity profile

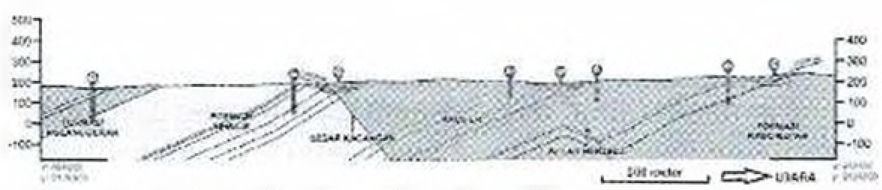

Figure 4. Detail cross section of rocks units and aquifer on research area based on geological surface mapping and geoelectric resistivity profile

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