QUALITY AND GROUNDWATER FLOW AT DEGAN, BANJARARUM, WEST PROGO

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Abstrak

Penelitian ini merupakan kegiatan survei hidrogeologi dengan tujuan untuk mengetahui kualitas dan pola aliran airtanah di daerah Degan dan sekitarnya, Desa Banjararum, Kecamatan Kalibawang, Kulon progo. Metode penelitian dilakukan dengan survey hidrogeologi untuk mengambil data muka airtanah dan kualitas airtanah yang berupa pH, TDS dan EC. daerah penelitian termasuk dalam fisiografi Kubah Kulon Progo, dimana daerah ini merupakan wilayah non CAT. Geomorfologi daerah penelitian di bagian utara dan barat didominasi oleh bentang alam yang relatif kasar membentuk perbukitan, sedangkan di bagian tengah, timur dan selatan merupakan bentang alam bergelombang lemah hingga dataran. Hasil penelitian menunjukkan bahwa kedalaman airtanah dangkal sebesar 1,2 – 10,8 m (dpt). Pola aliran airtanah ke arah timur/tenggara, dengan kondisi batas H5 dan V1. Akifer airtanah disusun oleh endapan koluvium serta bed rock yang lapuk – setengah lapuk. Nilai pH air di daerah penelitian berkisar dari 6,7 -7,1; TDS sebesar 165 – 901 ppm, sedangkan EC berkisar 187 - 1240 µS/cm. Dengan demikian, airtanah di daerah Degan bersifat netral dan tawar.

Kata kunci: *airtanah, pola aliran, kualitas airtanah*

Abstract

This research is a hydrogeological survey activity with the aim to determine the quality and pattern of groundwater flow in the Degan and surrounding areas, Banjararum Village, Kalibawang, West Progo District. The research method is carried out by hydrogeological surveys to collect groundwater data and groundwater quality in the form of pH, TDS and EC. The research area is included in the Dome of the Kulon Progo physiography, where this area is a non CAT area. The geomorphology of the study area in the north and west is dominated by relatively coarse landscapes forming hills, while in the central, eastern and southern parts it is a weak wavy landscape to the plains. The results showed that shallow groundwater depth of 1.2 - 10.8 m (under surface). The pattern of groundwater flow is to the east / southeast, with boundary conditions H5 and V1. Groundwater aquifers are composed of colluvium deposits and weathered - medium weathered rock. The pH value of water in the study area ranges from 6.7 -7.1; TDS is 165 - 901 ppm, while EC ranges from 187 - 1240 µS / cm. Thus, groundwater in the Degan area is neutral and tasteless.

Keywords*: groundwater, groundwater flow, groundwater quality*.

1. Introduction

This hydrogeological study was carried out in Degan, and its vicinity, Banjararum, West Progo District, Yogyakarta (Figure 1). The study area is astronomically located at the coordinates 7º43’0” – 7º44’40” LS dan 110º11’40” – 110º12º50” BT. included in Sendangagung Sheets, according to RBI Bakosurtanal published on 2001. This area includes some hamlets in Banjararum Village and surrounding area near ITNY field campuss. A lot of water needs along with the rise of activities on the field campus requires an understanding of the potential for smelly groundwater for this area so that water shortages can be anticipated.

2. Methodology

The research began with a study of libraries of the geological conditions of West Progo Dome Zone. Furthermore, by knowing its regional physiography, the hydrogeological survey was held directly in the research area. Standard geological equipment (compass, hammer, and GPS) were used and completed by topographic map of Sendangagung sheets. The hydrogeological description in the field is focused on measuring of groundwater level and its quality data such as pH, TDS and EC. Data analysis

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was done by generating groundwater table map. Groundwater flow can be interpreted from this water table data.

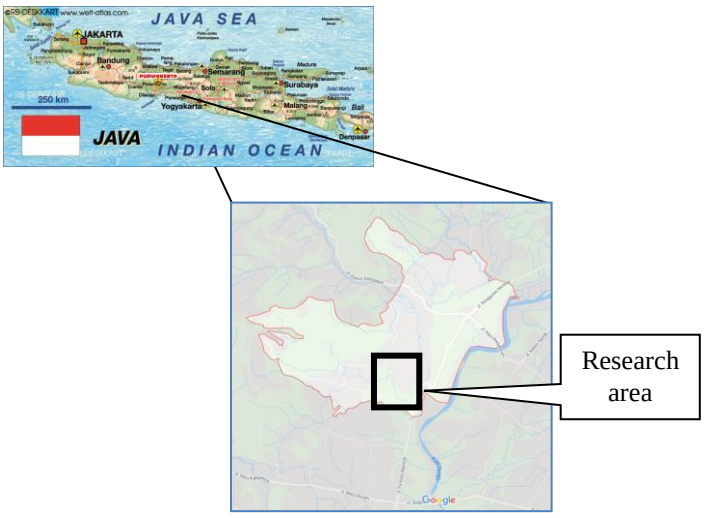


Figure 1. Location of research area.

3. Geology of Degan Area

3.1. Geomorphology

The research area generally occupies in the physiography of the West Progo Dome [1]. The morphology of Degan and its vicinity area can be divided into 3 units based on geomorphological unit classification [2], [3] as described below.

a. Denudational hilly unit
b. Denudational rolling Unit
c. Denudational undulating unit
d. Fluvial flat unit

Landform usually control shallow groundwater in Progo drainage area [4], as well as in the Banjararum area. Tha flat – undulating unit allows the presence of groundwater in shallow aquifer zones.

3.2. Stratigraphy

The study area is included in two Tertiary formations and Quaternary sediments [5]. The Tertiary formations include Nanggulan Formation and Old Andesite Formation (OAF) (Table 1). The Nanggulan Formation is the oldest rock formation in Kulon Progo. This formation is Eocene-Oligocene, composed of sandstone with lignite intercalations, carbonate sandstones, claystone with limonite concretion, carbonate claystone, sandstone, and tuffaceous marl.

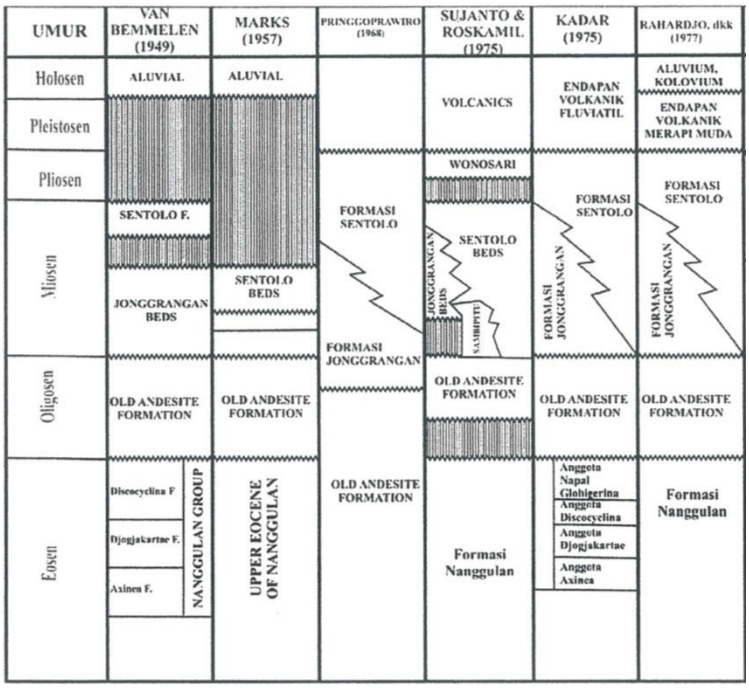
The Old Andesite Formation is composed by andesite breccias, tuffs, and volcanic sandstone, the Oligocene-Miocene age. Sometimes in this formation also found agglomerates and inserts andesite lava flow. The rocky soil also covers much of the research area.

3.3. Geological Structure

The geological structure in the study area is strongly influenced by the process processes that occur in the Miocene Oligocene. The structure is in the form of folds, joints and faults. The fold structure is in the center of the study area, referring to the Nanggulan Formation. The joint structure in the study area consisted of two types, namely, shear and tension joints, which is both of them can be found in the Nanggulan and Old Andesite Formations. Neotectonics are actively interpreted in this West Progo region, which is reflected in morphological pattern [6].

The Kulon Progo Mountains are rather oval in shape, described as the dome. This dome is a result of the lifting or anticline structure that has a circular or elliptical appearance and has a slope in all directions. The dome is the result of vertical movements (ridging) better known as minor undasion where the core and slopes consist of volcanic rock groups and at the top of the dome is found almost flat landscape shape called plateau which consists of limestone units [6].

Table 1. Stratigraphy of West Progo from some researchers [6].



3.4. Hydrogeology

The study area includes in one hydrogeological zone, there are non-basin area of the West Progo Hills as non groundwater basin [7]. The hydrogeological map is shown in Figure 2. The area usually characterized of hard water area.

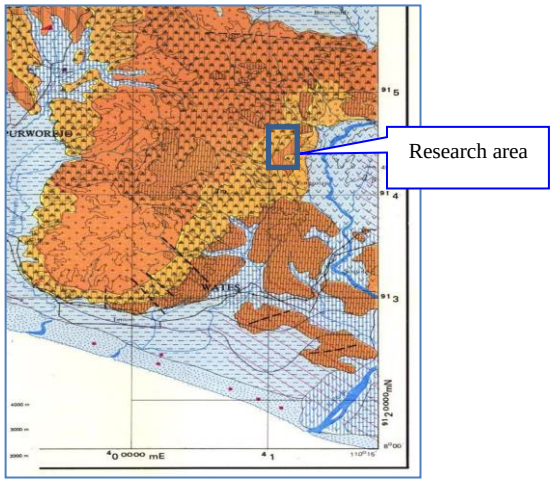


Figure 2. Research area in hydrogeological map [8].

	Aquifers (crack or porous) with low productivity and scarce groundwater areas	Aquifers with small productivity and locally significant	Generally low to very low continuity; local, limited quantities of groundwater can be obtained in the valley area or weathering zone
		Rare groundwater area	

4. Result and Analysis

4.1. Groundwater Table

The west progo area generally has small to medium-sized springs [9], however, hard and compact rocks such as the Old Andesite Formation may still produce medium-sized springs. In banjararum, these tertiary formations have generally begun to weathered or even become collovial with more potential as aquifers.

Groundwater depth in wells ranges from 1.2 - 10.8 m from the local land surface, meaning that it still includes shallow groundwater. The surface of groundwater in the study area is at an elevation of 95.96 - 167 asl. Examples of dug wells are shown in Figure 3, while map of groundwater in the study area can be seen in Figure 4. The map shows that the pattern of groundwater flows generally flows east or southeast.

Figure 3. One of some dug wells in research area can be found in Bundak, Tegal, Degan (Loc. 1).

Refer to preliminary study [10], the research area has a horizontal boundary type H5 (outflow boundary). The boundary H5 is the boundary of the groundwater basin with the direction of groundwater flow to the exit of the groundwater basin, in this case groundwater exits from the non CAT area in the eastern part of the research area towards the Progo river.

The vertical hydrostratigraphic boundary of the study area is the boundary type V1 (free surface boundary). This type of boundary has a limit of unconfined groundwater or phreatic face, is the upper vertical boundary of a groundwater basin [9]. The interpretation of the aquifer arrangement and the type of vertical boundary is presented in Figure 5. Groundwater potential depends on alluvial / coluvial which is not too thick, so the quantity of groundwater is not large.

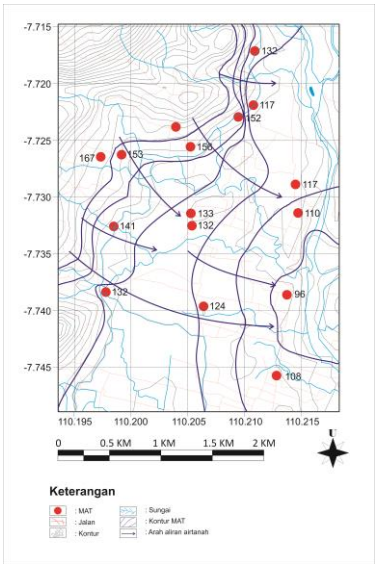


Figure 4. Groundwater table map of research area.

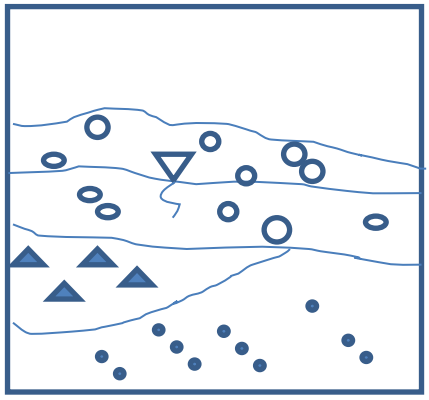


Figure 5. Boundary condition of V1 interpretation of aquifer in study area.

4.2. Quality of Groundwater

The pH value of groundwater and surface water in the study area ranges from 6.7 to 7.1, meaning that the acidity of the water is relatively neutral. The standard for drinking water issued by the Minister of Health [11] requires water pH to range from 6.5 to 8.5. This means that groundwater found in the research area is in accordance with the drinking water quality standard. Thus, groundwater in Degan and its surroundings, both from dug wells and springs, is used as drinking water. Furthermore, the ISO iso map is given in Figure 6.

The TDS value of the water studied ranges from 165 - 901 ppm. All water samples studied meet the requirements of drinking water according to the Minister of Health standards [11]. All water studied still includes fresh water (Carrol, 1962, in[12]). The TDS iso map is given in Figure 7.

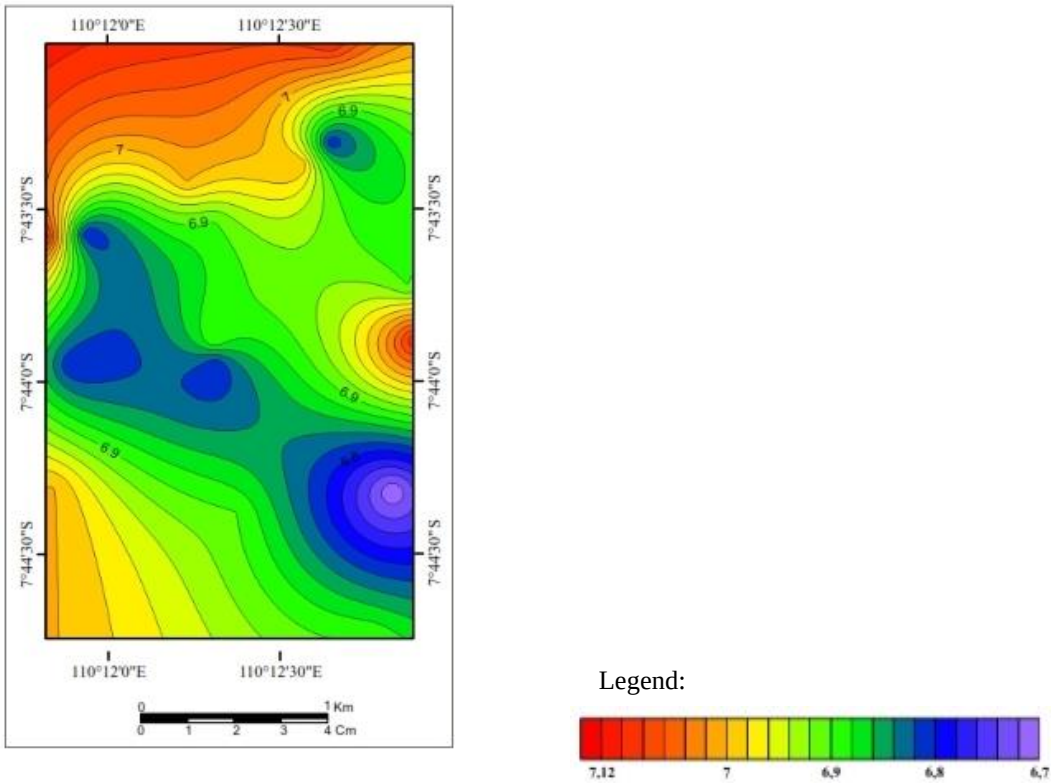


Figure 6. Iso-pH map of groundwater in research area.

Meanwhile, the EC value of the water studied showed a price range of 187-124µS / cm. Unfortunately, the Minister of Health regulation (2010) does not include EC values as a condition for drinking water. However, usually the EC value will be positively correlated with the TDS value, so if the

water has TDS that meets the drinking water requirements, the EC value will also be in accordance with the standard. Groundwater iso-EC maps are given in Figure 8.

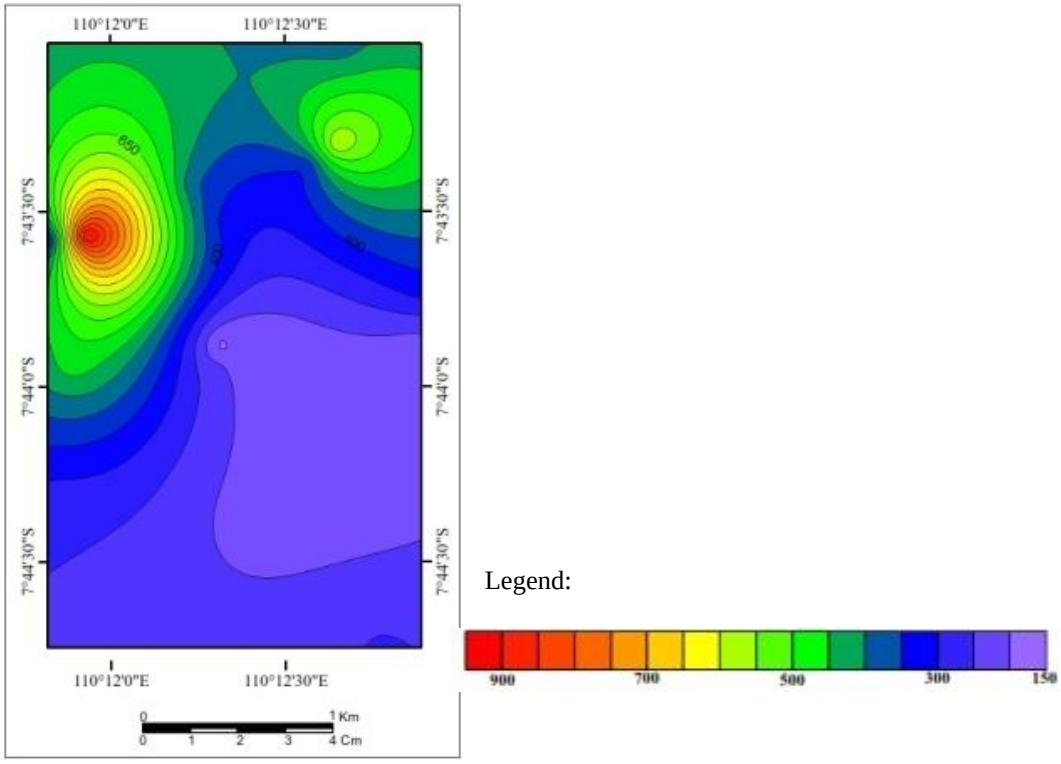


Figure 7. Iso-TDS map of groundwater in research area.

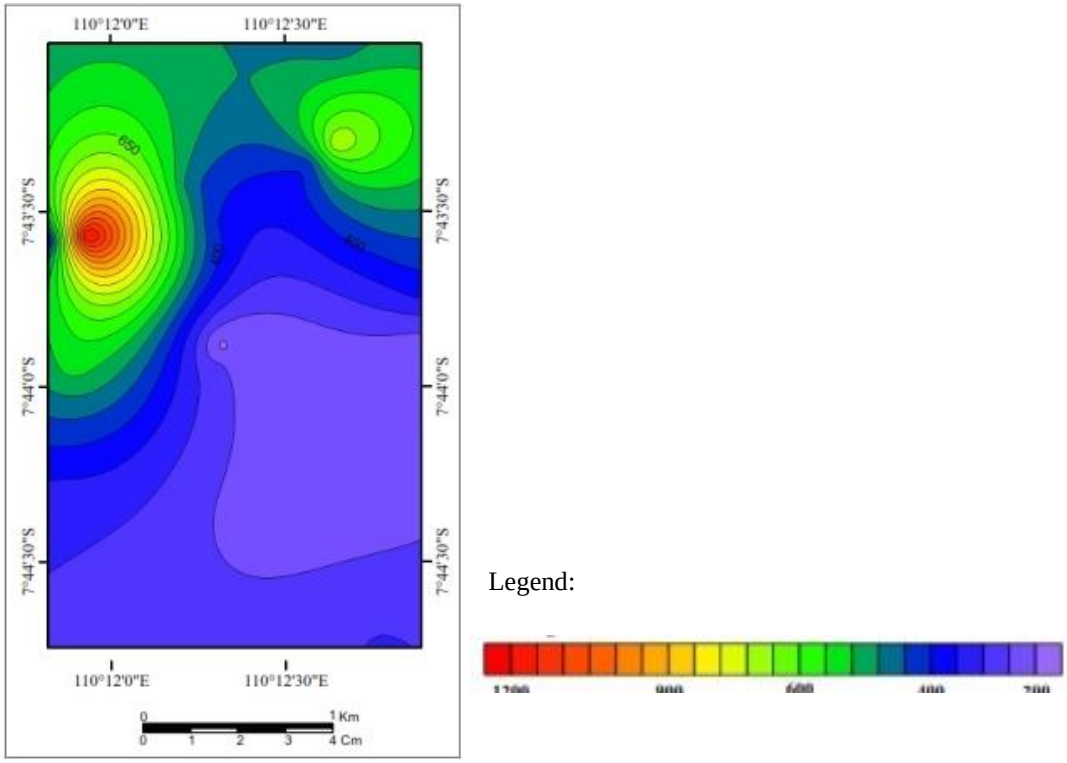


Figure 8. Iso-EC map of groundwater in research area.

4. Conclusion

The study of the geological groundwater geology of the Degan area, Banjararum Village, Kalibawang Subdistrict, shows that the quality of shallow groundwater resources is of good quality. The geology of this area is included in the Dome of the West Progo physiography, where this area is a non CAT area. The geomorphology of the research area in the north and west is dominated by relatively rough landscapes forming hills. Meanwhile, the central, eastern and southern parts are generally undulating/rolling to plain landscape. Groundwater is obtained at a depth of 1.2 - 10.8 m from the local land surface. The pattern of groundwater flow in the study area generally flows to the east / southeast, with the condition of horizontal boundary H5 and vertical boundary V1. Groundwater aquifers are composed of colluvium deposits and weathered - medium weathered rocks. The pH value of water in the study area ranges from 6.7 -7.1 and TDS 165 - 901 ppm, and EC ranges from 187 - 1240 µS / cm. This value indicates that groundwater is neutral and tasteless. Thus, a sufficiently good groundwater quality can be obtained in the Degan and surrounding areas, with potential for developing to the southeast, but it needs to be understood that groundwater potential is not large.

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