Study Aquifer Of Groundwater With Method Of Electrical Resistivity In Botanical Gardens Unmul Samarinda

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Abstract: The research was conducted to determine the depth and characteristics of the groundwater aquifers in the region Unmul Samarinda Botanical Garden. The study was conducted using an electric reistivitas. The research data consisted of electrical resistivity data, geological data, topography data, land cover and vegetation data. The results showed that the groundwater aquifer located at a depth of 10 m - 100 m on a line-1 and 15m - 114m on the 2nd line. Type aquifer groundwater in aquifers research sites are free, at the top of the aquifer covered by a layer of porous rock so there is still no movement of water into the aquifer, below the aquifer layer covered by a layer of impermeable serves as a barrier groundwater.

Keywords: Electrical resistivity, Groundwater aquifers, Free aquifer

Introduction

Conservation forests have an important role in preserving biodiversity and other environmental services (Yulian, et al, 2011; Alhani, et al, 2015). Water is an indispensable resource for the life of humans, animals and plants, both for drinking water, clean water, food supply, as well as to manage the farming business. Water resources requirements increasing in line with population growth, while the perceived availability is more limited (Fulazzaky, 2014). There is a close connection between forest areas with potential water resources, forest area as a supplier of water resources (Calder et al., 2007). Vegetation serves as cover layer of soil to hold water that slowly the water will get into the subsurface and groundwater aquifers layers towards the end. Vegetation, topography, slope and rock lithology can affect groundwater aquifers (Mohamadi and Ataollah, 2015). Vegetated region plays an important role in generating groundwater quality (Muttaqien et al, 2008; Samsoedin 2009; Hidayat, 2014). Vegetation is required as the impregnation of water into the subsurface (Ashazy and Cahyono, 2013). Forest ecological functions as a provider of environmental services such as water regulation, a producer of water resource potential (Mawardi and Sudaryono, 2006; Abu-hashim et al., 2015). Rainwater is able to reach the ground, some will teresapkan into the ground (infiltration) and the rest will melimpas through the surface of the soil (direct run-off) to the ravines to go back to the sea (Asdak, 2010). Groundwater is under the earth's surface in a water-saturated zone occupies the pore space of the rock (Anomohanran, 2011; Lawrence and Ojo, 2012; Khan et al., 2013; Rao et al., 2014). Electrical resistivity method is very effective to know the groundwater aquifer layer (Egbai 2011; Anudu et al., 2011; Ibrahim et al., 2012; Utom et al., 2012).

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Method

a. Research sites

This research was conducted in the area Unmul Samarinda Botanical Garden, are geographically located at coordinates: 0˚25'10 "LS - 0˚30'20" LS and 117˚14'0 "BT - 117˚14'14" BT (Figure 1). The administration was in Tanah Merah, district. North Samarinda, Samarinda, East Kalimantan.

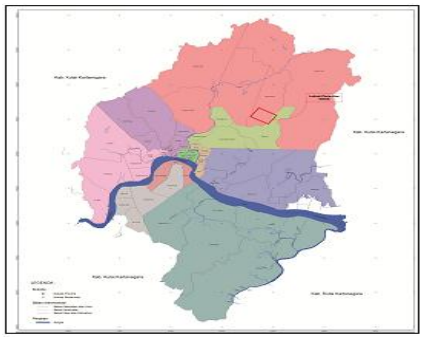

Figure 1. *Map of location Research (Anonymous, 2011)*

b. Data Research

The research data consisted of electrical resistivity measurement data in the track profile measurement. There are two trajectories profile measurements in this study as shown in Figure 2 below. The configuration used in the measurement of the electrical resistivity is the Wenner-Slumberger configuration, configuration Dipole-Dipole and Pole-Pole. Geological data, vegetation data of land cover and topography data research location.

c. Data analyst

Electrical resistivity measurement data were analyzed using the Software Res2Din to get a model 2D (two-dimensional) subsurface. Model 2D (two-dimensional) to determine the depth and characteristics of the groundwater aquifer layer at the sites. Geological data used to determine the location of rock lithology study, topographic data to determine the location of the topography and slope vegetation research and data used to determine the type of vegetation that cover the surface of the study site, the type of plants that are in the research area.

d. Interpretation

Interpretation of the results of the data analysis is done with reference to the electrical resistivity data analysts, geological data, topographic data and the data of vegetation land cover research areas to determine the characteristics of the aquifer groundwater at the sites. The results of the data analysis of the electrical resistivity by the Wenner-Slumberger configuration, the configuration of Dipole-Dipole and Pole-Pole configuration used for subsurface interpretation to determine the depth and characteristics of the groundwater aquifer region Botanical Garden Unmul Samarinda.

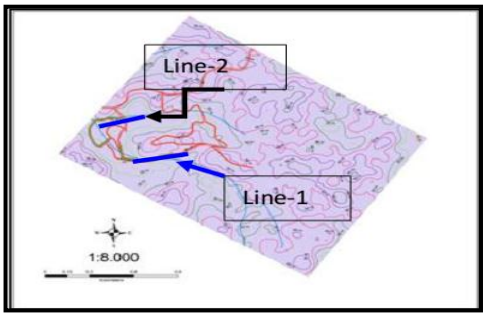

Figure 2. *Tracks Electrical Resistivity Measurements and Topographic Map*

Results and Discussion

The results of measurements of electrical resistivity data analysis using software Res2Din on line -1 is presented in the form of a 2D model (two-dimensional) as follows:

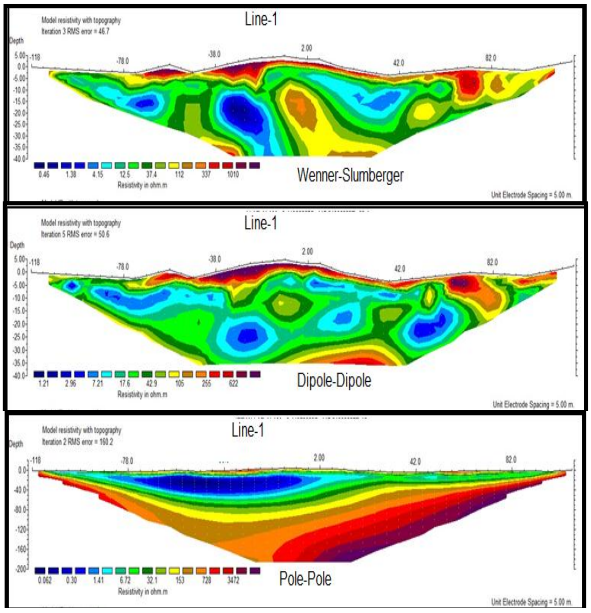

Figure 3. a) *line-1 Wenner-Slumberger, b) line-1 Dipole-Dipole, c) line-1 Pole-Pole*

Groundwater aquifers can be indicated on the electrical resistivity value is low, the water has a low electrical resistivity value but has high conductivity, so that water can conduct electricity. High electrical resistivity value describes the rocks that are more compact, no pore spaces are filled with water, these rocks can not conduct electricity, has low conductivity, in balikpapan rock formations are kind of silt, sand and sandstone. In the line-1 Wenner-Slumberger, low resistivity of less than 100 Ωm interpreted as groundwater aquifers. High electrical resistivity values ranging from 112 Ωm - 1010 Ωm interpreted as a rock, silt, sand and sandstone. Line-1 Dipole-Dipole resistivity values of less than 100 Ωm, high resistivity value of 105 Ωm - 622 Ωm. Line-1 Pole-Pole, low resistivity values of less than 100 Ωm interpreted as groundwater aquifers, high resistivity value of 153 Ωm - 3472 Ωm interpreted as silt stone, sand and sandstone are very compact. The resistivity value according to Telford et al (1995); Loke (2015) resistivity values of less than 100 Ωm a groundwater aquifer, high resistivity values to draw a compact rock types silt, sand and sandstone. The depth of the groundwater aquifer layer on a line-1 between 10 m - 100 m, as shown in a 2D (two-dimensional) model line-1 Pole-Pole. Circumstances covered vegetation on a line-1 and covered by vegetation as shown in Figure 4. Line-1 is located on the flat topography and the lowest, the vegetation cover of the surrounding land is at a rather steep slope to slope toward the line-1, rainwater which will fall to the ground percolate down to the aquifer and the line-1.Vegetasi around line-1 consists of groups of dipterocarp, grass, shrubs. Rainwater the down fall to the ground and impregnated stuck in the roots into the soil which eventually entered into the groundwater aquifers in the line-1, in accordance with (Ashazy and Cahyono, 2013; Hidayat, 2014). Characteristics of groundwater aquifers in the line-1 overburden aquifer is a rock that has pores so there is still a movement of water into the aquifer layer, was under a layer of impermeable rock aquifer is functioning as a groundwater barrier. Aquifer characteristics such as the above is called free aquifers. Model 2D (two-dimensional) line-2 Wenner-Slumberger have low electrical resistivity value of less than 100 Ωm in interpretation as groundwater aquifers, high resistivity value of 141 Ωm - 685 Ωm interpreted as compact rock of the kind of silt, lanaupasiran, sand and sandstone. Groundwater aquifer located at a depth of 10 m - 35 m on the configuration of the Wenner-Slumberger. Line-2 configuration Dipole-Dipole, the value of electrical resistivity low of less than 100 Ωm alleged aquifer groundwater is at a depth of 10 m - 35 m, the value of the electrical resistivity high 118 Ωm - 1105 Ωm suspected as rocks compact of the type of silt, silt sandy, sand and sandstone. In line 2 Pole-Pole, low electrical resistivity value of less than 100 Ωm seemed to be at a depth of 15 m - 114 m below the surface, under a layer of groundwater aquifers is very compact rock with a high resistivity value was 101 Ωm - 1877 Ωm. The rock is thought to be highly impermeable rock and serves as the base of groundwater aquifers. Characteristics of groundwater aquifers in the line-2 is a free aquifer, the upper part is a porous rock and that the movement of water enters the aquifer, the bottom of the impermeable layer that serves as a water barrier.

Figure 4. *Vegetation Cover Land Line-1*

Furthermore, the results of data analysis reisistivitas electric line-2 is shown in Figure 5 below:

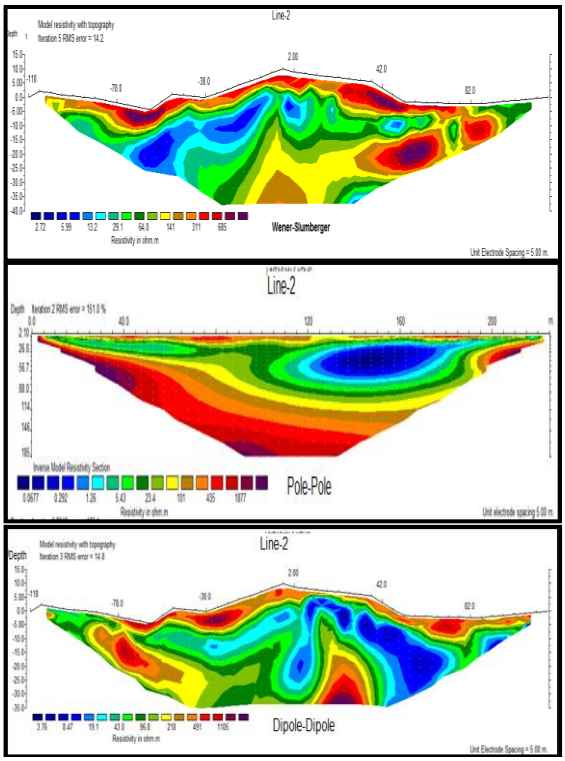

Figure 5. *a) Line-2 Wenner-Slumberger, b) Line-2 Dipole-Dipole, c) Line-2 Pole-Pole*

Figure 6. *Vegetation land cover Line-2*

Vegetation around the line-2 consists of groups of dipterocarp, grass, shrubs (figure 6). Rainwater the down fall to the ground and stuck in the roots into the soil which eventually entered into the groundwater aquifers in the line-2, in accordance with (Ashazy and Cahyono, 2013; Hidayat, 2014).

CONCLUSIONS

Based on the results and the above discussion it can be concluded that the depth of the layer aquifer groundwater research sites is 10m - 100m line-1 and 15 m - 114 m on a line-2, the characteristics of the aquifer groundwater line 1 and line 2 is the aquifer free.

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