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Investigation of aquifer distribution and groundwater quality in the Village of Rimbo Panjang, Kampar District

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ABSTRACT

The study using the geoelectric method produces resistivity values with different color images. Data is displayed in the form of a collection of 1D and 2D pseudosection points which are then processed using Progress and Res2Dinv software. The 1D cross-section results in the appearance of the subsurface structure vertically or shows the depth and thickness of the subsurface layers. The results of Wenner and Schlumberger configuration data processing show that there are differences in resistivity and depth values on each path but have the same lithology. This is because the Schlumberger configuration can only display 1 point of depth vertically, so the data obtained cannot compare the resistivity horizontally. But the advantage of the Schlumberger configuration is that it is capable of displaying a large depth compared to the Wenner configuration so that it is difficult to read a thin layer of this configuration. The Wenner configuration result displays the depth and length of the layer along the track so that the thickness of the layer from the start of the track to the end of the track can be interpreted. The layer which has a small thickness can be identified using the Wenner configuration, but cannot reach any deeper depths.

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1. INTRODUCTION

The cell geoelectric resistivity method can also be used to detect groundwater-bearing layers (aquifers) [1]. Groundwater is stored in a container (aquifer), which is a water-saturated geological formation that can store and release water in sufficient and economical quantities [2-4]. The geoelectric method is intended to obtain an overview of the soil layer below the surface and the possibility of groundwater and minerals at a certain depth [5, 6].

Groundwater is a very useful resource for living things on earth [7]. To obtain the structure of the earth's layer, investigations through the ground or underground must be carried out, so that it can be seen whether or not there is an aquifer, its thickness,depth, and to take water samples for analysis of water quality [8-10]. Although groundwater cannot be directly observed through the earth's surface, the ground surface investigation is an important initial investigation, at least it can describe the location of the groundwater. Several methods of ground surface investigation that can be carried out include geological methods [11], gravity methods [12], magnetic methods [13], seismic methods [14], and geoelectric methods [15]. Of these methods, the geoelectric method is a method that is widely used and the results are quite good [16].

The village of Rimbo Panjang is the place for research. In this area is a place of peat soil. Based on the description above, it is necessary to conduct research using the geoelectric method to determine groundwater and peat groundwater quality in the area to be studied.

2. RESEARCH METHODS

This research discusses the process of processing resistivity geoelectric data using Res2Dinv and Progress 3.0 software to obtain a resistivity cross-section that represents groundwater. The analysis was performed using the Wenner and Schlumberger configuration geoelectric method for the resulting underground water. Furthermore, this study discusses the quality of groundwater by taking 6 parameters from the well water of residents in the study area which will be tested for parameters COD, BOD, Ph, TDS, *Escherichia coli*, and Turbidity.

2.1. Research Scheme

In determining the resistivity of the Wenner configuration geoelectric method, 5 stages were carried out, namely a preliminary survey to determine the measurement path, data collection to obtain soil resistivity data, data processing to invert pseudo resistivity data into actual resistivity using software or software, and made into a lower model. surface, data analysis to analyze the results of data processing, and interpretation to explain information on subsurface conditions such as depth and others [17]. The research scheme is shown in the flow diagram as in Figure 1.

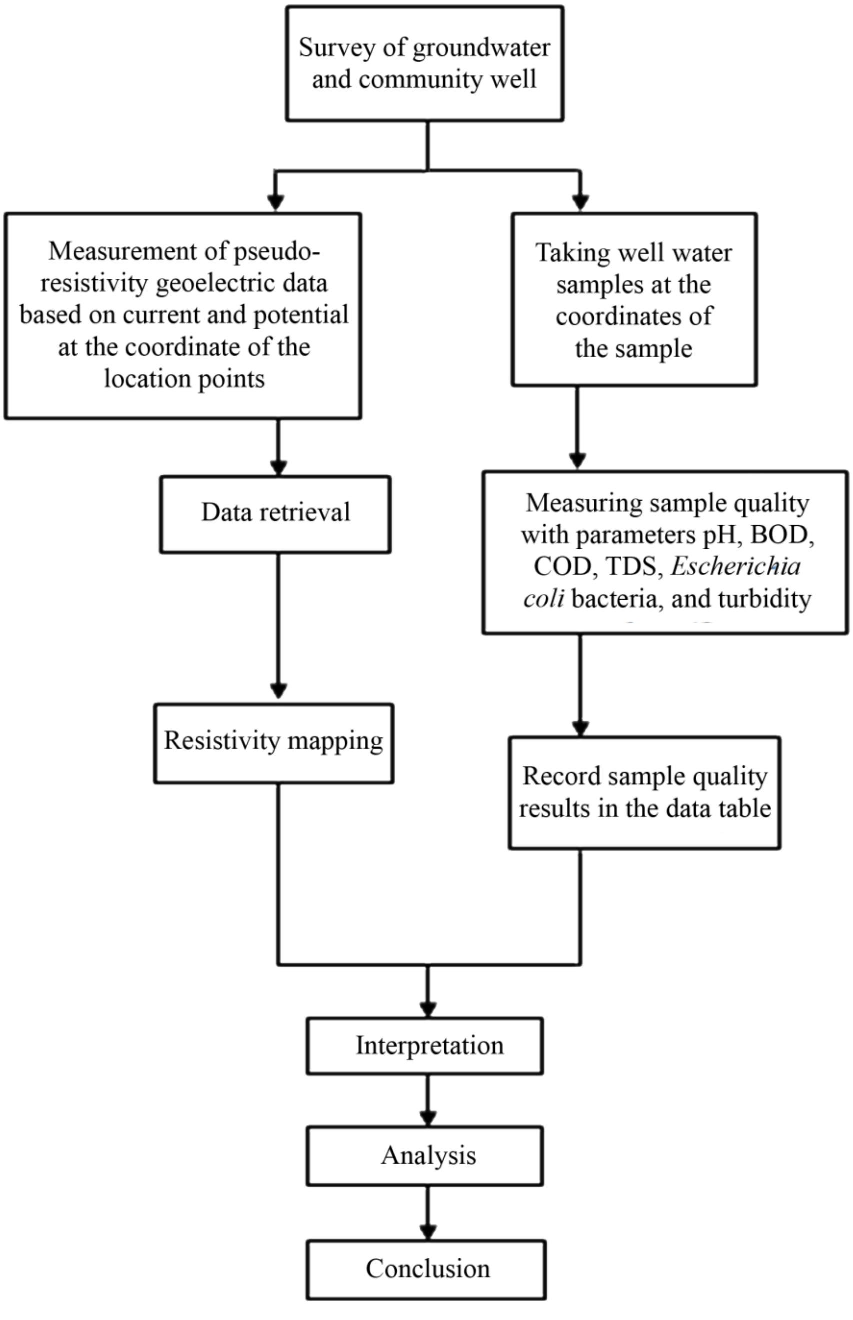

Figure 1. Flow chart of scheme research.

3. RESULTS AND DISCUSSIONS

This chapter presents the results of research and discussion on the interpretation of groundwater based on the geoelectric imagery of the Wenner and Schlumberger configurations as well as case study hydro-geochemistry in Rimbo Panjang Village.

3.1. Analysis and Interpretation of the Wenner Configuration Geoeletric Data

Figures 2, 3, 4, and 5 are two-dimensional cross-sectional shapes obtained from the geoelectric measurement results of the Wenner configuration on the measurement path of the study area. The results of data interpretation obtained the rock or mineral lithology structure of six categories for each layer, with different distances and depths. The type of lithology for each layer is determined based on the difference in the resistivity value [18].

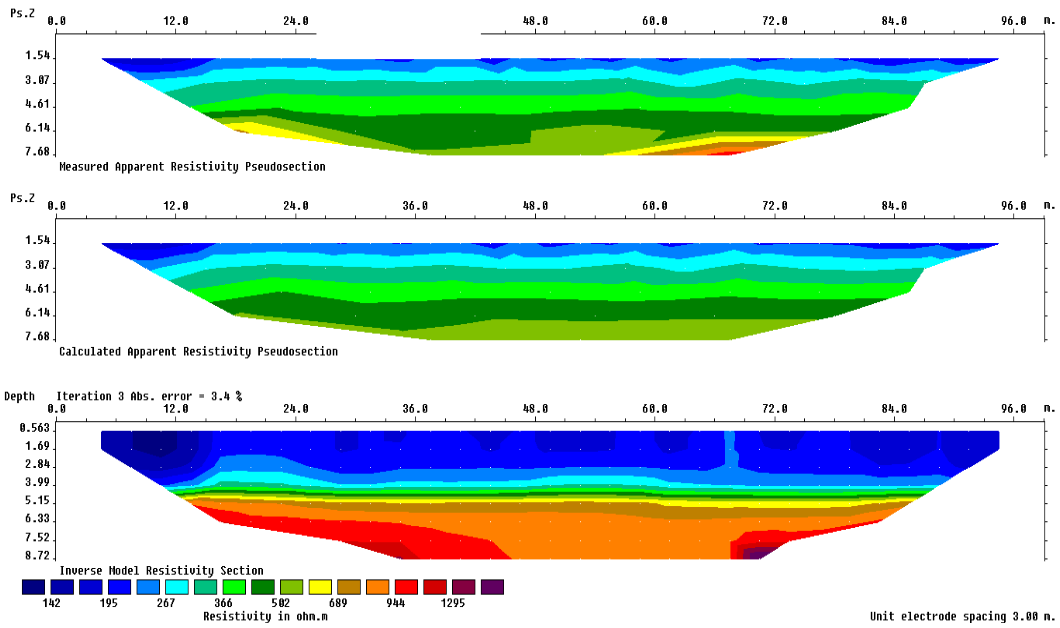

Figure 2. Passage 1 Wenner configuration.

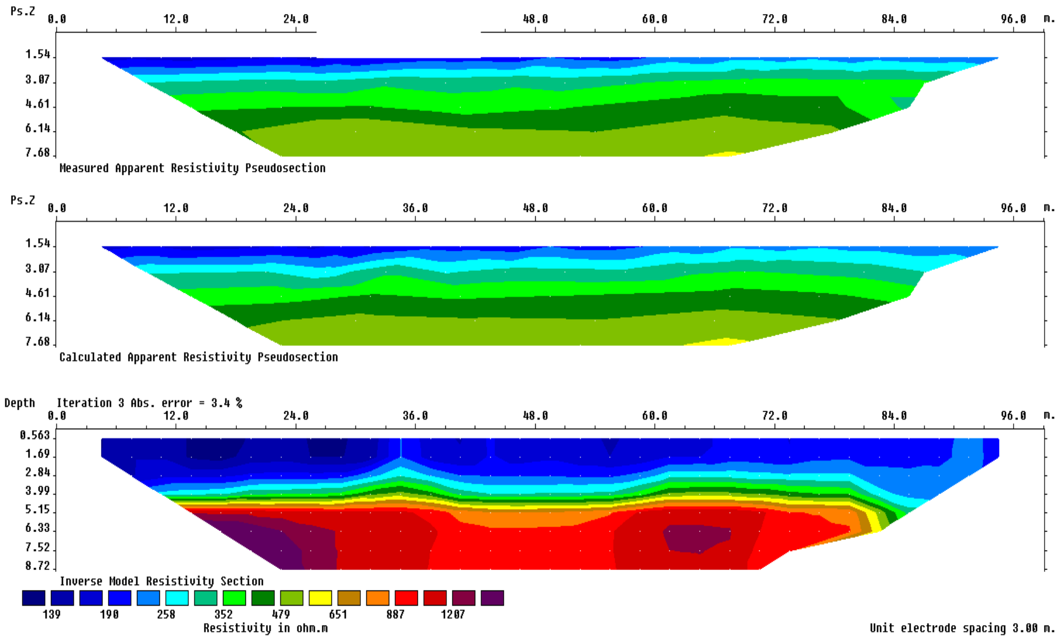

Figure 3. Passage 2 Wenner configuration.

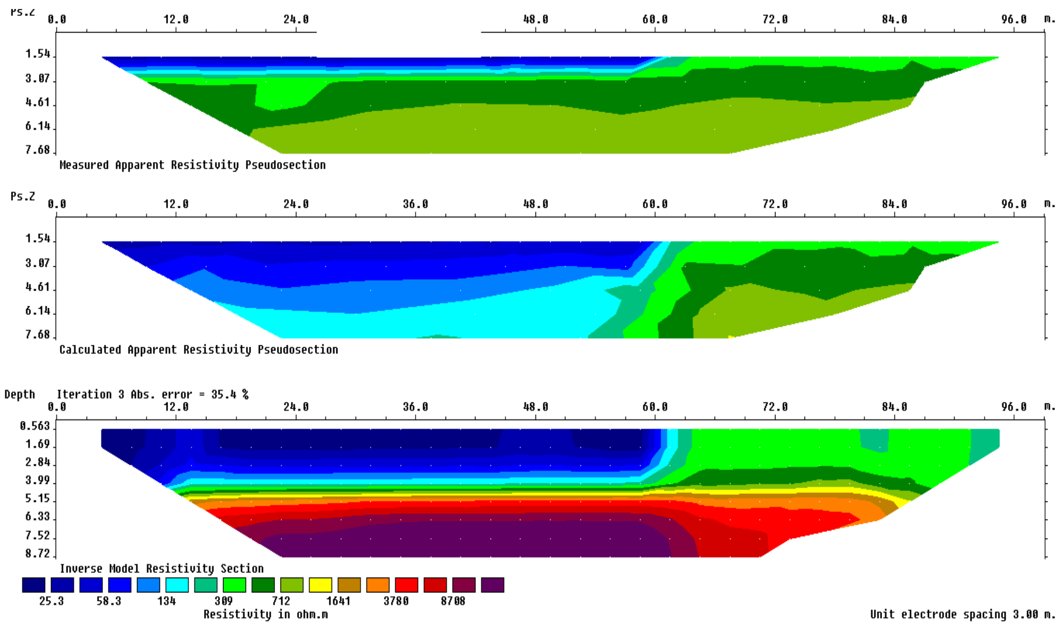

Figure 4. Passage 3 Wenner configuration.

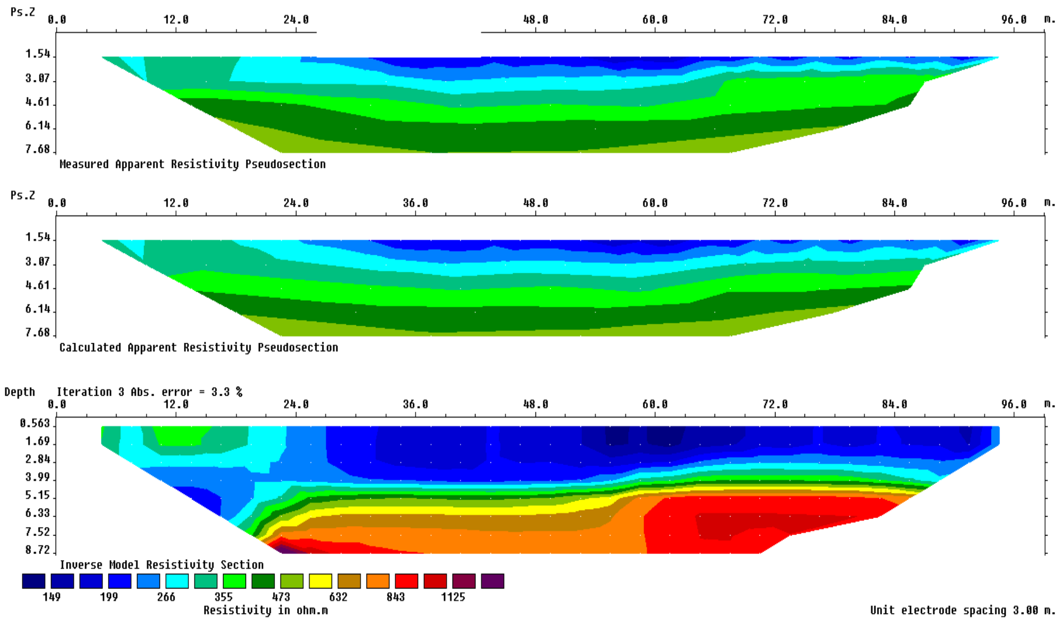

Figure 5. Passage 4 Wenner configuration.

3.2. Analysis and Interpretation of the Schlumberger Configuration Geoelectric Data

The resistivity value obtained from the 1D section in Figure 6 shows that the resistivity value in each layer is different, this is influenced by different types of subsurface layers. The first layer on line 1 is interpreted as a layer of peat and clay with a resistivity value of 395.68 Ωm at a depth of 0 – 1 meters. This first layer can be seen directly from the outcrops around the track [19].

The second layer with a resistivity value of 93.75 Ωm is interpreted as a layer of clay sand with a depth of 1 – 2 meters. The third layer is interpreted as a glauconite sandstone layer with a resistivity value of 856.03 Ωm at a depth of 2 – 6.5 meters. The fourth layer is interpreted as a layer of clay sand with a resistivity of 88.93 Ωm at a depth of 6.5 – 17.5 meters, and the fifth layer is interpreted as a layer of glauconite sandstone with a resistivity value of 1242.13 Ωm at a depth of 17.5 – 26 meters [20].

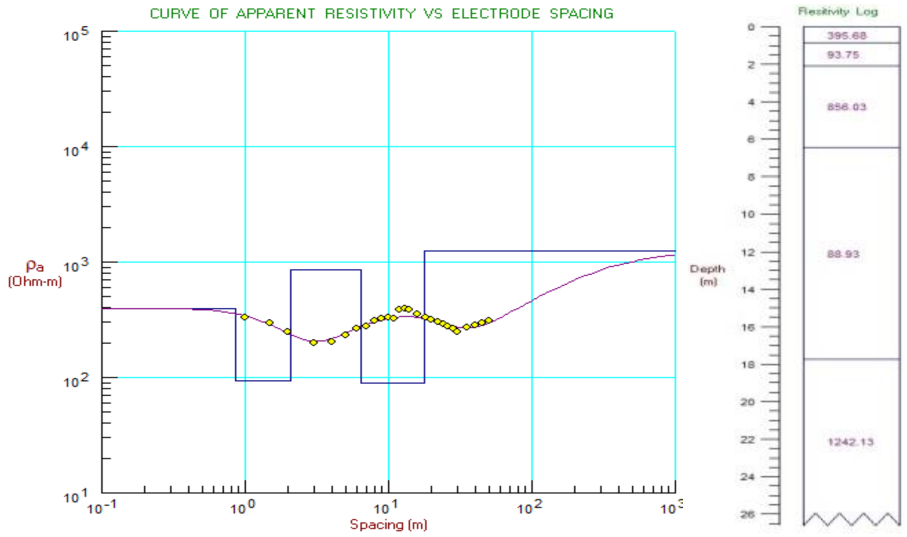

Figure 6. Geoelectric line data graph 1 Schlumberger configuration.

The resistivity value obtained from the 1D section in Figure 7 shows that the resistivity value in each layer is different. The first layer on track 2 is interpreted as a layer of peat and clay with a resistivity value of 66.23 Ωm at a depth of 0 – 1 meters. This first layer can be seen directly from the outcrops around the track [21]. The second layer with a resistivity value of 715.85 – 853.44 Ωm is interpreted as a layer of clay sand with a depth of 1 – 12 meters. The third layer is interpreted as a layer of glauconite sandstone with a resistivity value of 964.44 – 2344.69 Ωm at a depth of 12 – 28 meters. Resistivity of 2344.69 Ωm with a thickness of 28 m, it can be interpreted that the third layer has the same content as the fourth layer, namely sandstone, and dry gravel [22].

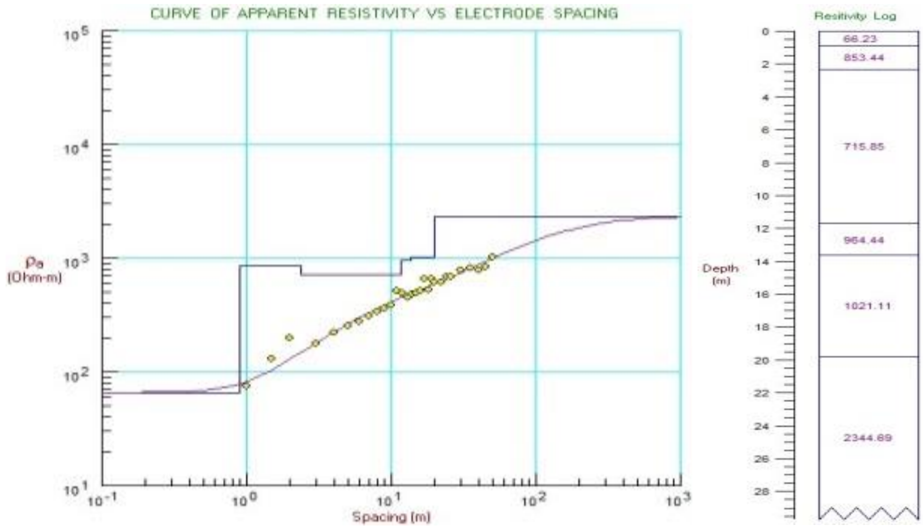

Figure 7. Geoelectric line data graph 2 Schlumberger configuration.

The resistivity values obtained from the 1D cross-section in Figure 8 show that the resistivity values in each layer are different. The first layer on track 3 is interpreted as a layer of clay sand with a resistivity value of 762.79 – 1081 Ωm at a depth of 0 – 4 meters. This first layer can be seen directly from the ground surface and outcrops around the track. The second layer with a resistivity value of 1691.88 – 1746.81 Ωm is interpreted as a layer of glauconite sandstone with a depth of 4 – 12 meters. The third layer is interpreted as a layer of peat and clay with a resistivity value of 264.51 Ωm at a depth of 12 – 17 meters. The fourth layer is interpreted as clay sand with a resistivity value of 331.75 – 506.03 Ωm at a depth of 17 – 35 meters.

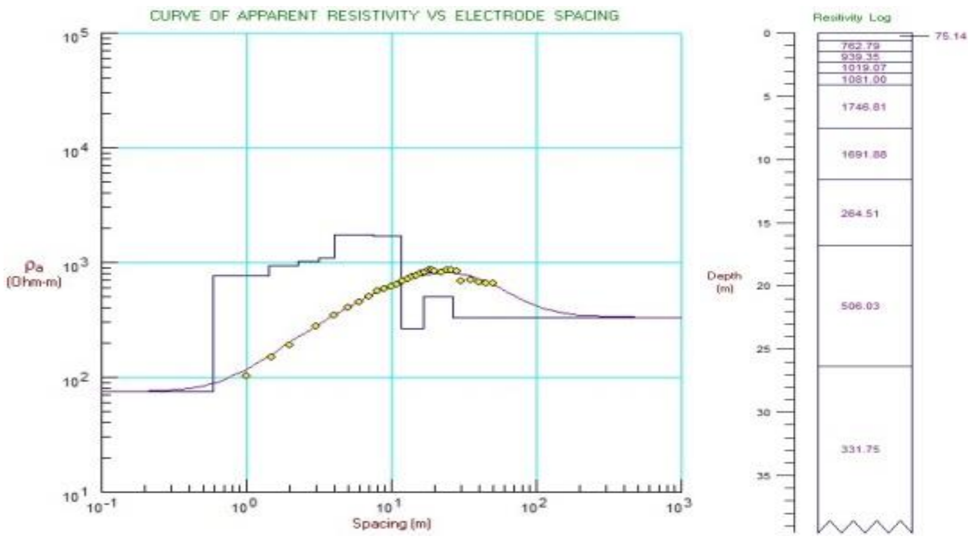

Figure 8. Geoelectric line data graph 3 Schlumberger configuration.

The resistivity value obtained from the 1D section in Figure 9 shows that the resistivity value in each layer is different. The first layer on track 4 is interpreted as a layer of peat and clay with a resistivity value of 138.40 – 214.1 Ωm at a depth of 0 – 3 meters. This first layer can be seen directly from above ground level and outcrops around the track. The second layer with a resistivity value of 877.47 Ωm is interpreted as a layer of clay sand with a depth of 3 – 10.5 meters [23]. The third layer is interpreted as a glauconite sandstone layer with a resistivity value of 1885.99 Ωm at a depth of 10.5 – 14 meters. The fourth layer is interpreted as a clay layer with a resistivity value of 55.82 – 115.65 Ωm at a depth of 14 – 18.5 meters and the fifth layer is interpreted as a layer of glauconite sandstone with a resistivity of 1148.54 Ωm at a depth of 18.5 – 26 meters [24].

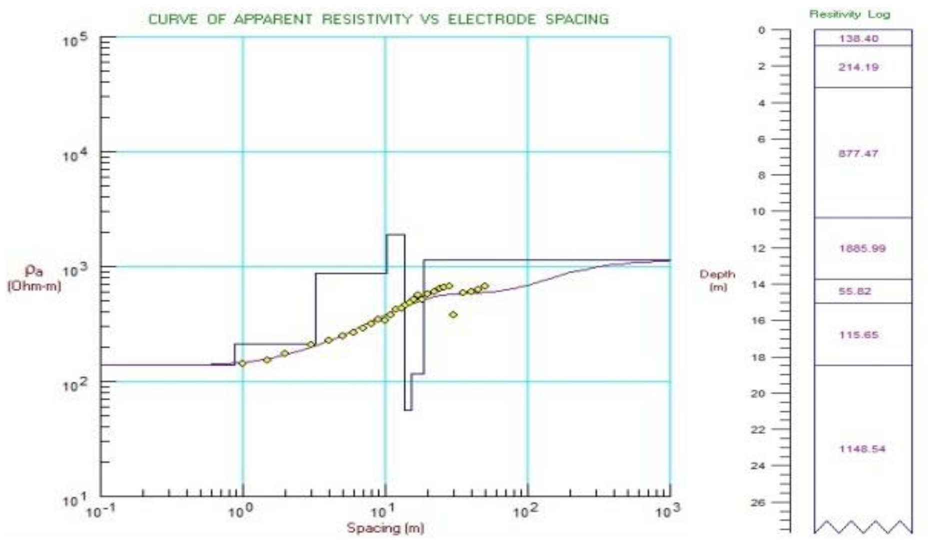

Figure 9. Geoelectric line data graph 4 Schlumberger configuration.

3.3. Water Quality Test Results with Parameters COD, BOD, pH, TDS, *E. coli*, and Turbidity

The quality of groundwater determines the health of the living creatures that use it. The source of the disease comes from water quality that is not good or the quality is below the national test result standard. According to [25] concerning conditions and supervision of water quality, clean water is water that is clear, colorless, odorless, tasteless, and does not contain minerals/germs that harm the body. The water quality test taken from the resident's wells at several points was adjusted to the research trajectory. The aim was to determine the water quality on several parameters such as COD, BOD, PH, TDS, *E. coli*, and turbidity. Laboratory test results for water quality are shown in Table 1.

Table 1. Results of water quality tests.

Sample	COD (mg/l)	BOD (mg/l)	pH	TDS (mg/l)	Turbidity (NTU)
Track 1	42.21	14.25	5.19	97.9	1.34
Track 2	107.6	34.86	5.29	11.4	0.82
Track 3	77.62	23.73	4.75	8.04	1.06
Track 4	66.72	23.20	5.10	7.72	0.72
Track 1	42.21	14.25	5.19	97.9	1.34

4. CONCLUSION

The results obtained in the Rimbo Panjang area with peat and loam soils also obtained pH, COD, and BOD values outside the specified standard limits. The results of the study concluded that groundwater covered with a layer of peat had poor water quality. A comparison between 1D and 2D cross-sections has some similarities in terms of rocks or minerals contained in the soil surface. The test results of the resident's well water sample include the parameters tested, it can be said that the well water has very low pollution and is not suitable for consumption, referring to the Regulation of the Minister of Health of the Republic of Indonesia Number 32 of 2017 due to the pH value < 6.5.

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