Detection of Pollutants on Resistance of Wenner Configuration Geoelectric Methods in the Petompon and Simongan River Border Area in Kaligarang River

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Abstract:- **Research on subsurface and pollutant structures was carried out by Danusaputro (2017) to determine the presence of pollutants in the Petompon and Simongan regions of Kaligarang River. The geoelectric method of the Dipole-dipole configuration used yields less visible pollutants on its cross-section, so it is necessary to compare the results using the Wenner geoelectric configuration method to obtain results that can corroborate and improve the results of previous studies. The comparison of the results made is to compare the structural and pollutant cross-section results obtained in the previous study with the structural and pollutant cross-section results obtained by the geometrical configuration method of the Wenner and the interconnected cross-sectional surface results mapped by Thanden (1996). Taking data by Wenner method is done by taking 3 trajectories on 2 fields each track length is 100 meters with a distance between electrode 3 meter. The results of the comparison obtained from the two configurations are that there are similarities of the structure of clay and breccia and the similarity in the presence of pollutants at a depth of 0.75 to 5.96 meters. The pollutant resistivity values obtained between the two configurations are different but still within the resistivity range for the pollutant value.**

Keywords: Pollutants, Resistivity Wenner Configuration, Dipole-dipole Configuration

I. INTRODUCTION

The geoelectric method is a geophysical method that studies the nature of electric currents in the earth and ways to detect currents on the surface of the earth [1]. This includes potential measurements and measurements of currents that occur both naturally and due to the injection of currents into the earth. Therefore, the geoelectric method has many types, one of which is the resistivity geoelectric method [2].

The purpose of the geoelectric method itself is to find out subsurface structures by making measurements at the ground surface [3]. Normal resistivity measurements are made by injecting current into the ground through two current electrodes and measuring the voltage difference generated at the two potential electrodes [4]. So that subsurface resistivity can be estimated. Soil resistivity is related to various geological parameters such as mineral and liquid content, porosity, degree of fracture, percentage of fracture-filled with groundwater, and degree of water saturation in rocks [5].

In a previous study conducted by Danusaputro (2016) it was found that the soil in the river border had been contaminated with heavy metals due to the seepage of pollutants from the river [6]. This research was carried out using the dipole-dipole resistivity configuration method because it only wanted the results of a cross-section with shallow depth [7]. The geoelectric method that aims at mapping there is two configurations namely the dipole-dipole configuration and the Wenner configuration. This study also aims to look for pollutants and compare them with the results of pollutants obtained in research by Danusaputro (2016) with the dipole-dipole configuration [8]. By looking at the results of the cross-section of the two configurations, we can compare how the presence of pollutants in the area. The purpose of mapping is to find out information on lateral resistivity variation so that the mapping technique is done by using a specific electrode configuration with the distance between fixed electrodes, the entire electrode arrangement is moved to follow the path [9]. Electrode configurations commonly used are Wenner and Dipole-dipole. However, according the Wenner configuration has the advantage that it can be used for mapping and sounding measurements [10].

Based on the description above, the research will be conducted again in the same area, which is around the west river flood canal, precisely in the Petompon and Simongan area, Semarang. This research was conducted with different configurations to find out the similarities and differences of the two configurations, Dipole-dipole and Wenner, and make a comparison of the results of the resistivity cross-section to determine the distribution of pollutants below the surface of the soil due to seepage of pollutants from the Kaligarang River. The purpose of this research is to compare the results of the resistivity cross-section with what has been done by Danusaputro (2016) and find out the differences and similarities in the dipole-dipole and Wenner configurations so that further research can better understand and know the effectiveness of using configurations for the research field which is almost the same as the field research [11].

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II. METHODOLOGY

A. Time and place

The research will use and process primary data whose data will be taken on 29 December 2017 - 29 January 2018 by making acquisitions in the Semarang area precisely in the Petompon Area, Sampangan Village, Gajah Mungkur District and in the Simongan area.

B. Research methods

The acquisition was carried out using the Wenner configuration of 3 lanes on Field A and 3 lanes on Field B with each track length of 100 meters, the distance between the electrodes of 3 meters with n= 1, 2, 3, 4, 5, and 6, respectively [12]. The results of this Wenner configuration section will be compared with secondary data Danusaputro (2016) results of the dipole-dipole cross-section configuration in the same area with a track length of 90 meters, the distance between the electrodes is 10 meters with n= 1,2,3,4,5. This data will be processed using Geoelectric data processing software, namely Ms.Excel, and RES2DINV [13].

This research was conducted using a geoelectric resistivity method with 2 configurations namely the Wenner configuration and the Dipole-dipole configuration. The goal of research is to compare the detection of pollutants in the cross-section of the two configurations[14]. For the Wenner configuration, data acquisition was carried out at the Petompon and Simongan fields with a distance between electrodes of 3 meters, n= 1, 2, 3, 4, 5, and 6 at a track length of 100 meters. Whereas in the dipole-dipole configuration there is no direct data acquisition but rather the interpretation and cross-sectional results of previous studies by Danusaputro (2016) [15]. In the previous research, the acquisition of the dipole-dipole configuration with the distance between the electrodes was 10 meters, n= 1, 2, 3, 4, 5 at the track length of 90 meters.

The difference between the electrode and n distance in the dipole-dipole and Wenner configuration data acquisition is intended so that the cross-section results obtained or the measurement points of the data obtained between the dipole-dipole and Wenner configurations are the same so that the results of the presence of pollutants in the dipole configuration section can be compared [16]. Dipole and Wenner configurations to find out the similarities and differences in the presence of pollutants in the cross-section of the two configurations.

Basically, the resistivity value, rocks and minerals can be categorized into 3 types, namely good conductors in the range of $10^{-8} < 1$ Ωm, average conductors in the range of $1 < 10^{7}$ Ωm, and insulators in the range> 10^{7} Ωm [17].

III. RESULT AND DISCUSSION

Wenner Configuration Cross-section Correlation Results

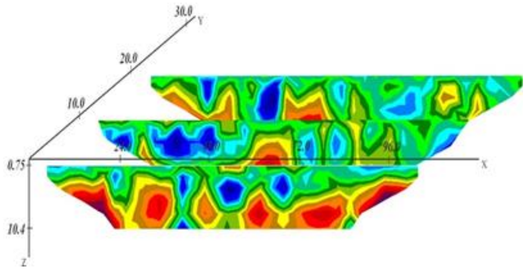

Figure 1 Correlation Field A

It can be seen from Fig 1., the correlation of cross-section results, the sequence of cross-section results from front to back, from the farthest with the river's edge to the closest are Line 1-3, Line 1-2, and Line 1-1.

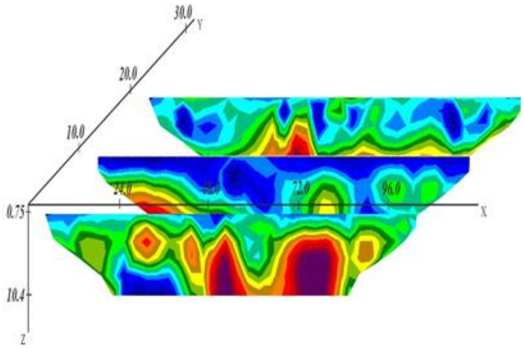

Figure 2 Correlation Field B

It can be seen from Fig 2., the correlation of the cross-section results, the sequence of images of the cross-section results from front to back, from the closest to the river mouth to the furthest to the river bank are Line 2-3, Line 2-2, Line 2-1.

Thus it can be seen that the presence of heavy metals is evident in clays with resistivity values of 0.0405 - 3.76 Ωm.

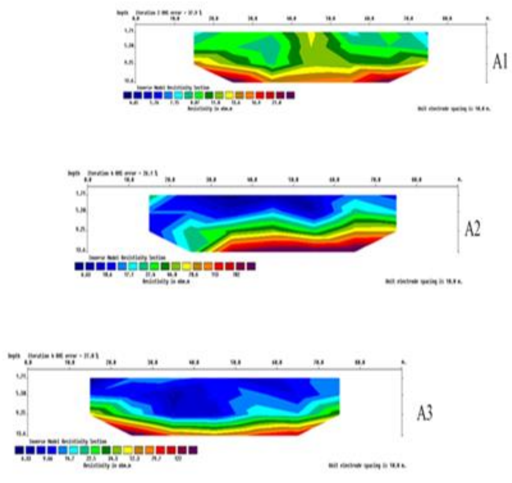

Figure 3 Cross-section Dipole - Field Dipole Configuration A

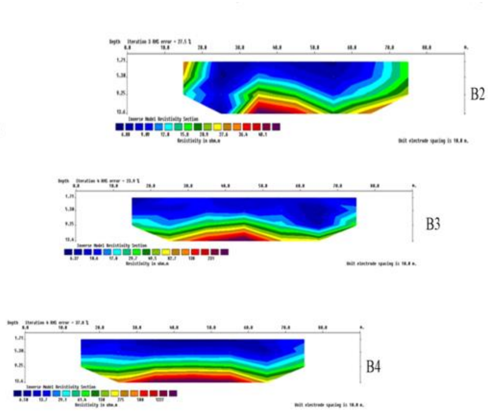

Figure 4 Cross-section Dipole - Field Dipole Configuration B

In Fig. 3 and Fig. 4, this study data collection was performed by the geoelectric method using the Dipole-dipole configuration. This study aims to make a cross-section of subsurface structures at study sites A and B on the banks of the Kaligarang River, Semarang, and compare the results of the detection of cross-pollutants at the same location with the dipole-dipole and Wenner configurations. In this study also requires a cross-section of the dipole-dipole configuration obtained from Danusaputro (2017) because the purpose of this study itself is to compare the results of the cross-section [18].

From the Wenner configuration section which has been obtained and compared with the dipole-dipole configuration section results, it can be said that the Wenner configuration shows the presence of more visible pollutants compared to the dipole-dipole configuration, this can be influenced by the choice of configuration and determination of the path length, electrode distance and n it will affect the reading data when taking data [19]. In the dipole-dipole configuration the greater the distance between the penetrating electrodes it will indeed be deeper but in reading the results of the data obtained less thoroughly, whereas if the Wenner configuration when the electrode distance is wider will also be the same as the dipole the penetration will get deeper but the reading of the data the results will also be less thorough and accurate. But if the electrode spacing in the Wenner and dipole-dipole configurations is the same, the reading results will be more accurate in the dipole-dipole configuration than in the Wenner configuration. That is why the Wenner configuration data collection uses the distance between the electrodes which is 3 meters so that the data reading is more accurate. Another advantage of the Wenner configuration in data retrieval is faster and easier because each n will increase the distance of the electrodes so it will be more quickly completed than dipole-dipole data collection.

IV. CONCLUSION

From the results analysis, we conclude:

1. The results of the cross-section of the subsurface structure of the Petompon and Simongan border of the Kaligarang river, Semarang, there are 2 layers, namely Clay at a depth of 1-10 meters with a resistivity range of 1.54 - 73.1 Ω.m, and Breccia at a depth of 6-10 meters with a resistivity range of 73.1 - 4824 Ω.m.
2. Pollutants are detected at low resistivity in the range 0.0405 - 3.7676 m in the Clay layer.
3. The presence of pollutants is more clearly seen in the results of the cross-section with the Wenner configuration.

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