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Research Article
Geoelectrical and Geochemical Approaches for Groundwater Quality Assessment in the Equatorial Region

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Abstract

Background and Objective: Urban areas such as Pekanbaru produce 0.9 kg of waste per-person per-day. Particularly in the densely populated region, especially Pekanbaru City, the community tends to use drilled wells and ring wells to meet their water needs. Therefore, it is necessary to research the quality of groundwater. Hence, this study aims to determine the groundwater quality in the study area using the Schlumberger geoelectric method and to analyze based on the geochemical method. **Materials and Methods:** The proposed method is based on geoelectric data measurements using Schumberger's rule. This test was carried out on two lines in Padang Terubuk Village, Senapelan District, Pekanbaru City. The measured values of current and potential differences were analyzed statistically using IP2WIN software to obtain ground water. Next, 8 drilled well water samples were analyzed using the geochemical method to determine the quality of the groundwater which included the parameters pH, turbidity, TDS and conductivity which were measured using the AMTAST AMT03 tool. **Results:** The groundwater in line 1 is found in layer 10 at a depth of 12.9 m with a resistivity value of 14.8 m and rock types in the form of silt soil and soft wet soil. On line 2 groundwater is found in the 8th layer with a depth of 7 m and a resistivity value of 19 m and the rock type is silt/sandy soil. This is consistent with the facts on the ground where people use ring wells and drilled wells at depths of between 5 and 12 m. The results of the pH test for water suitable for consumption were only found in samples 1A and 1B based on government regulation. **Conclusion:** Ultimately, this research holds applicability within urban settings exhibiting similar regional traits, offering a viable approach to investigating potable groundwater.

Key words: Groundwater, quality, schlumberger, geoelectric, geochemical

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Urban areas such as Pekanbaru produce 0.9 kg of waste per-person per-day. Industrial waste and household waste can cause environmental pollution which in turn can also cause groundwater pollution[1]. This surge in population raises concerns about excessive groundwater use, potentially impacting its quantity, quality and reserves[2]. Given water's vital role in all life forms, its scarcity in terms of space, time and quality remains a critical concern[3]. Groundwater, a primary water source for residents, caters to diverse needs, with nearly half of the global population relying on it, including for food and drinking[4]. The urgency of this research is to answer the national problem regarding the availability of clean water in the community. The problem that often arises is that when a well is drilled, there is no fresh water found, or it is found but it is polluted, as evidenced by the indicator parameters pH, turbidity, TDS and conductivity. This research is very urgent to carry out because the results of the research become an innovative concept for the application of providing clean water to the community. The study of groundwater management thus that it is free from the impact of pollution is in line with the vision of the University of Riau, namely a Superior Research University with dignity in the Field of Science and Technology in the Southeast Asia Region in 2035, namely the management aspect of natural resource management. There is several research that has been carried out by Juandi and Syahril[5] which is a source of inspiration so that this research can be carried out. Research studies a new approach to the empirical relationship between soil permeability and resistivity and its application to determine groundwater quantities in a district area. The quality of underground water is influenced by pollution which is studied based on the geoelectric method[6]. Groundwater resources must be managed properly and proposed methods for determining sustainable limits for aquifer exploitation[6]. Study of sustainable unconfined aquifer models, the government can use water utilization models and sustainable unconfined aquifer management policies[7]. Study of groundwater utilization in various aspects, which can overcome the problem of excessive exploitation for the benefit of society[8]. The assessment of underground water delves into its limited availability, attributed to the uneven dispersion in a specific area[9]. The presence of groundwater is intricately linked to geological and geohydrological conditions. Nevertheless, it remains imperative to appraise its potential within an area before utilizing it to ensure clean water access[10]. The geoelectric method is used to analyze groundwater potential while the quality properties are determined geochemicall[10]. Juandi *et al.*[11] have discussed studies on the existence of several environmental factors that influence the sustainability of underground water[11,12].

The objectives resulting from this research are (1) Designing aquifer distribution zone modeling in the study area using the Schlumberger geoelectric method, (2) Analyzing the clean water potential model in the study area using vertical mapping, (3) Analyzing the level of pollution in groundwater potential in the study area using geochemical methods and (4) Implementing recommendations to local governments regarding innovations in providing sustainable clean water in the study area.

The research results provide information on the distribution of subsurface lithological structures and the quality of subsurface water. This study is novel in the form of a new approach in the form of an innovative concept for providing groundwater for the community using the integration of geoelectrical and geochemical methods. This concept is an innovation for the community in the form of information on obtaining clean water for consumption in the form of the location of drilling points to obtain clean water, as well as providing recommendations to the government regarding information on underground water that must be protected from the threat of environmental pollution, thereby supporting the growth of residential and economic development in the area clean water supply sector.

MATERIALS AND METHODS

Study duration: This investigation involved collecting, processing, formulating and analyzing data was conducted between May, 2022 and October, 2023.

Study location: Geographically, Padang Terubuk Village is at the latitude and longitude coordinates 0.533731 and 101.434249. The territorial boundaries of Padang Terubuk Village, Senapelan District, Pekanbaru City are as follows: (1) To the North, it is bordered by Jalan Riau, Kampung Bandar Village and Kampung Baru Village, (2) To the East, it borders Jalan Ahmad Yani, Sago Village and Pekanbaru City District, (3) To the West, it borders Jalan H. Guru Sulaiman and Payung Sekaki District and (4) To the South, it is bordered by Jalan Kenanga, Kodim Market and Sidomulyo Street.

Model development: The steps of the Schlumberger method were: Determining the research coordinates and then determining the length of the area path. The current values and voltage differences obtained were recorded as initial

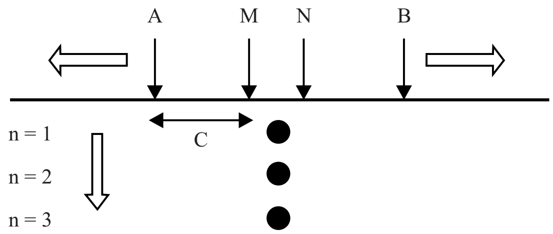

Fig. 1: Model design using the Schlumberger method

carried out with the same steps as at the first point and then the current electrode and potential electrode were moved a predetermined distance with the measured path length completed. The model design for the Schlumberger method was shown in Fig. 1.

Regional hydrogeology study area: A geological formation that can store and carry groundwater in large or small amounts to wells or springs is called an aquifer. A layer of sand or gravel is one geological formation that can act as an aquifer. Aquifers covered by layers of rock (for example clay) with low water permeability are known as aquitards. The same layer can also cover an aquifer, placing the groundwater in the aquifer under pressure, known as a confined aquifer.

Model parameters: Geoelectric parameters are determined from Eq. 1 and 2, which were obtained using a geoelectric measuring instrument. The apparent resistivity of the Schlumberger configuration was based on Eq. 1, namely[13,14]:

$$\rho_s = k\frac{\Delta V}{I} \quad (1)$$

With k geometric factors are formulated:

$$K_{sch} = na\,(n+n^2) \quad (2)$$

Groundwater quality parameters include pH, TDS and conductivity obtained using the AMTAST AMT03 measuring instrument. Measuring the pH value using the AMTAST AMT03 water quality test tool is carried out by turning on the tool which is calibrated with pH 7 and pH 4 solutions. The TDS value using the AMTAST AMT03 water quality test tool is carried out by turning on the tool which is calibrated with a 940 ppm TDS solution. Measurement of conductivity values are measured using the AMTAST AMT03 water quality test tool by turning on the tool which is calibrated with a conductivity solution of 1413 mS cm^{-1}.

Research data recovery line: This research was conducted by analyzing primary data collected from the field using the Schlumberger configuration resistivity geoelectric method[3] and geochemistry[6]. In this study, two lines with a length of 100 m each were used at the research location for data collection.

RESULTS

Based on the results of geoelectrical data conducted in Padang Teruk Sub-District, Senapelan District, Pekanbaru City with coordinates 0°32'00.7"N 101°26'11.8"E", using the Schlumberger configuration. The model design for the Schlumberger method was shown in Fig. 1. Figure 1 is a Schlumberger method model design measurement carried out using current electrodes and potential electrodes as shown in Fig. 1. The measured values of the current electrodes and potential electrodes were analyzed statistically using IP2WIN software, the analysis results are shown in Fig. 2(a-b). The results of rock resistivity measurement data can be seen in the following explanation. Line1 in this study is located at coordinates 0°32'1.59" North Latitude and 101°26'12.966" East with a stretch direction from Northeast to Southwest line 2 is located at coordinates 0°32'0.0726" LU and 101°26'13.08264"E stretches from Southeast to Northwest. Line 1 and line 2 have a length of 100 m each with 40 m between lines. The results of calculations and processing using IP2WIN software for the Schlumberger method obtained an error value of 2.25% for line 1 and 2.07% for line 2, as shown in Fig. 2.

The depth of layer 1 which is read by the IP2WIN software is up to 25.6 m below the ground surface, while line 2 gets a depth of up to 25 m below the ground surface as shown in Fig. 2. Modeling of the distribution of resistance values for the material type below the soil surface along line 1 can be seen in Table 1 and 2. The measurement of resistivity values on line 1 and line 2 uses the Schlumberger configuration which obtains the results which can be seen in Table 1 and 2.

Based on the geochemical method, 8 samples of drilled well water have been analyzed to determine the quality of groundwater which includes the parameters pH, TDS, conductivity and turbidity, respectively shown in Table 3-6. Table 3 is the result of field pH testing showing that there are differences in pH values in the samples analyzed. Table 4 shows the results of water quality testing based on TDS. Based on Table 4, it can be seen that there are also several variations in TDS values in the research area. Table 5 is the results of air testing based on conductivity measurements. Based on Table 5, it can be seen that the conductivity value ranges from 42-500 μmhos cm^{-1} which is in the fresh water category so it

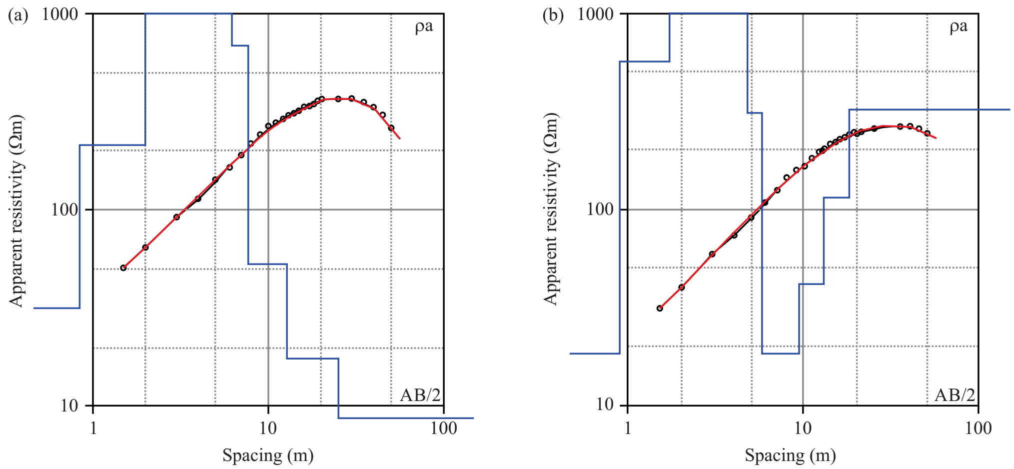

Fig. 2(a-b): Interface of (a) Line 1 and (b) Line 2 in data processing results

Table 1: Interpretation data of line 1

Line 1					
Layers	Depth (m)	Resistivity (Ωm)	Rock type	Water type	Rock type
1	0	3.6	Silt soil and soft wet silt soil	Groundwater	Unconsolidated sediment
2	0.84	214	Rooted bedrock filled with moist soil	-	Igneous and metaphorical rocks
3	1.99	2314	Bedrock filled with dry soil	-	Igneous and metaphorical rocks
4	6.17	683	Bedrock filled with dry soil	-	Igneous and metaphorical rocks
5	7.65	52.9	Silt and sandy soil	Groundwater	Consolidated sediments
6	12.8	17.6	Silt and sandy soil	Groundwater	Consolidated sediments
7	25	4.35	Silt and sandy soil	Groundwater	Consolidated sediments

Table 2: Interpretation data of line 2

Line 2					
Layers	Depth (m)	Resistivity (Ωm)	Rock type	Water type	Rock type
1	0	18.3	Silt and sandy soil	Groundwater	Unconsolidated sediment
2	0.886	559	Bedrock filled with dry soil	-	Igneous and metaphorical rocks
3	1.71	2716	Unweathered bedrock	-	Igneous and metaphorical rocks
4	3.95	973	Bedrock filled with dry soil	-	Igneous and metaphorical rocks
5	4.72	305	Bedrock filled with dry soil	-	Igneous and metaphorical rocks
6	5.76	18.3	Silt and sandy soil	Groundwater	Igneous and metaphorical rocks
7	9.33	41.4	Silt and sandy soil	Groundwater	Consolidated sediments
8	12.9	114	Silt and sandy soil	-	Consolidated sediments
9	17.9	319	Bedrock filled with dry soil	-	Consolidated sediments

Table 3: Quality standard pH coordinate x (North Latitude) y (East Latitude)

	Coordinate point			
Sample code	x (North Latitude)	y (East Latitude)	pH	Quality standard
1A	0°31'58,31832"	101°26'12,1146"	6.72	6.5-8.5 (492/Kemenkes/Per/IV/2010)
1B	0°31'59,69064"	101°26'12,91848"	6.66	Rule of Ministry of Health, Republic of Indonesia
1C	0°31'58,78632"	101°26'12,6276"	6.28	
1D	0°31'57,71388"	101°26'13,07832"	6.10	
2A	0°32'1,92768"	101°26'13,0038"	5.53	
2B	0°32'1,76676"	101°26'13,30332"	5.35	
2C	0°32'0,9312"	101°26'13,25436"	5.97	
2D	0°31'59,65248"	101°26'14,06004"	6.30	

Table 4: Water quality test results based on TDS

Sample code	Coordinate point x (North latitude)	Coordinate point y (East latitude)	TDS (mg L^{-1})	Quality standard
1°	0°31'58,31832"	101°26'12,1146"	74	Max 1000 mg L^{-1} (PP No. 492/Kemenkes/Per/IV/2010)
1B	0°31'59,69064"	101°26'12,91848"	127	
1C	0°31'58,78632"	101°26'12,6276"	192	
1D	0°31'57,71388"	101°26'13,07832"	102	
2A	0°32'1,92768"	101°26'13,0038"	98	
2B	0°32'1,76676"	101°26'13,30332"	107	
2C	0°32'0,9312"	101°26'13,25436"	137	
2D	0°31'59,65248"	101°26'14,06004"	162	

Table 5: Results of water quality testing based on conductivity

Sample code	Coordinate point x (North latitude)	Coordinate point y (East longitude)	Conductivity (µmhos cm^{-1})	Quality standard
1A	0°31'58,31832"	101°26'12,1146"	123	42- 500 µS cm^{-1}
1B	0°31'59,69064"	101°26'12,91848"	212	
1C	0°31'58,78632"	101°26'12,6276"	347	
1D	0°31'57,71388"	101°26'13,07832"	180	
2A	0°32'1,92768"	101°26'13,0038"	127	
2B	0°32'1,76676"	101°26'13,30332"	160	
2C	0°32'0,9312"	101°26'13,25436"	184	
2D	0°31'59,65248"	101°26'14,06004"	249	

Table 6: Results of water quality testing based on turbidity

Sample code	Coordinate point x (North latitude)	Coordinate point y (East longitude)	Turbidity (NTU)	Quality standard
1A	0°31'58,31832"	101°26'12,1146"	0.74	25 NTU (PP No. 492/Kemenkes/Per/IV/2010)
1B	0°31'59,69064"	101°26'12,91848"	3.34	
1C	0°31'58,78632"	101°26'12,6276"	0.04	
1D	0°31'57,71388"	101°26'13,07832"	0.28	
2A	0°32'1,92768"	101°26'13,0038"	0.2	
2B	0°32'1,76676"	101°26'13,30332"	0.08	
2C	0°32'0,9312"	101°26'13,25436"	16.69	
2D	0°31'59,65248"	101°26'14,06004"	0.14	

is suitable for consumption. Table 6 is the results of the water turbidity test. It can be seen that the turbidity value is below the quality standard based on government regulation no. 492/Kemenkes/Per/IV/2010.

DISCUSSION

Table 1 contains several rock types that have 11 layers, this is in accordance with what is shown in Fig. 2, where each layer has a different rock resistivity value. The first layer is on the soil surface, the resistivity value is obtained in the form of fresh water obtained from rainwater with the rock type in the form of consolidated sediments as shown in Fig 2. Table 2 is the result of the rock resistivity obtained from line 2 and obtained from 12 layers. Each layer has a different rock resistivity value. Layer 1 on the soil surface, the resistivity value is obtained in the form of silt soil and soft wet soil. The water source in layer 1 is in the form of rainwater which absorbs into the surface with unconsolidated sedimentary rock types.

The research area is a residential location, where the community uses 2 sources of water, namely water from drilled wells and ring wells. Ring wells used by residents have a depth of 5-12 m. A survey was carried out on several houses using ring wells and the results were obtained that during the rainy season, water tends to be easy to obtain, while during the dry season ring wells have little water so they experience water shortages several times. The survey was conducted in several residents' houses, according to the results of geoelectrical measurements, where on line 1 a depth of 5.86 m was obtained which has the type of rooted bedrock filled with moisture soil with water sources derived from rainwater. Line 2 is obtained at a depth of 5.47 m with a resistivity value of 147 Ωm. This resistivity value is included in the type of silt/sandy soil which the source of water comes from rainwater. These results were by a survey of several residents' houses that have a ring well depth of 5-12 m. This type of rock is of course very dependent on rainwater as its main water source and if there is a dry season then water will be difficult to obtain.

Residents around the research area of line 1 and 2 do not only use ring wells as their main source of water. Some residents' houses also use drilled wells with a depth of 11-12 m or the local community calls 2 pipes as a source of depth measurement. The source of water from drilled wells is groundwater and to get it you have to drill using a special tool to a certain depth or until you get water[7]. Water at that depth based on field data calculations is very suitable because at a depth of 12.9 m, a resistivity value of 14.8 Ωm is obtained on line 1. Line 2 obtains a depth of 11.3 m with a resistivity value of 54.7 Ωm. The type of rock at this depth is silt soil/soft wet soil for line 1 and fresh water in layer 2, with a water source, namely groundwater according to the statement. The type of rock at this depth is in the form of consolidated sediment where minerals can be dissolved or precipitated. Settlement of minerals reduces pore space and allows liquid to pass through small gaps which can be sucked up by drilling machines[15].

Rock type for line 1 and fresh water in layer 2 with the water source namely ground water according to the resistivity value obtained[2].

Geochemistry discussion: Water is one of the most important natural resources on Earth. Without water, Earth would not be able to accommodate various types of life. Water quality is the stage where the water source is suitable for use in everyday life. Be it for household industries, large industries or households[16]. Polluted groundwater will harm local residents. Groundwater quality needs to be tested with the parameters pH TDS, conductivity and turbidity. Data collection using 8 samples. The water samples taken were close to the research location and came from residents' homes. Residents' houses adjacent to the research location have a variety of wells, including drilled wells and ring/dug wells. The average depth of drilled wells varies from 11-12 m. Ring wells used by residents have a depth of 5-12 m.

Analysis of pH quality test parameters: The pH is one of the important parameters to determine the level of acid/base in water[3]. Changes in water pH can cause changes in taste, color and smell. Good drinking water has a neutral pH, not acidic/alkaline. The pH standard according to PP No.492/Kemenkes/Per/IV/2010 of 6.5-8.5. The following are the results of field pH testing which can be seen in Table 3. Reviewed based on Permenkes No. 429 of 2010, water that is suitable for drinking is in samples 1A and 1B, while in samples 1C to 2D it is not suitable for consumption. Sample 1A is water that comes from a drilled well with a depth of 12 m, while sample 1B comes from a resident's house using a ring well. A low pH value will cause the water to be acidic so that at a certain level no creatures can live in these waters. Low pH values will also cause corrosion in metal pipelines so the water that passes through the pipes will contain these metals[17]. The different pH values in each sample occurred due to differences in organic content from domestic, industrial and agricultural activities in the vicinity of the study site. The research location is very close to residential areas, welding workshops, home industries, landfills and restaurants. Another influence that causes changes in pH is the condition of the residents' wells which vary, both in terms of shape and in terms of depth. Ring wells that do not use a lid at the top are very easily contaminated by rainwater. Samples whose water comes from ring wells are in 1B, 1C, 2C and 2D. Other samples, namely 1A, 1D, 2A and 2B, used drilled wells. Changes in pH in water are strongly influenced by the physical, chemical and biological processes of the organisms that live in it. The altitude of the area can also affect water quality, because of the nature of water that flows from high to low. Wastewater that is in a high place will flow to a low place. Sampling locations 1 and 2 have different heights. The difference in ground height between sample 1 and sample 2 is approximately 3 m. This also affects the water in sample 2 to have a lower pH with a trend of 5. The research location is a garbage dump for residents of RW 4, Padang Terubuk Village. Residents who live in the research location have been disposing of garbage since the 80s and until now there has been no handling at all. Garbage that has piled up is only burned and some of it melts into the ground. There are two sources of groundwater pollution, namely natural pollutants (minerals and microorganisms) and artificial pollutants. Man-made pollutants such as chemical residues are generally more dangerous than natural pollutants. Artificial pollutants can come from household, industrial and agricultural waste. Sampling location 2 is very close to the research location and this causes the pH to be low and not suitable for drinking[3].

Analysis of Total Dissolved Solid (TDS) test: High TDS levels in water indicate that there is influence from solid substances including rock weathering, soil runoff and the influence of domestic waste. The research location is a place for residents to dispose of garbage for decades, both organic and inorganic waste. Ground surface water containing hazardous materials such as radioactive substances, heavy metals, household waste and detergent waste can cause pollution to surface areas or groundwater flows. Heavy metals such as Hg, Zn, Pb, Cd can pollute surface water and ground water. The results of water quality testing based on TDS can be seen in Table 4. The TDS measurement results showed the highest value in sample 1C of 192 mg L^{-1} and the lowest in sample 1A of 74 mg L^{-1}. The water in the vicinity of the study site is very suitable for consumption when viewed based on the levels of TDS or dissolved solids based on PP No. 492/Kemenkes/Per/IV/2010 where the highest TDS level for drinking water is 1000 mg L^{-1}. The high and low TDS values in soil are strongly influenced by rock weathering, soil runoff and the influence of domestic waste[18]. Apart from this, the TDS value is also caused by inorganic materials and organic substances dissolved in the soil. Reducing the levels of organic and inorganic matter in the soil can be done by planting plants above the soil surface. Even though the research location is a garbage dump for residents, the results of the TDS levels obtained based on water testing are still below the threshold set by the Minister of Health. This is due to the fact that there are still many plants in the research location, either deliberately planted or growing wild. This was in accordance with the elaboration above if the plants that are above the soil surface can reduce TDS levels. So that the water consumed by residents in the area around the research location is very fit for drinking.

Analysis of conductivity: Conductivity or electrical conductivity (DHL) is a measure of the ability of a solution to conduct electric current. The more dissolved salts that can be ionized, the higher the DHL value. In addition, the valence number and concentration of dissolved ions greatly affect the value of DHL. Acids, bases and salts are good electrical conductors, whereas organic materials (sucrose and benzene) which cannot undergo dissociation are poor electrical conductors[19]. The results of water testing based on conductivity can be seen in Table 5. Table 5 states that fresh water is in the range of 0-1000 µmhos cm^{-1}, where water suitable for consumption ranges from 42-500 µmhos cm^{-1}. The results of water testing based on the TDS parameter at the research location can be said to be suitable for consumption because it is still below the quality standard. Samples 1A, 1D, 2A, 2B and 2C are in the low conductivity category, while samples 1B, 1C and 2D are in the medium conductivity category. The highest conductivity value was in sample 1C which was 347 µmhos cm^{-1} and the lowest point was in sample 1A which was 123 µmhos cm^{-1}. The average conductivity value in the study area is 198 µmhos cm^{-1}. That value is still categorized as low conductivity. The high and low conductivity values in an area are due to the fact that the area contains inorganic materials in the form of ions, lowlands and a former landfill. The research location has an Altitude of 11-14 m above sea level. This altitude includes lowlands because it is located <400 m above sea level. Some of the activities suspected of causing water pollution are the disposal of domestic and factory waste, the use of chemical fertilizers and welding workshops. The research location, which is in RW 4, Padang Terubuk Village, also has a welding workshop. The activity of the welding workshop business can cause heavy metals such as cadmium. These heavy metals are needed by living things in small amounts, but if the metal levels are excessive in the body, it can cause poisoning. As a result of the welding workshop activities at the research location, the conductivity value reached the moderate conductivity category. If the higher the conductivity value of water, the heavy metal content contained in it will be dangerous. Excessive metal levels will not be used by the body and will still be processed by the kidneys, which can lead to precipitation and can cause kidney failure.

Analysis of turbidity parameters: Turbidity is an important water quality parameter because it is related to aesthetics. This parameter is physically visible so it is easy to determine whether the water quality is good or not. Water that is classified as not experiencing turbidity is <25 NTU. The source of turbidity that occurs in wells or shallow groundwater comes from rainwater runoff that enters the groundwater layer. Groundwater that is experiencing turbidity should be treated first to reduce its turbidity level so that it is suitable for consumption. The results of water testing based on turbidity can be seen in Table 6. Sample 2B is the lowest value obtained, namely 0.08 NTU. Residents in sample 2B use drilled wells as the main source with a depth of 12 m. The results of the interviews that have been carried out are that residents with sample 2B use their water for their daily needs, namely bathing, washing and even consumption. The turbidity value is based on the research results if it is based on PP No. 492/Kemenkes/Per/IV/2010 below the quality standard, which is 25 NTU. Sample 2C showed the highest turbidity value compared to the others, namely 16.69. Interviews conducted with residents who used 2C water samples found that ring wells with a depth of 5 m are used as the main source of water. The resident only uses water for bathing and washing, while for consumption he buys gallons of water. Water that has a high level of turbidity will experience difficulties if it is processed into clean water. This opinion was in accordance with what happened on the ground that residents in sample 2C chose not to process it into clean water. The research location which is directly opposite the houses of sample 2C residents is one of the causes of the turbidity of the water used. This was by the results of research which states that organic waste contains too high a solid, causing turbidity and reducing the penetration of sunlight in photosynthetic biota. One source of organic waste is liquid waste and if it seeps into the soil it can damage fertility and water sources in it. If we live in a polluted environment and consume anything from it, it can endanger our health and various diseases such as diarrhea and dysentery can arise in society[3].

CONCLUSION

Based on the results of data processing using the IP2WIN software, 11 to 12 soil layers and their resistivity values are obtained. Groundwater on line 1 is found in layer 10 at a depth of 12.9 m with a resistivity value of 14.8 Ωm and the rock types are silt soil and soft wet soil. On line 2 groundwater is found in the 8th layer with a depth of 7 m and a resistivity value of 19 Ωm and the rock type is silt/sand soil. This is to the facts on the ground where the community uses ring wells and drilled wells at depths of between 5-12 m. Based on groundwater quality tests using 8 samples. Groundwater at the research location is suitable for consumption if it is assessed based on the parameters of TDS, conductivity and turbidity. The results of the pH test for water suitable for consumption were only found in samples 1A and 1B based on Government Regulation No. 492/ Ministry of Health /Per/IV/2010.

SIGNIFICANCE STATEMENT

Urban areas such as Pekanbaru produce 0.9 kg of waste per-person per-day. Particularly in the densely populated region, especially Pekanbaru city, the community tends to use drilled wells and ring wells to meet their water needs. This study is novel in the form of a new approach in the form of an innovative concept for providing groundwater for the community using the integration of geoelectrical and geochemical methods.

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