

# Groundwater Quality Analysis in the Cilodong Region, Cilodong District, Depok City, West Java Province

M. Adimas Amri<sup>1</sup>, Himmes Fitra Yuda<sup>1</sup>, Suherman Dwi Nuryana<sup>1</sup>, Fajar Hendrasto<sup>1</sup>, Arini Dian Lestari<sup>1</sup>, Fiati Nurmaya<sup>2</sup>, Raisya Ardhana Elsaisni Syaffa<sup>1</sup>

<sup>1</sup>Department of Geological Engineering, Faculty of Earth Technology and Energy, Univeristas Trisakti, Grogol, Jakarta Barat, 316572

<sup>2</sup>Geological Technology Study Program, Bandung Mining Energy Polytechnic, Bandung, Indonesia  
Email address: m.adimas@trisakti.ac.id

**Abstract**— The research area is located in the Cilodong District, Depok City, West Java Province. This study was conducted to determine the quality of groundwater in the Cilodong area. The method used in this study involves groundwater sampling and physical property analysis carried out directly in the field, as well as chemical property analysis conducted in the laboratory. The purpose of this study was to determine the quality of groundwater in the Cilodong area. The results of this study indicate that several parameters have levels that do not conform to the standards set in Permenkes No.492 of 2010, such as fluoride, nitrate, and pH. The high levels of some parameters are caused by natural factors such as rain and non-natural factors such as land use around dug wells for agricultural.

**Keywords**— Groundwater, Quality, Physical Properties, and Chemical Properties.

## I. INTRODUCTION

Groundwater is one of the water sources that can be used for daily purposes. To obtain groundwater, you can use dug wells, drilled wells, and pantek wells according to your needs. Water is an important element in both urban and rural areas for development. Most residents in Depok City, especially in the Cilodong Subdistrict, still use groundwater as a source of clean water and drinking water for consumption.

Water that can be used as clean water for daily use has specific requirements outlined in Permenkes No. 492 of 2010. The Permenkes states that there are several parameters for clean water quality, namely, the physical properties, chemical properties, and microbiological content of the water. The physical parameters include properties such as color, odor, and taste. The chemical parameters involve any chemical content in the tested water sample. The microbiological parameters include microbial content in water, such as Total Coliform and Fecal Coliform.

This research is a study to determine the quality of groundwater and to assess the hydrogeological conditions in the study area. The research area is administratively located in the Cilodong District, Depok City, at a geographical position of 6°26'13.13" S and 106°50'07.93" E.



Fig. 1. Research Locations.

## II. METHOD

The methods used in the research to achieve the objectives can be clearly organized in the report into the following work steps: Data Collection Stage, Data Retrieval Stage, Analysis and Interpretation Preparation Stage, and Report Preparation Stage.

## III. RESULT AND DISCUSSION

The results of the research are in the form of groundwater level distribution, physical parameters, and chemical parameters.

### A. Groundwater Level Distribution

Data on the distribution of groundwater levels were used to create a groundwater level distribution map in units of meters (m) and decimeters (dm) to determine the flow direction. The research area is divided into two groundwater flow directions: the northern part flows southwest, and the southern part flows north. The research area has an unconfined aquifer type (Figure 2).

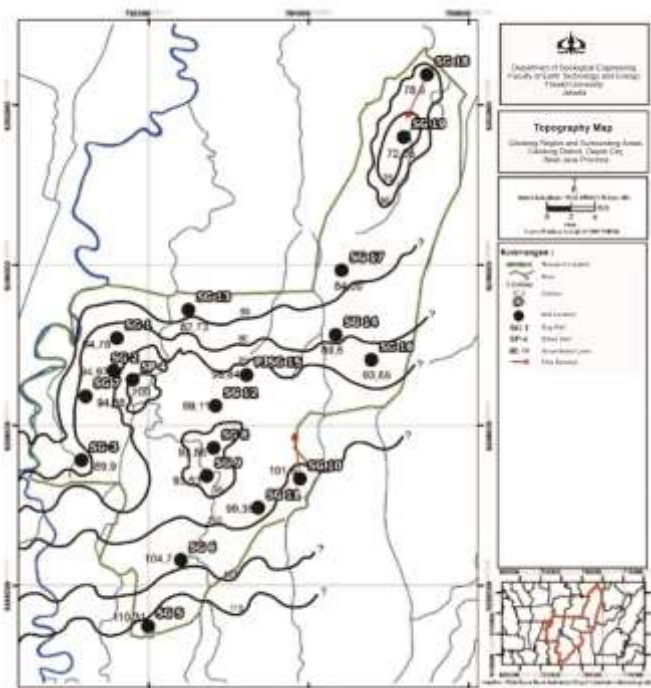


Fig. 2. Groundwater sampling locations at SG-8 and SG-13.

**B. Groundwater Quality Analysis**

Analysis of groundwater used for daily community use refers to Permenkes No. 492 of 2010 on water quality

standards for drinking water. The results of groundwater quality analysis in Cilodong Subdistrict, Depok City, can be seen in Table 1.

Based on Table 1, it can be seen that of the 13 test parameters used as a reference for groundwater quality in Cilodong District, 2 parameters exceed the groundwater quality standards set by Permenkes No. 492 of 2010, namely Nitrate and Fluoride, while the other parameters still meet the groundwater quality requirements.

**C. Physical Parameters**

– *Odor and Taste*

Based on the analysis in Table 1, it can be seen that in the 12 samples tested from dug wells, there is no groundwater that fails to comply with Permenkes No. 492 of 2010. All analysis results indicate that the water is odorless and tasteless.

– *Total Dissolved Solid (TDS)*

From the results of the analysis, it can be seen that the TDS levels in the samples range from 40 mg/L to 200 mg/L. According to Permenkes No. 492 of 2010, the maximum allowable TDS value is 300 mg/L, meaning the samples are still below the groundwater quality standard. Therefore, there is no problem or anomaly regarding TDS levels in the groundwater of the research area.

TABLE I. Groundwater Quality Analysis.

No	Parameters	Maximum Allowable Content	Analysis Result											
			SG-02	SG-03	SG-07	SG-08	SG-10	SG-12	SG-13	SG-14	SG-15	SG-17	SG-18	SG-19
Physical Parameters														
1	Odor	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless	Odorless
2	TDS (mg/l)	<300	110	90	120	100	80	40	60	50	110	90	200	170
3	Taste	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless	Tasteless
4	Temperature (°C)	±3	28.7	28.8	28.4	29.1	28.8	28.2	28.4	29.6	30.1	31	29.2	28.9
Chemical Parameters														
1	F (fluoride)	1.5 mg/l	2.936	1.08	0.035	0.079	<0.0001	0.146	<0.0001	<0.0001	<0.0001	<0.0001	2.45	<0.0001
2	Cl (chloride)	250 mg/l	36.267	18.257	29.288	33.71	22.428	11.846	26.192	12.037	35.19	29.092	70.517	55.986
3	pH	6.5 - 8.5	3.47	4.63	3.58	3.79	3.68	3.9	3.96	4.77	5.3	3.91	3.31	4
4	SO4 (sulfate)	400 mg/l	3.788	22.011	2.455	22.398	1.722	14.601	84.853	10.879	37.148	1.289	1.604	3.619
5	NO3 (nitrate)	50 mg/l	74.947	69.753	114.459	75.11	64.096	9.304	21.977	31.682	11.649	62.243	148.414	143.266

– *Temperature*

The temperature measurement of groundwater was carried out directly in the field at the time of groundwater collection. In the research area, the temperature ranges from 28.2°C to 31°C. According to Permenkes No. 492 of 2010, groundwater suitable for consumption should have a temperature within ±3°C of the surrounding air temperature. According to Suripin (2002), the normal temperature in natural (tropical) areas is around 30°C. The average temperature in the research area, Cilodong District, is between 27°C and 31°C, which is considered normal.

In the research area, the analysis results show fluoride levels ranging from <0.0001 to 2.936 mg/L. According to Permenkes No. 492 of 2010, the maximum allowable fluoride content in groundwater is 1.5 mg/L. In the research area, there are 2 samples, namely SG-2 and SG-18, that exceed this groundwater quality standard limit.

– *Cl (chloride)*

The analysis showed that chloride levels in the research area ranged from 11.846 mg/L to 70.517 mg/L. According to Permenkes No. 492 of 2010, the maximum allowable chloride level is 250 mg/L. Some chloride levels in the research area are relatively high, although they do not exceed the maximum water quality standard. This is due to groundwater sampling

**D. Chemical Parameters**

– *F (fluoride)*

being conducted during the rainy season, resulting in samples from dug wells being mixed with rainwater.

– *SO4 (sulfate)*

The analysis results show that sulfate levels in the study area range from 1,289 mg/L to 84,853 mg/L. According to Permenkes No. 492 of 2010, the maximum allowable sulfate level in groundwater is 400 mg/L. In the research area, none of the sulfate levels exceed the maximum groundwater quality standards that have been set.

– *NO3 (nitrate)*

The analysis results in the study area show nitrate levels ranging from 9.304 mg/L to 148.414 mg/L. According to Permenkes No. 492 of 2010, the maximum allowable nitrate level in groundwater is 50 mg/L. Out of the 12 dug wells tested, only 4 have nitrate levels that do not exceed the maximum groundwater quality standards. The remaining 8 dug wells exceed the specified levels due to the land use around them, which includes farms such as chicken and catfish farms.

– *pH*

The pH levels in the research area, based on analysis results, range from 3.31 to 5.3. According to Permenkes No. 492 of 2010, the acceptable pH range for groundwater is from 6.5 to 8.5. The current pH levels in the research area are below the acceptable standards for groundwater quality. According to Sudadi (2003), a pH level below 6 indicates acidic

water, which can lead to corrosiveness in pipes and the dissolution of certain toxic metal elements. Conversely, a pH level above 8.5 can lead to sediment or scale formation in pipes and the production of toxic trihalomethanes.

#### IV. CONCLUSION

The groundwater quality in Cilodong District, Depok City, exhibits elevated levels of certain parameters such as fluoride, nitrate, and pH, which do not meet the standards set in Permenkes No. 492 of 2010. These elevated levels are attributed to natural factors such as rainfall, as well as anthropogenic factors such as agricultural activities near the dug wells.

#### REFERENCES

- [1] Fetter. C. W. 1994. *Applied Hydrogeology*. Prentice-Hall, inc., New Jersey.
- [2] Minister of Health Regulation No. 492 of 2010 on Drinking Water Quality Requirements, Jakarta.
- [3] Sudadi, P. 2003. *Penentuan Kualitas Air Tanah Melalui Analisis Kimia Terpilih*. Groundwater Utilization Sub Directorate, DTLGKP. Bandung.
- [4] Sehadijaya, N. 2014. *Perbandingan Kandungan Nitrat (No3) Pada Air Sumur Gali Masyarakat di Kelurahan Padengo Kecamatan Kabila*. Department of Public Health, Faculty of Health and Sport Sciences, Gorontalo State University.
- [5] Ompusunggu, H. 2009. *Analisa Kandungan Nitrat Air Sumur Gali Masyarakat di Sekitar Tempat Pembuangan Akhir (TPA) Sampah di Desa Namo Bintang Kecamatan Pancur Batu Kabupaten Deli Serdang*. Faculty of Public Health, University of North Sumatra. Medan.