Surface Geological Survey as Preliminary Study for Providing Water Source of Agriculture in Tayuban Village, Panjatan, Kulonprogo

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Surface Geological Survey as Preliminary Study for Providing Water Source of Agriculture in Tayuban Village, Panjatan, Kulonprogo

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Abstract. The government's policy in the food sector is to achieve food self-sufficiency in the context of national food security, whose priority is in the form of partiality to farmers to improve welfare. This policy cannot be felt yet by the farmers who live in Tayuban village, Panjatan Sub district, Kulonprogo Regency, because there are still obstacles in its implementation. The problem faced by farmers in this village in increasing crop production is the lack of availability of water sources for irrigating secondary crops, especially in the dry season. The lack of water availability causes plant productivity lower, that impacts low income for the farmers. To overcome the problem of water shortages by finding ground water sources. The method in this paper is to conduct a surface geological survey to find out the distribution of sandstones as groundwater aquifers roughly and use topographic mapping data in the form of flow patterns, watershed boundaries and watershed forms. The results of this study can be concluded that Tayuban village is a syncline that can function as a reservoir of water

INTRODUCTION

While growing populations and increasing water requirements are a certainty, there is a big uncertainty about how these requirements will be affected by human activities (Hadizadeh F. et al., 2018). The intensification of irrigated agriculture is a prerequisite for fulfilling the rising food requirements of the burgeoning global population (Singh A, 2016). The Tayuban area is an alluvial and coastal plain area where most of the population has a livelihood as farmers. Large and sustainable sources of water must be available to fulfill irrigation in the Tayuban area. In the exploration for water sources or aquifers it begins with a surface geological survey. The method can also be used elsewhere by finding syncline structure.. The results of surface geological survey will be used as preliminary data to determine whether the area has the potential to be a water supplier to irrigate agricultural land in Kulonprogo. The location of the study area is pointed at **FIGURE 1**.

GEOLOGY

Geomorphology

Kulonprogo is part of the southern Central Java zone. The northern and southern parts of Kulonprogo are bordered by the coastal plain of the Indonesian Ocean and the northwestern part of it is related to the South Serayu Mountains.

The morphology of the study area is briefly divided into 3 parts, named:

- Morphology of denudation hills (denudation process) is shown anticline and syncline
- Morphology of alluvial plain (research area)
- Morphology of sand dunes

The morphology study area is viewed in **FIGURE 2.**

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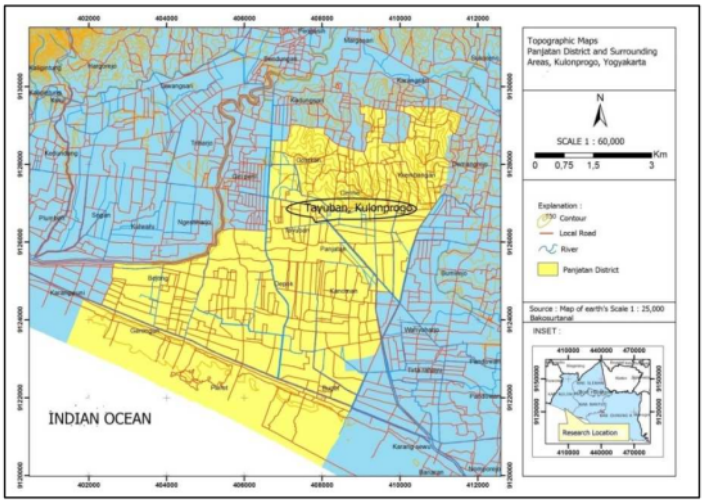

FIGURE 1. Research Location in Tayuban Village, Panjatan, Kulonprogo

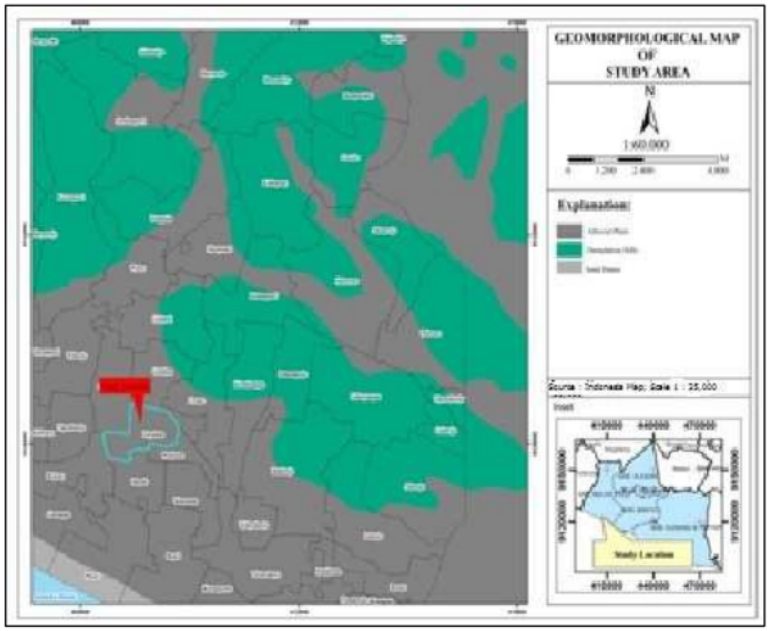

FIGURE 2. Morphology of Study Area [8]

The geological map of the research area is Sentolo Formations, which consists of Agglomerates and Marls. It is located at the bottom, the more upward changes into layered limestones with neritic facies, beside coral reefs are also found.

The distribution of this Formation can be seen in the geological map of **FIGURE 3**

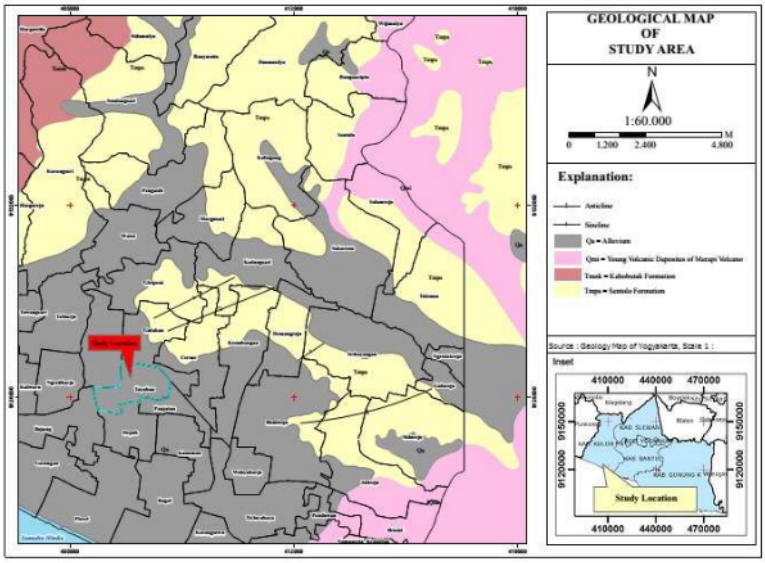

FIGURE 3. Geology Map of Study Area [7]

STRATIGRAPHY

The research area is part of the Kulonprogo regional stratigraphy, which consists of old to young Formations namely the Sentolo Formation and Alluvial Deposits (**FIGURE 4.**) Kulonprogo regional stratigraphy is sequentially started from the oldest, includes Formation Nanggulan, Kebobutak Formation, Jonggrangan Formation, Sentolo Formation, Andesite and Dacite intrusion rocks and Alluvium [4]. Stratigraphy of research area is represented by Sentolo Formation and Alluvial Deposits. The Sentolo Formation consists of Agglomerates and Marls which are located at the bottom layer then upward changes to limestone layer with neritic facies. In this location also found coral limestone with the same age as the Jonggrangan Formation. Alluvial deposits are composed of crust, sand, silt, and clay along a large river and coastal plain. The alluvial of the river itself coexists with alluvial results from the collapse of volcanic material.

Geologic Sructure of Kulonprogo Region

Regionally, the Sentolo Formation is widespread in the study area, consisting of limestone and maritime sandstone. This Formation overlies with the rocks of the Jonggrangan Formation and is suppressed out of harmony with alluvial deposits (Rahardjo et al., 1995). Based on observations made, it is generally known as limestone. [4]

The geological structure of the research area is interpreted as not having a large fault controlling, but in some areas, it shows local structures. In the Nanggulan Formation, meso shows geological structures such as up faults, down faults, horizontal faults, folds and cracks, as well as some accompanying structures.

Whereas in Kebobutak Formation, Dukuh Formation, and Sentolo Formation, down fault appeared in some areas, even in the Proximal Facies of the Ancient Ijo Volcano area, having a down fault and horizontal fault, radial towards the Central Facies of Ancient Ijo Volcano. While the anticline and syncline structures in the Sentolo Formation which is estimated in the Distal Facies of Ancient Volcano Ijo is interpreted to be formed from the pyroclastic material isostation force and down fault on Mount Ijo [2] as shown in **FIGURE 3**.

The surface geological survey results in the village of Tayuban show the paddy field area which is an alluvial deposits that is composed of crust, sand, silt and clay (**FIGURE 5**.).

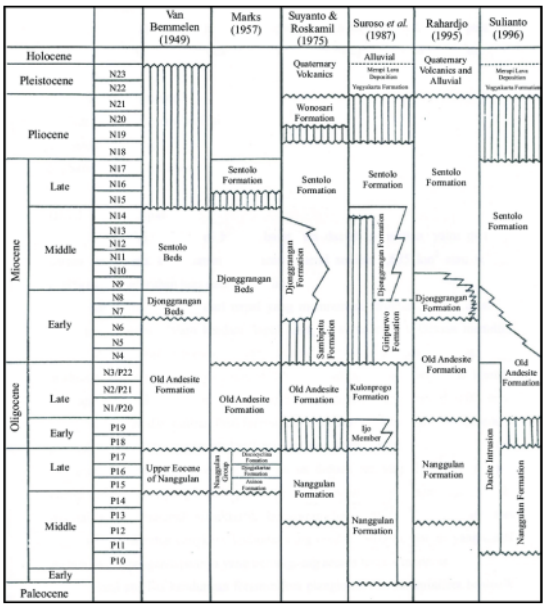

FIGURE 4. Stratigraphic Arrangement in Several Publications of Kulonprogo Zone [6]

FIGURE 5. The rice field area of Tayuban Village is an Alluvial Plain

FIGURE 6 shows the lithology of the outcrop in the Kepek Giripeni river which is a limestone alternates with marl.

Based on surface geological survey obtained strike and dip of layer in the village of Giripeni are N 187° E /7° and Triharjo N 35° E / 5°. So that it can be interpreted as syncline.

HYDROLOGIC CYCLE

Hydrological cycle is a simplified accounting of the complex interactions of meteorological, biological, chemical, and geological phenomenon. It is the water movement, starts from surface water, ground water, and vegetation to the atmosphere and back to the earth in the form of precipitation. The transfer of water from plant tissues to the atmosphere is called transpiration. Plants absorb water from the soil through the root system. Rainfall can be abstracted onto vegetation, intentionally stored in ponds, be abstracted by depression storage (unintentional small volumes), infiltrated into the soil, or be available for discharge (rainfall excess). Rainfall that infiltrates into the soil, moves or percolates to the water table.

The following picture explain about hydrologic cycle, in **FIGURE 7.**

FIGURE 6. Limestone lithology alternates with marl in the Kepek Giripeni River

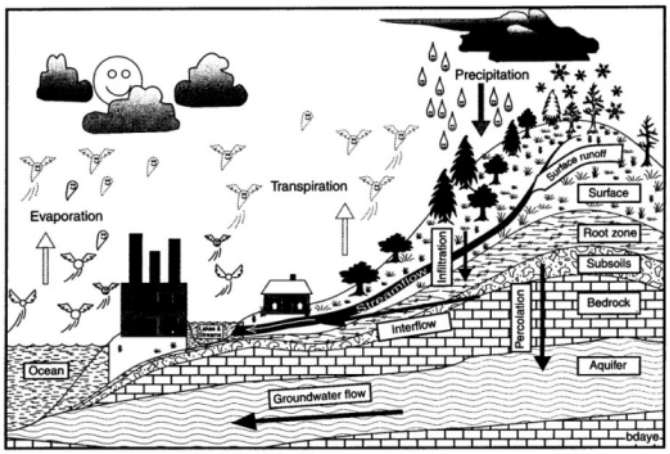

FIGURE 7. The Hydrologic Cycle [1]

WATERSHED MAP

Watershed is a region or area bounded peripherally by a divide and draining ultimately to a particular watercourse or body of water.

WATERSHED SHAPE

Hydrologists distinguish watersheds based on their flow patterns. The flow pattern is influenced by geomorphology, topography, and shape of the region. According to Andy D. Ward and Stanley W. Trimble, the shape of watershed consists of the pattern of circular or fan shape and elongated shape (long, narrow) in **FIGURE 8.**

1. Circular
2. Elongated watershed

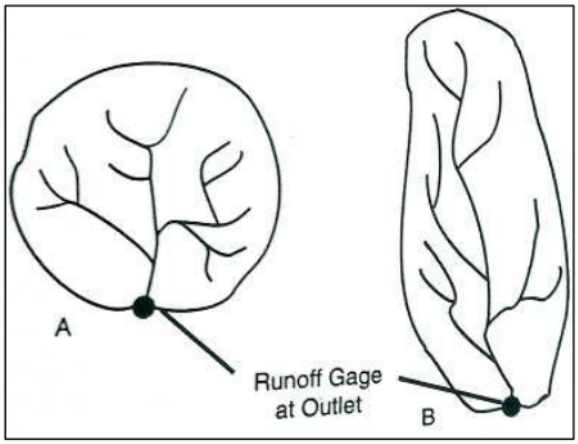

FIGURE 8. Catchment Shapes: (A) Fan and (B) Elongated [1]

The watershed in the study area is made based on the map of the Earth from the pattern of its river flow can be separated into 6 SUB DAS. In the study area included in SUB DAS 3, shown by **FIGURE 8**, are elongated patterns.

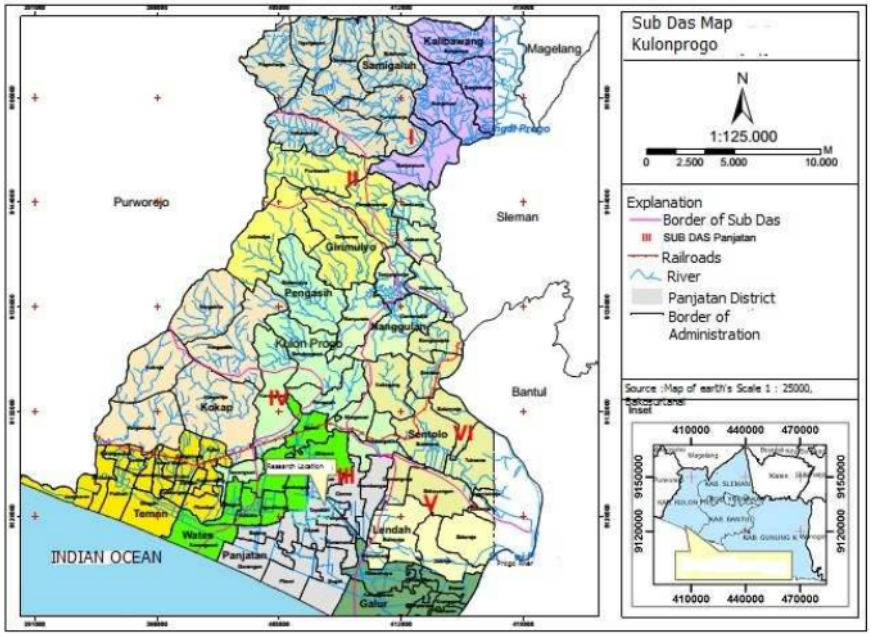

FIGURE 9. Sub Watershed Map of Kulonprogo [8]

The division of the watershed area which based on the cross section can be divided into 3 parts, namely upland, middle land and lowland, shown by **FIGURE 10.**

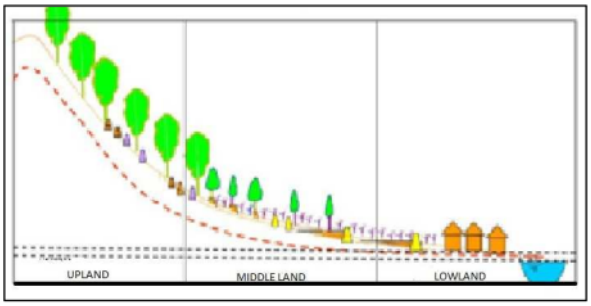

FIGURE 10. Cross Section of Watershed

In the upland of watershed serves as a natural reservoir and reservoir buffer, control of soil carrying capacity, limited utilization, used for protected forests, rafting activities. In the central part of the watershed it functions as a transitional area, functioning also for environmental protection and cultivation (plantations and agriculture), activities for irrigation (dams). In the lowland part of the watershed, it can be used for agriculture, secondary crops and areas for the economy.

DISCUSSION

Based on the geological map of secondary data and surface geological survey data, the research area has hilly morphology and alluvial terrain. From the results of strike and dip measurements in Giripeni and Triharjo villages respectively at N 187º E /7º and Triharjo N 35º E / 5º, then it called a syncline. Lithology in hilly area is composed of limestone-marls of Sentolo Formation which is deposited in the marine environment (neritic facies), this will affect the water quality produced. Whereas in alluvial deposit is composed of sand, gravel and clay lithology is good enough functioning in ground water aquifer. The research area study is located between the middle land and lowland part which is located near the free sea, it has the potential to be infiltrated by sea water.

The research is located in SUB DAS 3 in **FIGURE 9**, as elongated pattern, which geologically included in Sentolo Formation and alluvial in syncline. It functions as aquifer, which can be used as a water source in the surrounding area. Whereas alluvial plains can function as an aquifer which is shown from the water source of the population around Tayuban village at a shallow depth.

CONCLUSION

The research area in terms of geology is a syncline that can be shown the opposite value of dip and strike at Giripeni and Triharjo villages as a water reservoir. In terms of the lithology of the study area, the excellent alluvial deposits function as a fairly large aquifer. The research area has a watershed in the form of elongated patterns, so it has a significant risk of flooding in lowland of the river flow.

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