Model Design of the Mine Drainage System Kaolin Mining Site Djawani Gunung Abadi, Trenggalek Regency, East Java Province

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Abstract: Mining drainage is aimed at minimizing water entering the front mining as well as removing water from the mining front area. Djawani Gunung Abadi Ltd is one of the companies engaged in the mining industry kaolin is located in Karangan District, Trenggalek Regency, East Java Province. This research was conducted with the aim of designing a mine drainage system at Djawani Gunung Abadi Ltd so that water does not enter the mining sites. From the results of the research and discussion carried out, a large amount of. The total water discharge entering the mine site is 0.55 m^3/second with an area rain catch of 19 Ha and bottom pit area of 6,046 Ha. Calculation of capacity the open channel is the width of the upper surface of the channel (B) of 1.1 m; channel base width (b) by 0.48 m; channel height (d) of 0.97 m; water depth (h) of 0.48 m; Tall guard (w) of 0.49 m; channel slope by 2%; by channel wall coefficient (n) of 0.045; resulting in an open channel reservoir capacity of 0.55 m^3/s with a settling pond capacity of 2,500 m^3.

1 INTRODUCTION

Be advised that papers in a technically unsuitable form will be returned for retyping. After returned the manuscript must be appropriately modified. Mining drainage is one of the important aspects of open pit mining related to working conditions, safety, productivity and the environment where mine jetting aims to minimize water entering the mining front and remove water from the mining front area. The company's mining system that applies this quarry method, whose entire activity is directly related to weather and climate, causes the mining front to come face to face with water from rain and runoff water, high rainfall can affect and even hinder mining operations.

PT. Djawani Gunung Abadi is one of the companies engaged in the Kaolin mining industry located in Karangan District, Trenggalek Regency, East Java Province. During mining activities, this company does not yet have mining activities so that during the rainy season the usual problem is the presence of rainwater entering the mining site. When there is high rainfall, the water from rainwater will inundate the mining area which causes the mining site to be muddy.

2 CASE STUDY AND DESCRIPTION

Djawani Gunung Abadi Ltd is located in Trenggalek Region, with the address National III Buluagung street, Karangan District, Trenggalek Regency, East Java Province. To reach the territory of PT. Djawani Gunung Abadi, which is located in Ngentrong Village, Karangan District, can be reached by using the 7-land route. With a total time taken 4 hours 15 minutes do not use rest.

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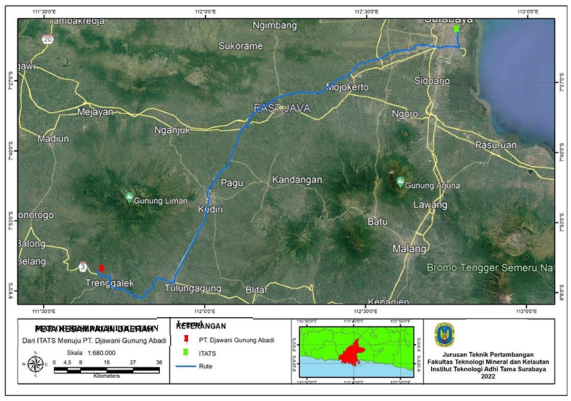

Figure 1: Map of Research Location.

2.1 Local Geology

Tectonically, the Southern mountainous zone of Java is a magmatic arc formed from the results of the support activities of the Indian Plate - Australia and the Asian Plate in the Late Oligocene - early Miocene. This magmatic size stretches from west to east along Java Island. The geological structures found in the investigation area are minor stocky due to loading and processing of larger geological structures. The strike direction of the rock layer is generally relatively West–East direction i.e. N 100º E, with a dip slope between 15º. The research site is included in 2 (two) rock formations, namely the Mandalika 8 (Tomm) Formation which is composed of interspersions of volcanic brection, lava and tuff, sided with tufan sandstones, siltstones and clay rocks of late Oligocene to Early Miocene age and Alluvium Formation (Qa) composed of tholocene-aged keracal, gravel, silt, and clay.

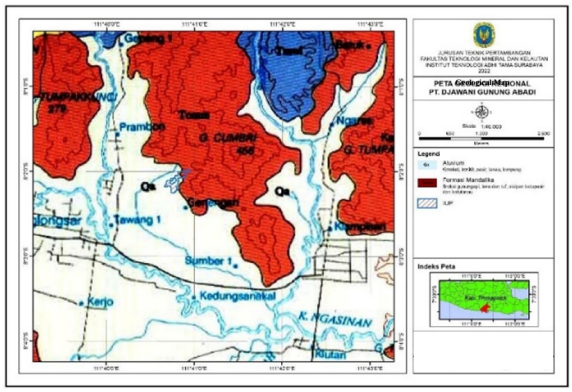

Figure 2: Geological Map Research Area.

3 METHODOLOGY

Djawani Gunung Abadi Ltd is located in Trenggalek Region, with the address National III Buluagung street, Karangan District, Trenggalek

Several methods of collecting information or data were used in this study to gain a thorough understanding of the subject matter that was the focus of the investigation. The authors collected information using primary data and secondary data, two separate data collection methods. While primary data is information collected from the actual field, secondary data is information collected through bookkeeping and companies. The author then uses this information to help with troubleshooting.

3.1 Primary Data

Primary data is information collected by taking or measuring directly in the field. The following are the study's key findings:

- Rainfall data

  Rainfall data is obtained from data from the Central Statistics Agency and then used as data for calculating rainfall plans so that water discharge values are obtained. The rainfall data used is data for the last 10 years so that planning and analyzing rainfall plans is easier and more accurate.

3.2 Secondary Data

Secondary data is information that has been collected from sources other than the field, such as literature or companies. In this study, the secondary data were:

- Topographic map

Topographic Maps are obtained from the company. Where this map is used by researchers to determine the area of the catchment area.

- Geological map

Geological maps are obtained from the literature. Where this map is used to find out the lithology or rock layer at the research site so that it can be known the possibility of rock layers becoming aquifers or the possibility of groundwater.

- Land use map

Land use maps are obtained from the company or from the web literature of the spatial plan and the trenggalek regency. Where this map is used to help determine the runoff coefficient.

- Map of the mine situation

A map of the mine situation was obtained from the company. Where this map is used to find out the conditions or situation at the mining site so that it can determine the placement of open channels and the location of the settling pond correctly.

3.3 Data Collection Methods

Researchers need a variety of supporting data to support the need to research this research data. The data retrieval method used is modified according to the type of data collected as follows:

- Literature study

A literature study is a search for library resources on the issues to be addressed in the study, including information from journals, books, internet sources, and library databases.

- Research data collection

The implementation of this research utilizes various information collection techniques in an effort to gain a general understanding of the subject of the research focus. The authors used primary data and secondary data, two different data retrieval techniques, to collect information. Primary data comes directly from the field. Secondary data, on the other hand, comes from business and literature. For the author's approach to problem solving, he uses both techniques.

3.4 Data Analysis Techniques

After data collection, the next step is to organize the collected data into groups for analysis. The following data should be checked:

- Calculating rainfall plan

Then the rainfall data obtained is calculated with the help of Microsoft Excel.

$$CHR = X + (\frac{s}{Sn})(Yt - Yn)$$

- Calculating rainfall intensity

To calculate the intensity of precipitation using the Mononobe calculation formula below.

$$I = \frac{R_{24}}{24}\left(\frac{24}{t}\right)^{\frac{2}{3}}$$

- Determine area of catchment area

the determination uses Arcgis 10.4 and Surpac 6.3 software to determine the catchment area based on the catchment area that is expected to be a watershed. Topographic maps are used to calculate measurements in the mining area of Djawani Gunung Abadi ltd.

- Calculating runoff water discharge

$$Q = 0{,}278 \times C \times I \times A$$

- Calculating open channel dimensions

Makes use of a trapezoidal cross-section to determine the size of an open channel. Discharges affecting the design of open channels are taken into account when calculating the dimensions of open channels.

- Calculating settling pond dimensions

To determine the dimensions of the settling pond is adjusted to the pumping discharge and the volume of rain runoff. Where the determination of the dimensions of this settling pond is based on the Ministry of Energy and Mineral Resources 1827 K / MEM / 30/2018 concerning Good Mining Engineering Rules.

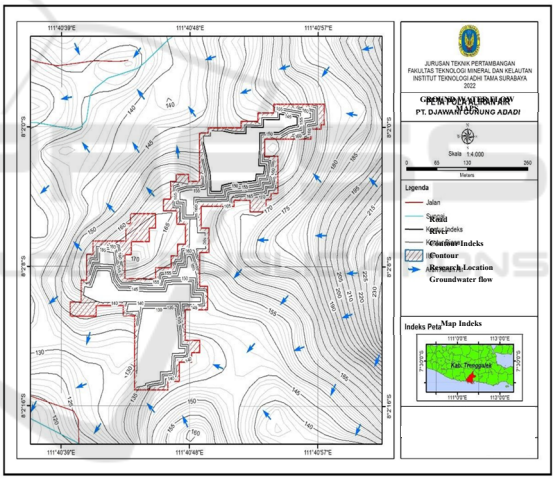

Figure 3: Map of Djawani Gunung Abadi Ltd Area Water Flow Direction.

Table 1: Rock strata properties.

Tilt	Land cover / type	Runoff coefficient (C)
	Rice fields, forests, swamps	0,2
<3% (Flat)	Plantation	0,3
	Housing	0,4
	Forests, plantations	0,4
3% -15%	Housing,	0,5
(Moderate)	The bushes are rather sparse,	0,6

Table 1(continued): Rock strata properties.

	Open field	0,7
	Forest,	0,6
> 15%	Housing,	0,7
(Steep)	The bush is a bit sparse	0,8
	Open land in the mine area	0,9

4 RESULT AND ANALYSIS

Data on rainfall and rainy days used as mine drainage analysis were obtained at the Central Statistics Agency of Trenggalek Regency in 2022. This data is sample data that is used as a calculation of runoff discharge. The amount of rainfall and rainy day data is as much as the last 10 years.

To calculate the size of the water flow, you need to know the intensity of precipitation. Rainfall intensity also known as the amount of rain per discrete amount of time is used to describe rainfall levels.

Table 2: Calculation of rainfall intensity.

Channel length (meter)	Average rainfall (mm/hour)	S	Time concentration (hours/day)	Intensity Rainfall (I)
4.950	110,46	73,43	4	0,0152

4.1 Open Channel Dimensions

Channeling at PT. Djawani Gunung Abadi uses the channeling system is a trench. This channel serves to accommodate and drain water into the settling pond, in addition to the channel The existing trenches in the company also aim to prevent runoff water from entering the within the mining work area and does not interfere with mining activities nor production.

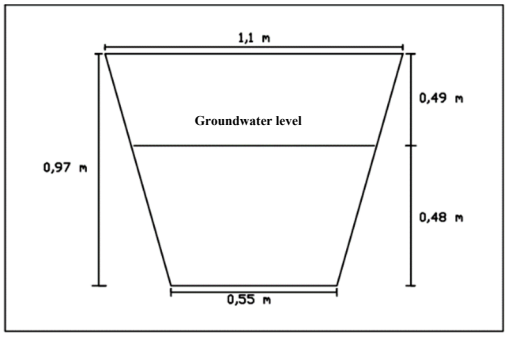

Figure 4: DTH open channel dimensions.

4.2 Settling Pond Dimensions

The settling pond serves to deposit sedimentary particles or mud before it is flowed to the river to the north of the mine site. The dimensions of the settling pond are designed based on runoff discharge in the mining area where the settling pond must have a larger capacity than the runoff discharge that will enter the pond so that it can hold water according to its discharge capacity.

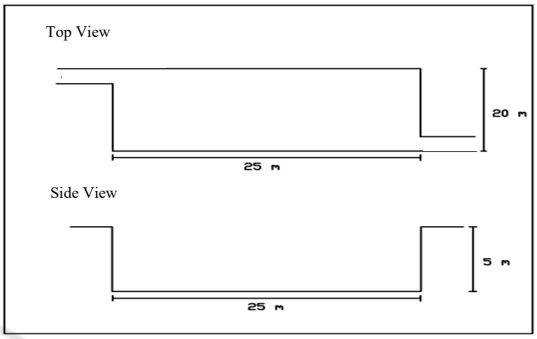

Figure 5: Settling Pond dimensions.

5 CONCLUSIONS

The results of the open channel design of PT. Djawani Gunung Abadi, can be concluded as follows:

1. The area of the rain catchment area based on the results of data processing carried out can be known, which is 190.000 m^2.
2. The discharge of water entering the mine is divided into 2 (two) namely runoff water discharge and rainwater discharge that enters the pit. The amount of runoff water discharge is 0.32 m^3/hour and the rainwater discharge entering the pit is 0.25 m^3/hour. So that the total water discharge entering the mine is 0.55 m^3/hour.
3. The dimensions of the trench or open channel are based on the results of the calculation of the capacity of the open channel, namely the width of the upper surface of the channel (B) of 1.1 m; the width of the base of the channel (b) is 0.48 m; channel height (d) of 0.97 m; water depth (h) of 0.48 m; Guard height (w) of 0.49 m; channel slope by 2%; with a channel wall coefficient (n) of 0.045; So as to produce an open channel storage capacity of 0.55 m^3/sec, according to the amount of total discharge of water entering the mining site.
4. Settling pond design of PT. Djawani Gunung Abadi is rectangular in shape with pool dimensions, namely a pool width of 20 meters;

pool height 5 meters; pool length 25 meters; with the number of pools as many as 1 (one) pool. this producing a settling pond capacity of 2,500 m^2. The capacity of the mini kola can connect the total discharge of water entering the mine site for a period of 1 hour, which is 2,375 m^3/hour.

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