SOIL ERODIBILITY IN POST COAL MINING LAND RECLAMATION AREA IN BACKFILLING MTBU AIR LAYA

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SOIL ERODIBILITY IN POST COAL MINING LAND RECLAMATION AREA IN BACKFILLING MTBU AIR LAYA TAMBANG (TAL) PT. BUKIT ASAM TBK, TANJUNG ENIM MINING UNIT (UPTE) MUARA ENIM, SOUTH SUMATERA

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Abstract

Reclamation activities will be realized and effective, with necessary to carry out for knowing level soil erodibility, for knowing influence erodibility and can minimize the risk of inhibiting vegetation growth. an Erosion Study is very important crucial in mining area, in particular in ex-mining area which will be revegetated, because will affect vegetation growth. Therefore trusted necessary protection good soil mechanically, vegetatively alsochemical so that soil sustainability & soil productivity permanent awake. The survey method is a method for obtaining field data by means of observation, and systematic recording of the phenomena being investigated. While the analytical method used on the data obtained is through a study of several theoretical foundations and theoretical calculations on the supporting parameters of the object and research subject. Physical properties of the soil in the reclamation of ex-mining land show a moderate value of soil erodibility, is 0.23. The moderate erodibility value indicates that the soil in the area is susceptible to erosion caused by rainwater. The impact is a Loss of a layer of soil that is relatively rich in nutrients and organic matter and Land productivity declines or even cannot be used for production. With a moderate erodibility value indicating that the soil in the area is susceptible to erosion caused by rainwater. Things that can minimize this impact are to improve the condition of the chemical properties of the soil so that vegetation can grow well and further studies are carried out on efforts to control erosion.

Keywords: *Reclamation, Erodibility, Mining*

INTRODUCTION

Indonesia is a country rich in natural resources, one of which is minerals (coal, oil, natural gas, tin). In this era of globalization, every country builds its economy through industrial activities that process their own natural resources. This is done to compete with other countries and promote their economic development. Therefore, many companies process mining products for production, and the emergence of the mining industry in Indonesia has had both positive and negative impacts on society and the country. The positive impacts of mining include job creation for the community, and mining production can be used to meet domestic and international market demands, so that mining exports can increase state revenues and economic growth. The mining industry can also attract foreign investment to Indonesia. On the other hand, the mining industry also has a negative impact, namely environmental damage if these activities are not managed properly. Mining activities will cause changes in the landscape such as topography, vegetation cover, hydrological patterns and damage to soil structures. This is what makes it difficult in the process of recovering and restoring ex-Mining land according to its designation. Reclamation is an activity carried out throughout the stages of the mining business to organize, restore, and improve the quality of the environment and ecosystem so that it can function again according to its designation (Regulation of the Minister of Energy and Mineral Resources of the Republic of Indonesia Number 26 of 2018, Article 1).(top soil), plantingcover crop, planting pioneer crops, handling heavy metals (Juniah, 2017).

PT. Bukit Asam, Tbk Tanjung Enim Mining Unit, is located in Tanjung Enim District, Muara Enim Regency, South Sumatra Province. Is a company engaged in the management and supply of coal resources. PT. Bukit Asam, Tbk has been conducting mining activities since 1981. PT. Bukit Asam, Tbk is an open pit mining system using open pit. This can cause changes in land form. Changes in land form due to mining activities can be permanent or temporary, so carrying out reclamation activities requires different approaches and technologies (Dariah et al., 2010), decreased soil productivity caused by the mining process, soil compaction caused by the transportation process (Dariah et al., 2010). Hauling), erosion and sedimentation caused by runoff (Run off), noise caused by working tools, and loss of ground cover vegetation resulting from the land clearing process (Land clearing) that will cause environmental damage.

According to Balkau F. and Parsons A. (1999) in Karliansyah (2001), the United Nations Environment Program (UNEP, 1999) classifies the impacts arising from mining activities as follows:

- Habitat and biodiversity damage at mining sites
- Protection of the ecosystem/habitat/biodiversity around the mining site.
- Landscape change/visual disturbance/loss of land use
- Site stabilization and rehabilitation
- Mining waste and tailings disposal
- Tailings facility accident/landslide
- Unused equipment, solid waste, household waste
- Air Emissions
- Dust
- Climate change
- Energy Consumption
- Mudflow and changes in river flow
- Wastewater and acid mine drainage
- Groundwater changes and contamination
- B3 and chemical waste
- Chemical management, safety and workers

- Noise
- Radiation
- Occupational Health and Safety
- Heavy metal toxicity
- Cultural heritage and archaeological sites Public health around the mine

Therefore, to restore the quality of ex-mining land so that it can become strategic and productive land, it is necessary to do reclamation so that it can be used sustainably in order to support increasing community economic income. In order for reclamation activities to be realized to be effective, it is necessary to carry out an erosion study, an Erosion Study is very important crucial inmining area, in particular in ex-mining area which will be revegetated, because will affect vegetation growth. Therefore trusted necessary protection good soil mechanically, vegetatively alsochemical so that soil sustainability & soil productivity permanent awake. So, this research was conducted for knowing level soil erodibility,for knowing influence erodibility & can minimize the risk of inhibiting vegetation growth.

METHODS

The method used in this research is survey method and analytical method. The survey method is a method for obtaining field data by means of observation, and systematic recording of the phenomena being investigated. While the analytical method used on the data obtained is through a study of several theoretical foundations and theoretical calculations on the supporting parameters of the object and research subject. Calculation using the Weschheimer equation. To get the value of the Erodibility Index (K).

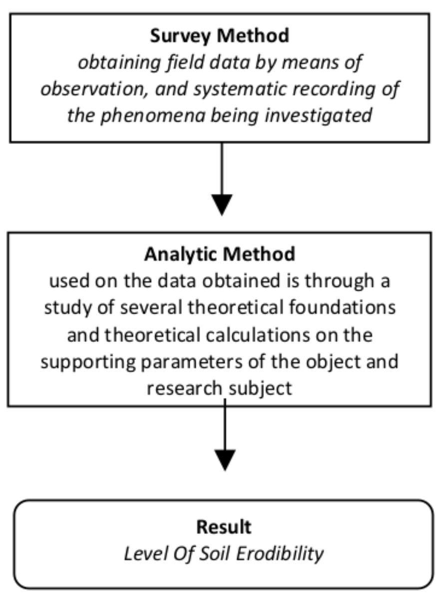

Figure 1. Research Procedure

Variable of Research

According to Sugiyono (2015: 63) Research variables are everything in any form determined by researchers to study so that information about these results is obtained, then conclusions are drawn.

• Topographical Conditions
• Permeability
• Erodibility

Stages of Research

This research produces an analysis of ex-mining land reclamation so that later it can improve the quality of ex-mining land so that it is safe and stable and can be used according to its designation.This research stage begins with studying the literature or library sources related to the topic of this research.

Preparation stage

The preparation stage is the initial stage in research activities. This stage is a literature study. Literature study is research that has the same preparation as other research, but the sources and methods of collecting data are by taking data in the library, reading, taking notes, and processing research materials. The required literature is literature related to the geology of the post-mining land environment. The literature that the author uses is in the form of journals, books and other documents. This activity will assist in research and data collection in the field.

Data Collection Stage

The data collection stage in this study was carried out in two ways, namely by using primary data and secondary data.

a. Primary data

Primary data is a source of research data obtained directly from the original source, in other words the data used is obtained directly from research activities, primary data will be taken at the research location. Primary data includes data:

1. Parameter Data of Ex-Mining Land
2. Landform Setting Data

b. Secondary Data

Secondary data is a source of data obtained indirectly or not original, such as from magazines, books, documents, etc. Secondary data includes data:

1. Reference Journals, Books
2. Legislation
3. Company Archives
4. Previous Research
5. References related to ex-mining land reclamation planning in the form of topographic maps, rainfall data, reclamation maps, baseline maps, and slopes.

Data Processing Stage Data Analysis

Analyzing the soil erodibility of ex-mining land so that later it can improve the quality of ex-mining land so that it is safe and stable with erotion and can be minimalism the risk of the erotion.

RESULTS AND DISCUSSION

Research Sites

The research was conducted in PT,Bukit Asam, Tanjung Enim, South Sumatra, The Tanjung Enim Mining Unit (UPTE) is located in Tanjung Enim, Lawang Kidul District, Muara Enim Regency and partly located in the Lahat Regency, South Sumatra Province. The map can be seen in **Figure 2.**

Based on the geographical conditions of the mining area of PT. Bukit Asam is divided into three mining locations, namely the Air Laya Mine (TAL), Muara Tiga Besar (MTB), and Banko (Figure 3.2). The location of the research area is in the IUP Tambang Air Laya Mining Tnjung enim The map can be seen in **Figure 3.**

Condition of Reclaimed Land

The ex-mining land located in the IUP Tambang Air Laya for Reclamation Planning ID 62 and 63, (**Figure 5**) is ±2 years old and has been reorganized, and has been planted with several types of plants. The area in ID 62 is 19,368 m2, and ID 63 is 109,832.47 m2. Based on topographic map analysis, the research location is at an elevation of 50-100 masl which shows that the land condition is in a hilly area and can be ignored and there is no standing water in the ex-mining land reclamation site. Efforts to reclamate ex-coal mining land are not only carried out post-mining, but must be carried out from the beginning of the mining plan, namely starting at the pre-construction stage, construction, operation stage, to the post-operation stage which includes licensing activities, land acquisition mechanisms, vegetation management, topsoil management (top soil) and ground cover (sub soil) and land enrichment to increase soil productivity.

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The plants grown in the revegetation area are relatively diverse, namely the types of legumes and non-leguminosae. The selection of plant types and arrangements in the field can take into account the ecological, aesthetic and economical aspects. The types of plants that are classified as adaptive in the PTBA revegetation area are:Acacia auriculaiformis (narrow-leaved acacia), Acacia mangium (broad-leaved acacia), Eucalyptus sp (eucalyptus), Glyricidia mucronata (gamal), Leucaena glauca (Chinese petai), albizia falcata (sengon), Hibiscus tiliaceus (waru), Gmelina arborea (white teak), Bambussa sp (bamboo), Peronema canescens (sungkai), Pterocarpus indicus (angsana) and Cassia siamea (ki rain). Some of revegetation on ID 62-63 can be seen on **Figure 4.**

Climatic Conditions

The high rainfall of 2645.7 mm/year causes cover crop plants in the form of bamboo, sengon buto, longkida, Nauclea orientalis, Angsana, etc. to show results that are not yet significant. This is due to the condition of the land that is eroded by runoff and the vulnerability of the soil to erosion. It can be seen from the physiography of the Tanjung Enim Regency area, including the tropical climate

Erodibility Rate

According to Amiril S (2009), erodibility which is not able to absorb water when it rains makes fine soil particles drift along with soil nutrients. High runoff and erosion on the land indicate high nutrient loss so that it will reduce crop productivity in the rainy season. Soil erodibility factor (K) can be calculated using the Hammer formula (1978) in Doli Friday Rainto (2019), as follows:

$$K = \frac{2{,}713M^{1{,}14}(10)^{-4}(12-a) + 3{,}25\,(b-2) + 2{,}5\,(c-3)}{100}$$

Which is :
M = (% ash + % sand) (100% clay)
a = organic material content (1,724 x C organic)
C organic = %
b = soil structure code
c = soil permeability value

Table 1. Type of Structure

Type of Structure	**Value**
Very fine granular	1
Fine granular	2
Medium, coarse granular	3
Blocky, platy, massif	4

Based on the results of field observations and available data, in general the material is Claye siltstone with code Strucutre 3 in **Table 2** . where the Analytic of physic and chemistry values can be seen in **Table 2.**

Permeability

Based on the data (permeability) on the material can be seen in **Table. 3.** These results indicate that the value of water absorption (permeability) is categorized slowly, which ranges from 0.20 to 0.49 cm/hour. With an average value of 0.34 cm/hour. Soil texture greatly affects soil permeability.

This is because the water when it is on the soil surface or the material will pass through the soil texture. For example, a sand-textured soil will easily pass water in the soil, while a clay-textured soil will be very slow to pass water. Soil or material that is very slow in passing water will result in accumulation of water on the surface which will become puddles and flow depending on the slope of the media.

The movement of water on the soil will gradually erode on the surface of the soil or material resulting in depletion of the soil on the surface (Top Soil). While plants need Top Soilthat is the fertile part of the soil so that it can grow well. Of course this will be a problem in the process or reclamation activities.

Erodibility

The physical properties of the soil in the reclamation of ex-mining land show a moderate value of soil erodibility, which is 0.29. The value of Erodibility caused confition of physical and chemistry soil has & C organic with value 1,08 (low). This condition have a risk for compression and will be non stable and The easy soil erosion is caused by the physical condition of the soil which is directly in the general fill material, above 50 cm of humus material.

Table 2. Analytic of physic and chemistry value

Kode sampel	ph	N	c	P-dd	P-potensial	Code	Water %				Pori Drainase %		Water	Ca	Mg	Na	K	KTK	KB	Al-dd	H-dd	KB (%)
		%		ppm		Sturcture	pF 1	pF 2	pF2 54	pF 4.2	Fastly	Slowly	Available	(me/ 100 g)								
ID 62	4.21	0.06	0.85	3.08	27.72	3	33.45	30.85	26.34	16.31	4.97	4.51	10.03	0.23	0.06	0.04	0.07	32.64	1.22	8.1 1	5.72	1.22
ID 63	4.20	0. 16	1.31	3.56	32.01	3	34.93	31.86	26.44	19.83	14.71	5.42	6.61	0.23	0.03	0.03	0.05	13.75	2.42	3.91	8.67	2.42

Source: Data analysis Enivromental PT. Bukit asam (2021)

Table 3. data (permeability) on the material

Lab Code	Sample Code	Texture			Permeability (cm/hour)	Characteristic
		% Sand	% Clay	% Ash		
213	ID 62	50.57	37.24	12.19	0.49	Slowly
214	ID 63	46.38	39.35	14.28	0.20	Slowly

Source: Data analysis Enivromental PT. Bukit asam (2021)

Figure 2. Regional Map Location of PT. Bukit Asam Tbk.
(Source: PT. Bukit Asam Tbk Exploration Working Unit)

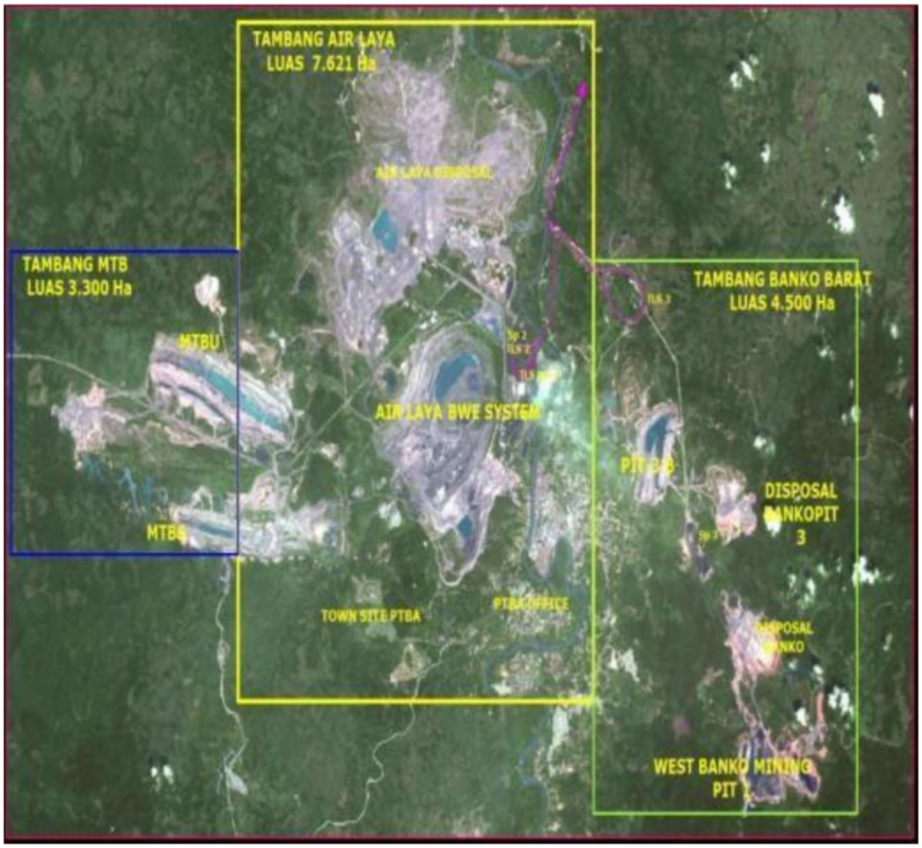

Figure 3. Mine Layout of Tanjung Enim Mining Unit
(Source: PT. Bukit Asam Tbk Exploration Working Unit)

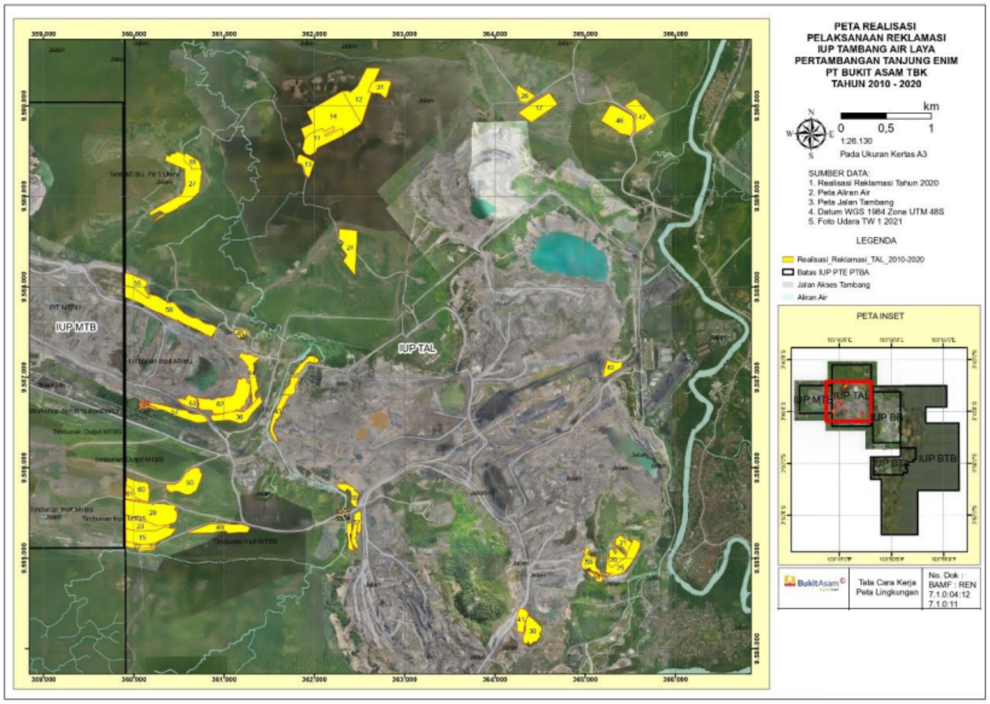

Figure 4. Plan for Reclamation of Ex-Coal Mine Land through Zoning the Area into Productive Land
(Source PT. Bukit Asam)

Figure 5. revegetation on ID 62-63

CONCLUSION

The physical properties of the soil in the reclamation of ex-mining land show a moderate value of soil erodibility, which is 0.29. The value of Erodibility caused confition of physical and chemistry soil has & C organic with value 1,08 (low). This condition have a risk for compression and will be non stable and The easy soil erosion is caused by the physical condition of the soil which is directly in the general fill material, above 50 cm of humus material.

So it is concluded, that it is necessary to take serious handling in the process of soil conservation. The moderate erodibility value indicates that the soil in the area is susceptible to erosion caused by rainwater. The impact is a Loss of a layer of soil that is relatively rich in nutrients and organic matter and Land productivity declines or even cannot be used for production.

With a moderate erodibility value indicating that the soil in the area is susceptible to erosion caused by rainwater. Things that can minimize this impact are to improve the condition of the chemical properties of the soil so that vegetation can grow well and further studies are carried out on efforts to control erosion on reclaimed land.

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