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Technical Design of *Mine Sequence (Trimonth)* in Coal Mining Based on Existing Mechanical Equipment at PT. Mega Bara Semesta *Jobsite* PT. SBP, Muara Enim Regency, South Sumatera

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Abstract

This study aims to make a technical design for coal mining in the first quarter of 2022 which includes a mining progress design, disposal design. The research methodology includes literature study to find literature references that directly support and relate to mining technical design. Then conduct orientation and observation of the problems that exist in the field. The data needed in this study are primary data and secondary data. The data that has been obtained is then processed and analyzed to produce a conclusion in the form of a mining technical design that meets the coal production target of 135,000 tons/quarter. Mining progress plan is made based on a predetermined production target of 135,000 tons/ quarter of coal. The results of the reserve based on the design in January 2022 obtained overburden volume of 166,637 BCM, coal of 45,348 tons with SR = 3.67: 1, in February 2022 obtained overburden volume of 167,655 BCM, coal of 45.017 tons with SR = 3,72 : 1, in March 2022 obtained overburden volume of 166,541 BCM, coal of 45,127 tons with SR = 3.69 : 1. The disposal design is located 1,893.09 m south of the pit. The total disposal capacity based on the design is 552,763 CCM with an area of 9.72 Ha. The amount of disposal capacity is 2.5% higher per year against the reserve based on the design with the type of embankment applied is the Terrance Dump. The type of Terrace Dump embankment was chosen because the topography in the study area is not too steep.

Keywords
technical design; Mine Sequence (Trimonth); existing mechanical equipment

I. Introduction

Mining technical design is an important part in planning mining activities with the aim of achieving the desired production target and providing an overview of the mining progress plan over a period of time. Therefore, it is necessary to make a technical design for mining and a disposal plan in the first quarter of 2022.

This research was conducted at PT. Mega Bara Semesta which operates in Tanjung Agung District, Muara Enim Regency, South Sumatra Province. PT. Mega Bara Universe is a mining company with a license in the form of SIUJP No. 131/KEP.KA.DPM-PTSP-6.1/IUJP/Vil/2018. The mining system used is an open pit mining system with the open pit coal mining method , because the position of the coal deposits is relatively upright, namely at a dip of 27 – 32 .

PT. Mega Bara Universe will do plan activity mining on Pit A for t the first quarter of 2022. Companies need to make short- term plans (Short Term Plan) which refers to the coal mining production target per specified month. Based on this, this research needs to make a technical design for mining to meet production targets. The results study expected could produce something technical design mining, disposal plans for each mining progress, as well as determining the need for the number of units of digging-loading equipment and transportation equipment needed in accordance with condition actual on the company. The increase in the value of the company's shares, the higher the company value, the higher it will be (Katharina, 2021). In the current economic development, manufacturing companies are required to be able to compete in the industrial world (Afiezan, 2020). The existence of the company can grow and be sustainable and the company gets a positive image from the wider community (Saleh, 2019).

Making mining technical design conducted so that implementation activity mining could walk effective and efficient, so that required a n P it design which will be used as a guideline for mining operations in something period time certain which in accordance with target production which has set. Based on observation in field company only have design mining sequence (trimonth) so there are some problems.

The objectives of this research include making progress plans mining per month in the first quarter of 2022 with a maximum limit of SR (Stripping Ratio) of 1: 5. Make a monthly disposal plan in the first quarter of 2022.

The results of this study can be used as a reference in the implementation of mining at PT. Mega Bara Semesta , as well as to determine the need for effective and efficient mechanical equipment.

II. Research Methods

The research methods used are: literature study, field orientation, field observation, data collection, data processing and analysis. In this study, a flow chart and work sequence were made as the direction of the research so that this research could be carried out in a systematic and directed manner.

III. Discussion

3.1 Results

In developing reading comprehension supplementary teaching materials based on local culture, there are seven stages adopted from R&D developed by Borg and Carry (2010). The State of Research Site

a. Morphological and Topographical Conditions

The morphological conditions of the research area are divided into various units, namely: unit morphology plains low and swamp, hills wavy, and hills steep, with condition back hills which relatively no orderly. Based on topographical conditions, the height of the research area is at elevation lowest 82 masl until with highest elevation 132 masl (see Picture 4.1).

b. Coal Sediment Condition

Coal deposits is very influential in determining the shape, distribution and distribution of coal and quality from sediment that alone, position *seam* coal on the research area is at

strike N 087 E , and has a slope relatively flat b e r ki s a r dip 27 - _ _ _ 32 . _ the condition of coal deposits in the study area has coal of the following qualities.

Table 1. Quality Parameter Coal Research Area

Parameter		**Results**			**Standard Methods**
		As Received Base	Air Dried Base	Dried Base	
Total Moisture	%	30.8	-	-	ASTM D3302/D3302M-19
Proximate Analysis					
- Inherent Moisture	%	-	12.99	-	ASTM D37173-2017A
- Ash Content	%	3.22	4.05	4.65	ASTM D3174-202(2018)
- Volatile Matter	%	33.41	42.01	48.28	ASTM D3175-2018
- Fixed Carbon	%	32.57	40.95	47.06	ASTM D3172-2013
Total Sulfur	%	0.24	0.3	0.34	ASTM D4239-18e1 (method A)
Gross Calorific Value	Kcal/kg	4706	5917	6800	ASTM D5865/D5865M-2019

Source: PT. Sriwijaya Bara Priharum, 2021

c. Coal Mining Production Target

Mining production target Coal is determined by market demand and the company *'s budget* PT. Mega Bara Universe . This coal mining production target will be mined within a period of three months and then divided every month . Total *tons of* Coal *onnase* on *Pit* A to be mined is 45000 Tons per month . The company limits the stripping *ratio* not to exceed 5 . Before mining activities are carried out, the company needs to make a *Pit* A mine design as a reference for estimating production targets that are close to actual conditions in the field. In the calculation of reserves using *Minescape* 5.7 software, the *overburden volume is* 500,883 BCM and coal is 135,492 tons .

d. Types of Mining Mechanical Tools

The choice of mechanical equipment is very dependent on the mining system used chosen. The selection of equipment is very influential on the geometry to be made. Tall and wide level surface work will influenced by range and the capability of the selected mechanical device. Selection of mechanical devices used in area study customized with condition topography and target production mining determined by the company. Mechanical tools and tool specifications could seen on attachment I . Need tool mechanical per month adapt target production mining the coal has determined by company.

Table 2. List Mechanical Tool and PA *plans*

Type Tool	Activity	Equipment
Tool Dig - Load	Layer Excavation and Loading Overburden	CAT 340D2L

	digging and _Loading Coal	CAT 330D2L
Tool Transport	Layer Transport Overburden	DT Scania P380
	Freight Coal	DT Scania P380

Source: PT. Mega Bara Universe, 2021

e. Coal Mining Technical Design

1. Mining Grade Geometry

Geometry design mining tiers are based on recommendations the results of the geotechnical study of PT. Mega Bara Universe . Mining grade geometry which will be designed is made based on slope stability analysis with a factor of appropriate security with recommendation geotechnical i.e.

2. Mine Road Design

The role of haul roads in a mining activity is very vital, so the correct haul road design will greatly support the mining activity.

1) Location

The location of the haul road consists of 2, namely the haul road to *the disposal area* and to the *stockpile* . The *disposal area* is located in the south of *Pit* A .

a) Mine Transport Road January 2022.
b) Transport distance to *disposal area* the average is 2032.91 m to the south of the *Pit* A mining *front* in an *out pit dump* outside the *Pit* A mining area. Transport distance to *stockpile* the average is 1672.40 m.
c) Mine Transport Road February 2022.
d) Transport distance to *disposal area* the average is 2093.96 m to the south of the *Pit* A mining *front* in an *out pit dump* outside the *Pit* A mining area. Transport distance to *stockpile* the average is 1732.37 m.
e) Mine Transport Road March 2022.
f) Transport distance to *disposal area* the average is 2393.67 m to the south of the *Pit* A mining *front* in an *out pit dump* outside the *Pit* A mining area. Transport distance to *stockpile* the average is 2 364.41 m.

2) Geometry of Mine Road (Ramp*)*

f. Overburden Heap Design (Disposal Area)

In mining activities so that mining operations can run smoothly, it is necessary to make a technical design for *overburden accumulation* (*disposal areas).* The design of *the disposal area* is designed with the following provisions:

1. The distance from the work surface (mining *front) is a consideration.*
2. Efforts are made to choose the *disposal location* on the *low wall side* so that if further mining is to be carried out it will not interfere with production because at the *low wall location* there is no coal seam.
3. Do not disturb the area to be mined, rivers or roads, and the surface topography is cultivated in the form of valleys.
4. Pay attention to the boundaries of mining concessions or IUPs from companies as boundaries.

The technical design of *overburden filling* requires several important parameters, these parameters include:

1. Angle *of Repose* = 37
2. *Bench* height = 5 m
3. The width of the ladder (*Bench width*) = 5 m

The parameters of the *disposal design* above are obtained from the recommendations geotechnical engineering conducted by PT. Mega Bara Universe. (Appendix D). The type of embankment selected is *Terrace Dump.* This type of stockpiling was chosen because the research area has a relatively sloping topography and is not too steep.

g. Disposal Level Geometry

The total volume of *overburden* that must be excavated over four years is 500,833 BCM. The amount of *overburden* to be moved needs to be converted into CCM (Compacted *Cubic Meter)* units with a *shrinkage factor value according to the overburden* material. This is because at the time of stockpiling compaction efforts are carried out with heavy equipment passing through the embankment. The volume of *overburden* obtained in BCM (Bank *Cubic Meter)* is converted into CCM (Compacted *Cubic Meter)* units to 538,246 CCM with a *swell factor* of 0.8 5 and *a shrinkage factor* of 7.47 %. The capacity of the *disposal* provided is 2.5% higher per month than the total *overburden* to be removed based on the designed *reserve,* so that the total volume of the disposal design to be made is 552,763 CCM. The description of the annual disposal area design can be seen in Table 3.

Table 3. *Disposal Area* Design

Month	Vol. Mined *OB* (BCM)	Vol. Mined *OB* (LCM)	Vol. Mined *OB* (CCM)	*Disposal* Volume (CCM)
January	166,637	195,911	179,084	183.884
February	167,655	197.103	180.179	185.123
March	166,541	195,793	178,983	183.756
Total	500,833	588,207	538,246	552,763

h. Working Time

Mine working time is the sum of all available time could utilized for work by productive. PT. Mega Bara Semesta has a fixed working time of 20 hours which is divided into 2 *shifts* per day. For make it easy in planning, calculating and assessing the performance of mechanical devices, it is necessary consider existence lost time work.

There is a loss of work time caused by natural factors, tools, and equipment man. Based on results calculation time work mine with taking into account the loss of work time, the gain of work time effective as big as 370 hours/ month . For more details about time work effective and big lost time work could seen on Table 4. 4 and Appendix C.

i. Tool Productivity

Productivity of tools can be in the form of production of digging and loading equipment, the value of the calculation of the production of loading and unloading equipment and transportation equipment in a the design in general will be different from the results that will be obtained in actual execution of mining operations , this difference may be caused by lack of equipment during mining operations due to experiencing damage tools/ *breakdowns* .

Conditions of haul roads can also cause differences in yields or quantities tool production, in addition to rain which can stop at any time mining activity is an important reason for the production of a tool to change.

Table 4. Mechanical Tool Productivity

Month	Dig-Load Tool		Conveyance	
	CAT 340D2L	CAT 330D2L	Scania P380	Scania P380
	Overburden	Coal	*Overburden*	Coal
January	224.97 BCM/hour	169.95 tons/hour	30.50 BCM/hour	29.59 tons/hour
February	224.97 BCM/hour	169.95 tons/hour	30.50 BCM/hour	29.59 tons/hour
March	224.97 BCM/hour	169.95 tons/hour	30.50 BCM/hour	29.59 tons/hour

j. Digging Equipment Needs – Load Transport

Determination need tool dig-load and transport based on calculation tool productivity mechanical for could fulfil target production company. The company's production targets are relatively the same, causing the number of mechanical equipment needs to be used to be the same every year, the need for digging and loading tools and equipment transport every year.

Table 5. Mechanical Tool Needs for Overburden Layer *Stripping*

Month	*Overburden* Production Target (BCM)	Number of Dig-Load Tools	Effective Working Hours of Dig-Load Tool / Day	Number of Transport Equipment	Daily Transport *Cycle Time*
January	166,637	2	12.64 hours/unit	14	48 *CT* /unit
February	45,348	2	13.10 hours/unit	14	50CT / *unit*
March	167,655	2	13.29 hours / unit	14	50CT / *unit*

Table 6. Need for Mechanical Equipment for Coal Stripping

Year	Coal Production Target (Tons)	Number of Dig-Load Tools	Effective Working Hours of Dig-Load Tool / Day	Number of Transport Equipment	Daily Transport Cycle Time
January	45,348	4	12.30 hours / unit	3	42 *CT* /unit
February	45,107	4	12.57 hours / unit	3	43 *CT* / unit
March	45.127	4	11.93 hours / unit	3	43 *T* / unit

k. Production Scheduling Plan

Production scheduling on progress mining *P it* per month on *P it* A is carried out in various stages until the production target is reached . In this research, a mining progress design will be made based on the ability productivity tool in fulfil target production. Scheduling production conducted gradually like following:

l. Stripping *Overburden* and Demolition Coal

In activity demolition layer *overburden* , PT. Mega Bara Universe uses method *manual digging* by tool mechanical CAT 340D2L with capacity *bucket* 2.2 m^3. For coal seam dismantling using CAT 3 3 0D 2L alat with a *bucket* capacity of 1.76 m^3. Excavation tools for coal work up to a limit of approximately 10 cm from the top of the coal seam (*roof*) and 10 cm from the bottom (*floor*) so that no mixed with layer impurities (*coal cleaning*).

m. Loading Layer *Overburden* and Coal

Loading material *overburden* use tool mechanical CAT 340D2L with capacity *bucket* 2.2 _ m ^{3} . For loading coal seams using tools mechanical CAT 3 3 0D 2L with capacity *bucket* 1.76 m 3 (^{see} Appendix I).

n. Freight Layer *Overburden* and Coal

Freight layer *overburden* and coal conducted with use *dump truck* which then brought going to location hoarding *disposal* for *overburden* and *stockpile* for coal. Freight material use tool transport DT Scania P380 with capacity tub 14 m ^{3} for *overburden* and 30 tonnes for coal (See Appendix I)

o. Coal Production and *Overburden* per Month

1. Mining Scheduling January 2022

In January 2022, mining activities will be carried out in *Pit* A by opening a mining area of 2.95 ha in the east *pit* and 2.53 for the west *pit* , to meet coal production of 45,348 tons and *overburden* of 166,637 BCM with a *stripping ratio value* of 1: 3.67 . Mining operations will be carried out from an elevation of 110 masl to an elevation of 90 masl. The transport distance from *the out pit dump* to *the disposal area* is an average of 2032.91 m and to the stockpile an average of 1672.40 m from the *Pit* A location.

In *overburden removal,* 2 units of CAT 340D2L digging equipment and 14 units of DT Scania P380 transport equipment were used. Meanwhile, the coal transfer uses 1 unit of digging and loading equipment and 4 units of DT Scania P380 transportation equipment. Mining activities will be carried out for 1 month with an operating time of 20 hours per day which is divided into 2 shifts. The achievement of the production target is seen from the number of daily rates achieved by each DT Scania P380 unit.

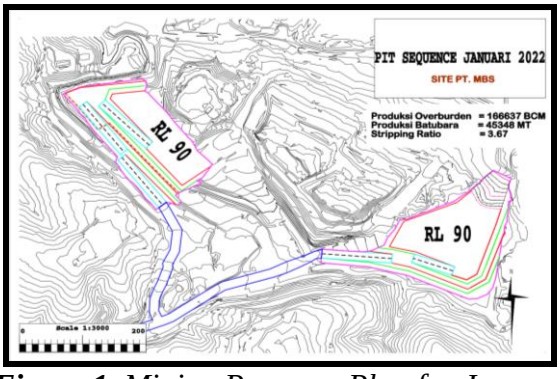

Figure 1. *Mining Progress Plan for January*

Table 7. Coal Production and *Overburden* January 2022

Month	Material	Production Target	*Reserve* design
January	*Overburden*	166.000 BCM/month	166,637 BCM/month
	Coal	45,000 Tons/month	45,348 Tons/month
	SR	<5	3.67

2. Mining Scheduling February 2022

In February 2022 mining activities will be carried out in *Pit* A by opening a mining area of 2.95 ha in the east *pit* and 4.44 ha in the west *pit* to meet coal production of 45,017 tons and *overburden* of 167,655 BCM with a *stripping ratio* of 1: 3,72 . Mining operations will be carried out at an elevation of 90 masl to 85 masl in the east and west *pits* . The transport distance from *the out pit dump* to *the disposal area* is an average of 2093.96 m and to the stockpile an average of 1732.37 m from the *Pit* A location.

In *overburden removal,* 2 units of CAT 340D2L digging equipment and 14 units of DT Scania P380 transport equipment were used. While the coal transfer uses 1 unit of digging and loading equipment and 3 units of DT Scania P380 transportation equipment. Mining activities will be carried out for 1 month with an operational time of 20 hours per day which is divided into 2 shifts. The achievement of the production target is seen from the number of daily ritases achieved by the DT Scania P380 unit.

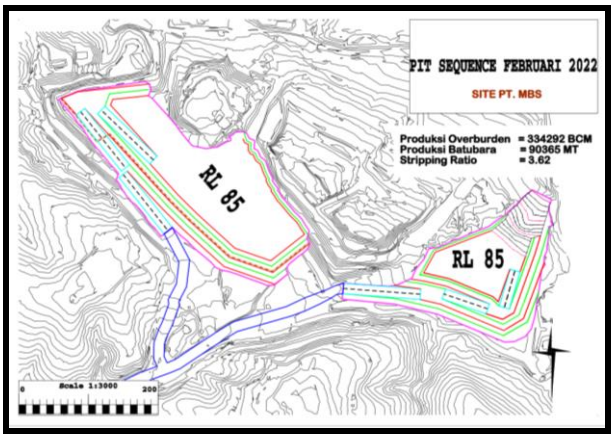

Figure 2. *February Mining Progress Plan*

Table 8. Coal Production and *Overburden* February 2022

Month	Material	Production Target	*Reserve* design
February	*Overburden*	166.000 BCM/month	167,655 BCM/ month
	Coal	45,000 Tons/ month	45,017 Tons/month
	SR	<5	3.72

3. Mining Scheduling March 2022

In March 2022 mining activities will be carried out in *Pit* A by opening a mining area of 3.49 ha in the east *pit* and 5.82 ha in the west *pit* to meet coal production of 45,127 tons and *overburden* of 166,541 BCM with a *stripping ratio* of 1: 3.69 . Mining operations will be

carried out at an elevation of 85 masl to 70 in the west *pit* and mining at elevation 85 in the east *pit* . The transport distance from *the out pit dump* to *the disposal area* is an average of 2393.96 m and to the stockpile an average of 2364.41 m from the *Pit* A location.

Overburden removal, 1 unit of CAT 340D2L digging equipment and 7 units of DT Scania P380 transport equipment were used. Meanwhile, coal transfer requires 1 unit of digging and loading equipment and 4 units of DT Scania P380 transportation equipment. Mining activities will be carried out for 1 year with an operating time of 20 hours per day which is divided into 2 shifts. The achievement of the production target is seen from the number of daily rates achieved by each DT Scania P380 unit.

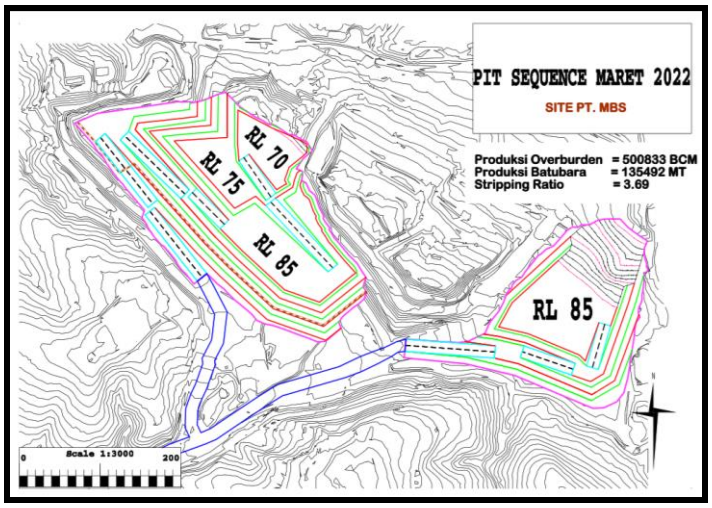

Figure 3. *Mining Progress Plan for March*

Table 9. Coal Production and *Overburden* March 2022

Month	Material	Production Target	*Reserve* design
March	*Overburden*	166,000 BCM/ year	166,541 BCM/ year
	Coal	45,000 Tons/ year	45,127 Tons/ year
	SR	<5	3.69

3.2 Discussion

The research area has a landscape form in the form of weak wavy hills with a height of up to 120 meters above sea level , position *seam* coal on the research area is at strike N 87º E , and has a slope of r e latif teg a k b e r ki s a r dip 27º - 32º, then the right type of mining to be applied in this area is an open pit mining system using the *open pit coal mining method.*

Based on data processing carried out on *Minespace* 5.7 Software, the total Coal reserves based on the design of the first quarter of 2022 are 135,492 t o n which will be divided into every month. The mining design produced in this study has an average *Stripping Ratio value of 3.69: 1, which is smaller than the maximum stripping ratio* that has been determined by the company, which is 5:1.

a. Mining Technical Design

There is no mining technical design yet at the research location becomes the main problem that must resolved. Mining progress technical plan is wrong one guidelines that can be used in carrying out mining activities, with existence mining progress plan , company could monitor progress mining , achievement target production, need tool which will work as well as as material n for evaluate every activity mining which has conducted. The mining

design design in this study was designed based on the latest situation in December 2021 with the mining direction heading south because it has a continuous direction of coal going south.

b. Mine Opening

Mine opening design in *Pit* A designed use system mine open with method mining *open coal mining pits* . Selection of mining methods based on geological conditions, topography, *sea distribution* coal, as well as the slope of the coal *seam* at the research site.

For three months, *Pit* A has a mine opening area of 3.49 Ha in the west *pit and 5.82 Ha in the* east *pit* . Mine opening blocks must meet the minimum width of the mining *front* . The width of the mining *front* will affect the mechanical equipment in carrying out maneuvers so that it can affect the productivity of the digging and loading equipment and the working transportation equipment. Due to the minimum width of the mining *front* being 22 m, the design opening block dimensions should not be less than the minimum width of the mining *front* . In this study, the design used in the monthly sequence has met the minimum width of the mining *front* .

1. Mine Haul Road Design

Mine haul roads are needed as access to and from transportation equipment to carry mining products so that mining operations can run smoothly. Roads are constructed near coal outcrops where land clearing is carried out early so as not to remove too much *overburden* . The width of the haul road also needs to pay attention to the width of the mine opening so as not to interfere with mining operations on the mining *front* .

design mine haul road considering the width of the largest mechanical device which will go through . The number of lanes used is 2 (two) double lanes for 2 (two) directions to be traversed by the DT Scania P380 conveyance. The minimum width on a straight road is 9.1 m, but in this research design a road width of 15 m is used and the width of the road at the bend is 17 m so that the width of the road that has met the minimum width can minimize the waiting time that occurs when trucks pass each other when transportation activities take place where the road width is based on the width of the largest mechanical tool is 3.52 m (see Appendix G) . Road design This mine has been adjusted to the Minister of Energy and Mineral Resources Decree No. 1827/K/30/MEM/2018 about Guidelines Implementation Rule Technique Mining which good and true .

The company has an SOP for road *grade* of 8% - 10%. Thing this related with cost, wide *front* mining and ability tool in the face of *resistance grades* . *Grade* below 8% in tool maneuver transportation speed can be optimized so that it can increase production but resulting in a larger mining *front area.* Mine opening *front* area large will cause the water that enters the *front* to be larger so that will disturbing o'clock production as well as increase value *stripping ratio* . Road *grade* above 10% in terms of mine openings will be smaller but will be difficult to tool transport perform maneuvers . Road mine which too steep will troublesome tool transport as well as increase consumption *fuel* (material burn) from tool transport.

2. Production Scheduling Plan

Coal production scheduling is based on the planned production target of PT. Mega Bara Semesta of 125,000 tons/quarter of coal by considering the planned loss during mining activities of 3%, loss in transportation activities of 2%, and loss in *stockpile of* 2%. Taking into account the loss plan, the annual production target is 135,000 tons/quarter.

Mining progress plans must be made based on recommendations for grade geometry and appropriate haul road geometry so that production targets can be met. The design of mining progress to meet production targets every year is carried out using *Minescape* 5.7 and

AutoCAD 2007 software, then scheduling is carried out using the help of the *Microsoft Excel* 2019 application.

Based on the design of mining progress, the production schedule for each year can be seen in Table 10.

Table 10. Production Scheduling January - March

Month	BB Production Target (tons)	OB Production Target (BCM)	BB Mined Vol (Tons)	Mined OB Vol (BCM)	SR
January	36,000	166,000	46,348	166,637	3.67
February	36,000	166,000	46.017	167,655	3.72
March	36,000	166,000	45.127	166,541	3.69

From the production schedule , different *Stripping Ratio values were obtained.* This is due to the condition of coal deposits, topographical conditions, and the design of mining progress that can be applied in the field. This does not really affect the economic value of long-term mining designs because the *stripping ratio value* at *Pit* A from January to March averages 3.69 which is still below the *stripping ratio value limit* given by PT. Mega Bara Universe which is equal to 5 : 1.

3. Effect of Coal Mining Design on *Stripping Ratio*

The *Stripping Ratio* (SR) value can be used as an initial evaluation of a mine to determine its feasibility to be mined. The smaller the *Stripping Ratio value* of a mine, the more feasible it is to mine because the less *overburden* is removed or the more coal can be mined. From January to March, different *stripping ratios* were obtained.

This is due to the condition of coal deposits, topographic conditions, and the design of mining progress that can be applied in the field. This does not really affect the economic value of the short-term mining design because the largest *Stripping Ratio value* is at *Pit* C, which is 3.72: 1 which is still below the *Stripping Ratio value limit* set by PT. Mega Bara Universe which is equal to 5 : 1.

Table 11. *Stripping Ratio Value* at *Pit* A PT. Mega Bara Universe

Month	*Stripping Ratio Target*	*Stripping Ratio by Design*
January	5	3.67
February	5	3.72
March	5	3.69
SR Average	5	3.69

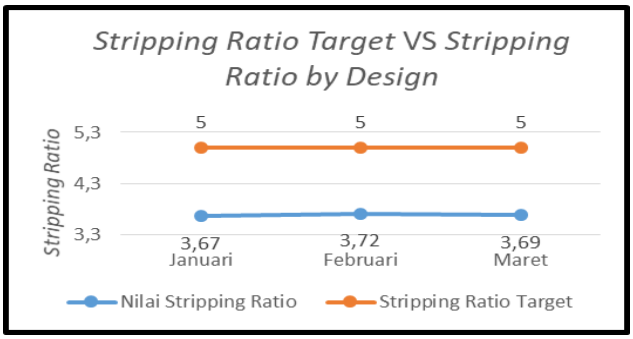

Figure 4. *Stripping Ratio Graph in Pit A PT. Mega Bara Universe*

4. Overburden Storage Design (Disposal)

Overburden pile that will be applied is *Terrace Dump,* because it is adapted to the relatively sloping topography and not too steep. The *Terrace Dump* pile is done by making a pile from the bottom up. In this study, only *the Out Pit Dump was applied* , this was adjusted to the mining method used, namely *Open Pit Coal Mining* and the condition of the coal *seam.* The In Pit *Dump* can only be applied if *the Pit* has already experienced *Mine Out*.

The final elevation of the disposal design in the first quarter of 2022 is 123 masl with a total disposal capacity of 551,700 CCM . The capacity of the *disposal* provided is 2.5% greater per year than the total *overburden* to be removed based on the designed *reserve* . This considers that if the actual conditions in the field at the time the compaction is carried out are not completely compacted, it is therefore necessary to estimate these factors to increase the volume capacity of the *disposal* . The total *disposal* capacity based on the design is 551,700 CCM with an area of 9.72 Ha that can accommodate all *overburden* that is uncovered.

5. Digging Tool Needs

The tools that will be used to excavate and load the *overburden* and coal seams into the conveyance are CAT 340D2L with a *bucket capacity of* 3.1 m^3 and CAT 330D2L with a *bucket capacity of* 1.76 m^3 .

The need for digging and loading equipment from January to March 2022 is the same, namely 2 units of CAT 340D2L and 1 unit of CAT 330D every month. The need for the same tool is due to the relatively equal volume of *overburden material* and coal with a *stripping ratio of* 3.69:1.

Even though they need the same number of digging and loading tools every month, the effective working hours of the tools each day have differences that are influenced by the design production target and the difference in the number of effective working hours of the company each year. In addition, the remaining daily operational time of the company is an estimate of spare time in the event of a loss of working time so that production targets can still be achieved.

6. Transport Equipment Needs

The equipment that will be used to transport the *overburden* and coal seams is the DT Scania P380 with a tank capacity of 14 m^3 . The need for transportation equipment in January to March is the same, namely 14 units of DT Scania P380 every month. The need for the same equipment is due to the relatively equal volume of *overburden material* and coal with a *stripping ratio ratio of* 1: 3.69. .

7. *Match Factor* (Work compatibility)

Based on the calculation results, the *match factor* does not change every year, because the need for both digging and loading equipment is the same every year. In the first year to the fifth year, the *match factor value for overburden* stripping activities using a combination of CAT 340D2L mechanical devices with DT Scania P380 is 1.10 . The *match factor value for coal stripping activities using a combination of CAT* 330D2L mechanical equipment with DT Scania P380 is 0.85. MF < 1 this means that the dug-and-load equipment works less than 100% while the conveyance works 100%, so there is a waiting time for the digging-loading equipment and if MF > 1 means that the digging-loading tool works 100% while the conveyance works less than 100 %, so there is a waiting time for the conveyance.

IV. Conclusion

Based on the description in the discussion chapter, several conclusions can be drawn as follows:

a. In January 2022 the overburden layer that was exposed was 166,637 BCM, coal mined 45,348 tons, SR = 3.67 : 1
b. In February 2022 the overburden layer that was exposed was 167,655 BCM, coal mined was 45,017 tons, SR = 3.72 : 1
c. In March 2022 the overburden layer uncovered was 166,541 BCM, coal mined 45,127 tons, SR = 3.69 : 1
d. The type of disposal applied is Terrace Dump. The disposal design is located 1893.09 m to the south of the pit with an elevation of 117 mdpl to 123 mdpl. The total disposal capacity based on the design is 552,763 CCM with an area of 9.72 Ha which can accommodate all overburden that is uncovered.

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