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Reclamation Plan on Stone Land of The Ex-Nickel Mining at PT Vale Indonesia Tbk Central Pinnacle Condemnation

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ABSTRACTS

Environmental and occupational safety issues in the world's mining business have always been the most important issues. The aim of the research was to find out the stages of reclamation activities, find out the area of the reclamation land, and find out how to reclamation on rocky soil. The research method was carried out in several stages, among others. The preparation stage included a literature review, research proposals, and administration. Collecting data directly from the research location in the form of reclamation area data, location point maps, drone photos, and topography as well as field documentation. In addition, secondary data which is also supporting data in this study is data on plant species and the prediction of topsoil. Computerized data processing with the help of mining software. Data presentation stage. All data that has been processed and analyzed is presented in the form of a research report. The process of reclamation activities begins with site surveys, land arrangement, land leveling, making access roads, making drainage canals, laying topsoil and making contour canals, making planting holes, and revegetation processes. It can be seen that the area to be reclaimed is 1.24 Ha. Especially on rocky soil, the process of leveling the ground begins with the blasting process. Sowing of topsoil is done at Konde Central Pinnacle.

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INTRODUCTION

Mining is part or all stages of activities in the context of managing and exploiting minerals or nickel that includes general investigation, exploration, feasibility studies, construction, mining, processing, refining, development, utilization, transportation and sales and post-mining activities (Arif, 2007). PT Vale Indonesia Tbk (PTVI) is the largest nickel mining company in Indonesia which is a subsidiary of Vale, a global mining company based in Brazil, previously named PT International Nickel Indonesia Tbk (Agus, 2016).

Environmental and occupational safety issues in the mining business in the world have always been the most important issue. The main problems that arise in ex-mining areas include environmental changes which include chemical changes, physical changes and biological changes (Syafrizal et all, 2011). Chemical changes affect the presence of groundwater and surface water, continuing physically, namely resulting in changes in microclimate caused by changes in land morphology and topography (Hifran,2018).

Furthermore, micro-climate changes are caused by changes in wind speed, disturbance of biological habitats in the form of flora and fauna, and a decrease in soil productivity as a result of the land becoming barren or bare (Sabtanto, 2008). 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 (Asballha, 2003; Jafar et al, 2022).

The main problems that arise in ex-miningareas include environmental changes which include chemical changes, physical changes and biological changes (Hoskin, 2002). Reclamation is an activity carried out throughout thestages of the mining business to organize, restore and improve the quality of the environment and ecosystem so that they can function again according to their designation (Ahmad, 2006). Primary data collection was obtained using a mobile phone as evidence of the implementation of research activities for research location data, reclamation locations were taken using GPS (global

Journal of Geology & Exploration
Vol. 2, No. 1, June 2023 :13 –23
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position system) and drones. Secondary data is given directly from supervisors in the company. Land arrangement is intended to obtain a surface finish that is stable and has a natural shape so that it is in harmony with the shape of the pristine landscape, supports the success of plant growth,facilitates access to further work throughout the area, and increases the aesthetic valueof the land (Munir, 2017). All irregular heaps are tidied up and leveled, deposits that have the potential to form a collection of water are filled with the result of pushing material from the leveled heap. Ex-mining land with irregular and uneven terrain (holes, relatively steep slopes) must be laid out in such a way as to be stable with low landslideand erosion hazard potential (Noor Rizqoon, 2004). Piling of rocks using top soil as thick as 50 cm on rockyground. Activities that are no less important are sowing topsoil, making contour drainsand making planting holes, these activities are carried out by making arrangements for making drainage and pocket ponds have been completed. Planting holes with a spacing of 3.5 meters and 4 meters can be ascertained that in 1 hectare of reclamationland for Konde Central Pinnacle 714 planting holes can be made, so it can be concluded that the planting holes for Konde Central Pinnacle are good with spacingsof 3.5m and 4m.

Based on this, the author conducts research with the title Planning for the Arrangement and Revegetation of the Rocky Land of the Former Nickel Mine of PT Vale Indonesia Tbk to find out how the process of reclamation activities, especially at PT Vale Indonesia in handling land whose topography tends to be hard and hilly and rocky, will certainly be very much different from the process of reclamation activities on land whose topography tends to be soft and only filled with soil without stones. So from this the author raises this title which is also based on recommendations by the research supervisor at PT Vale Indonesia Tbk (Maulana, 2017).

METHODS

Several stages were carried out in this research, including:

1. The preparation stage includes literature review, research proposal, and administration.
2. Directly from the research site in the form of reclamation area data, location point maps, drone photos and topography and field documentation. In addition, secondary data which is also supporting data in this research is data on plant species and top soil estimation.
3. Computerised data processing with the help of mining software.
4. Data presentation stage. All data that has been processed and analysed is presented in the form of a research report (thesis).

RESULTS AND DISCUSSION

Landscaping

To ensure the success of open access post-mining land recovery efforts, good land management is required. Land arrangement is intended to obtain a stable final surface and has a natural shape so that it is in harmony with the shape of the pristine landscape, supports the success of plant growth, facilitates access to further work throughout the area and increases the aesthetic value of the land. Land management of former mining activities needs to consider several things, such as the order of water cut aquifers, increased runoff water, the occurrence of erosion and sedimentation, instability, slope closeness, damage to soil structure, vegetation and others.

Making a topographic map design is very important for the first stage after the location review, the purpose is to show the level of slope steepness, as a base map for making other maps and help determine the location of reclamation road construction at the Konde Central Pinnacle location.

After the topographic design is made, the next step is to determine the road design, drainage and at the Konde Central Pinnacle location, determining the road design at the location by paying attention to all important specs including, ease of access to the Konde Central Pinnacle location with a minimum of 70 metres from road access to all sides at the Konde central Pinnacle location with the aim that planting and nursery activities can be easier and roads with grades exceeding 10% cannot be made due to safety.

Then for the design of drainage and pocket ponds must pay attention to the natural flow of water at the Konde Central Pinnacle location by considering the assessment of the hydrology team related to the catchment area.

Journal of Geology & Exploration
Vol. 2, No. 1, June 2023 :13 –23
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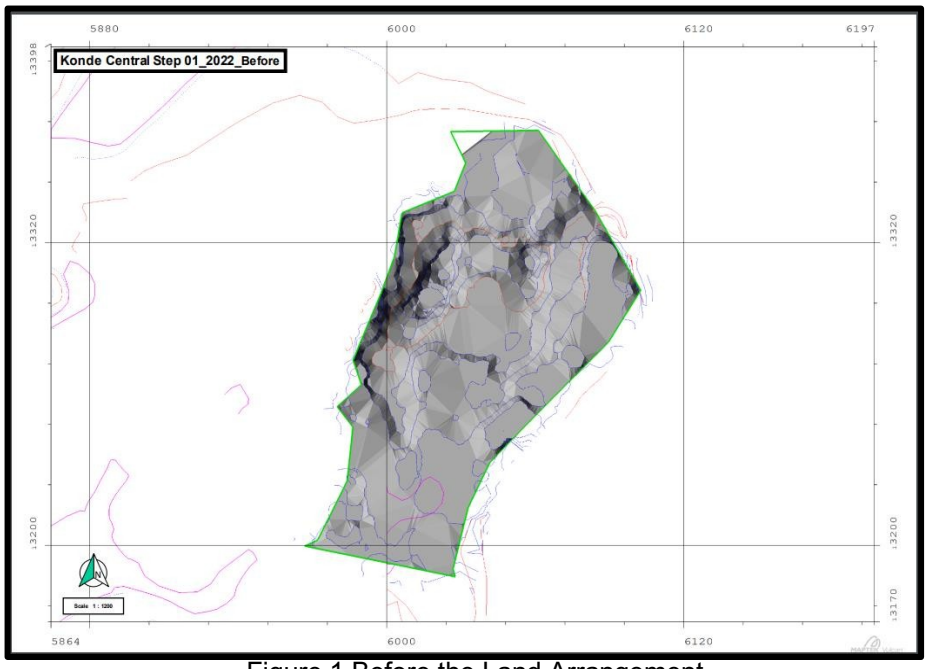

Figure 1 Before the Land Arrangement

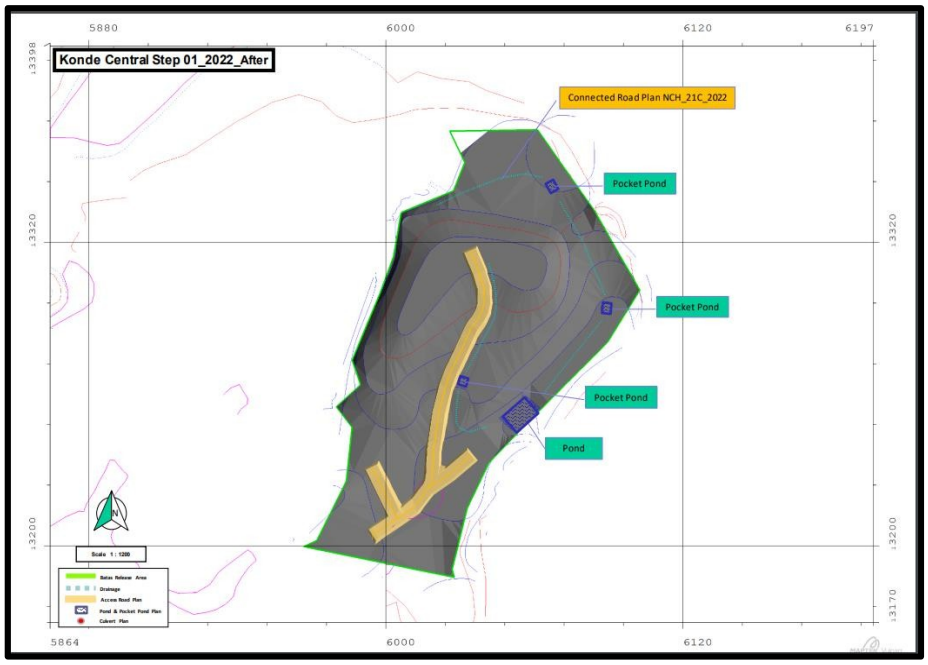

Figure 2 Results of Land Arrangement

Journal of Geology & Exploration
Vol. 2, No. 1, June 2023 :13 –23
E-ISSN 2963-2869

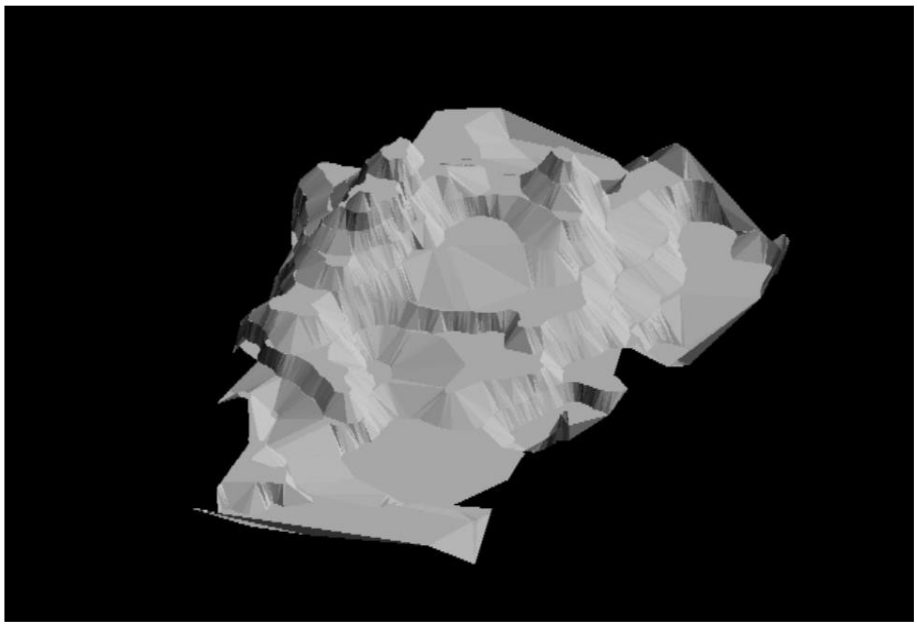

Figure 3 Topography design of the Konde Central Pinnacle area

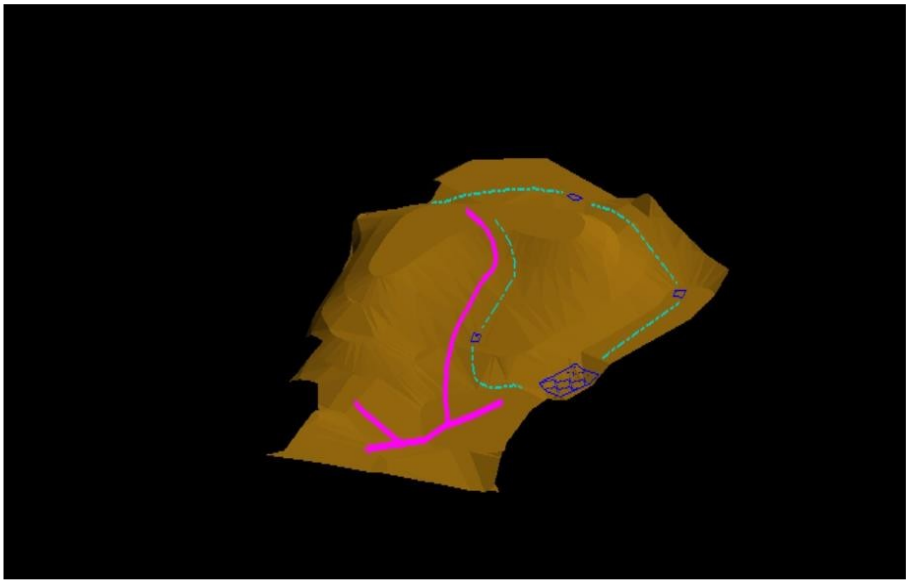

Figure 4 Design of reclamation plan for Konde Central Pinnacel area

Land Levelling

All unlined stockpiles were tidied up and levelled, and puddles that could potentially form puddles were filled with material from the levelled stockpiles. In carrying out levelling, repeated pushing must be avoided because it can cause excessive soil compaction, especially in the rocky land area at Konde Central Pinnacle, starting with the blasting process.

Journal of Geology & Exploration
Vol. 2, No. 1, June 2023 :13 –23
E-ISSN 2963-2869

Figure 5 Land levelling process using epiroc T50 heavy equipment

On rocky land such as the Konde central Pinnacle area where the material is hard and rocky, the hill requires blasting to facilitate the levelling process. This makes a big difference between the reclamation process carried out on soft land such as soil compared to the reclamation process on hard land such as rocky hills. Land levelling is aimed at obtaining stable slopes with low landslide and erosion potential and suitable for revegetation. Landform reconstruction is adapted to topographic conditions. Ex-mining land with irregular and uneven landforms (potholes, relatively steep slopes) must be arranged in such a way as to be stable with low potential for landslides and erosion. Rock backfilling using 50 cm thick top soil on rocky land.

Next, make a cross section or cross section at the Konde central Pinnacle location by paying attention to the higher and steeper areas so that it can be sloping and stable. After the topographic design, reclamation planning design and cross section design are carried out, then determine the estimate that will be obtained at the Konde Central Pinnacle location.

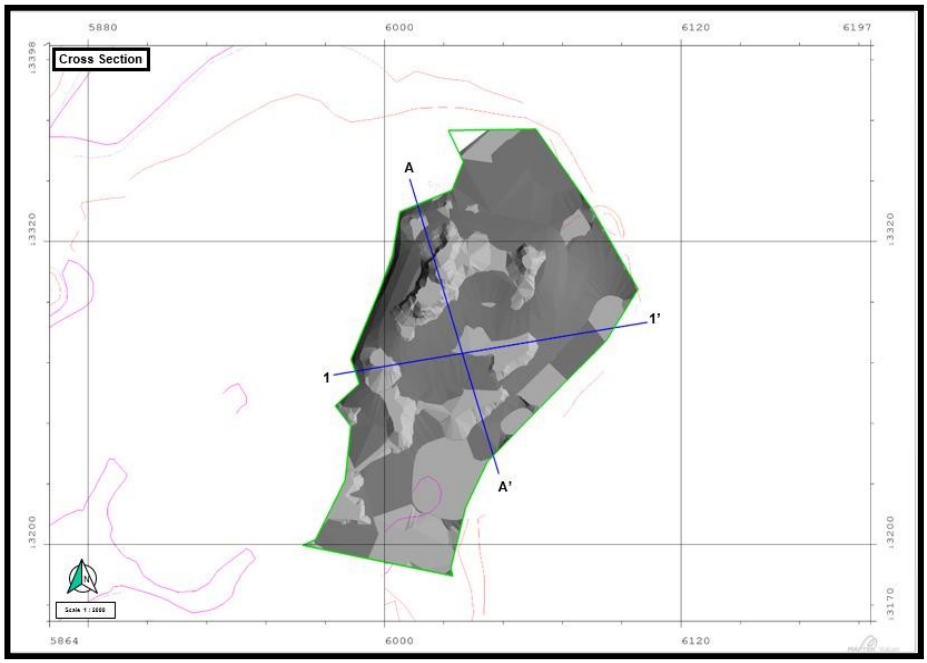

Figure 6 Desain Cross Section Konde Central Pinnacle

Journal of Geology & Exploration
Vol. 2, No. 1, June 2023 :13 –23
E-ISSN 2963-2869

Resloping instructions on cross sections A'-A and B'-B. The resloping technique guide explains the difference between the area before resloping and the area after resloping.Then planning on land levelling techniques at Konde Central Pinnacle, in the original condition after mining activities the landform is higher and steeper, with land levelling activities it is hoped that the landform can be sloping as expected.

Backfilling and resloping activities or land levelling need to be done because in high rainfall with a steep/sloping topographic shape can experience erosion due to runoff water at the Konde Central Pinnacle location. Land levelling activities at Konde Central Pinnacle can be said to be ideal with the achievement of the objectives of this activity carried out, namely closing the former mining pit, making high and steep slope areas, so that it can overcome the issue of runoff water erosion in the future using Dozer D10 heavy equipment (Anwar et al, 2023).

Reclamation road

The dimensions and thickness of the actual road construction are obtained from direct observation in the field using a meter to measure the width and thickness of the rock, while the average width measurement results carried out in the field are 5 m and the thickness of the road rock is around 0.65 m, with an average grade slope of 10%. Road construction using quarry material is then transported using a dumptruck to Konde Central Pinnacle, the quarry material is then compacted using an XCMG pc-200 excavator, from the planning results at the beginning of the reclamation obtained an estimated reclamation road with a length of 321 metres.

In making roads on reclaimed land first determine the calculation of the width of the dumptruck that will be traversed and the provisions of the number of lanes. So the actual road width in the Konde Central Pinnacle area is 5 m and the length is 321 m, while for the actual road thickness in the Konde Central Pinnacle area is 0.65 m. then analysed with technical calculations the road width obtained is 5 m, the thickness and slope of the actual road are then analysed with reference to the PT Vale Indonesia reclamation technical guidance literature, which is the recommended thickness of 0.5 m and the recommended slope is at least 10%. So it can be concluded that the road at Konde Central Pinnacle is ideal and functions according to its designation.

Figure 7 Reclaimed road construction using quarry materials

Drainage creation

It is important to direct and control surface runoff water to support successful reclamation efforts. If not controlled and directed, severe gully and ditch erosion can occur, causing many plants to fail. Drainage is made based on the final topography after landscaping, generally the shape of the drainage follows the foot of the slope so that a meandering water channel is formed that follows the foot of the slope and looks natural while also reducing the rate of water flow.

Journal of Geology & Exploration
Vol. 2, No. 1, June 2023 :13 –23
E-ISSN 2963-2869

There are three types of erosion control channels at the PTVI reclamation site, including branch channels, branch channels and main channels. Branch channels are channels from the confluence of two hillsides with an area of no more than 2 Ha. This channel drains surface runoff water from the two sub-branch channels into the branch channel. A branch channel is a channel where two or more slopes meet with an area of more than 10 Ha. This channel is classified as a branch channel because the area of the Konde Central Pinnacle area is 1.24 Ha.

Table 1 Data on the type of waterways/drainage

Water line type	Surface width on	Depth	Wide base surface
Saluran anak cabang	3 m	0.8 m	1 m
Saluran cabang	3.5 m	1 m	1.5 m
Saluran utama	5.5 m	2 m	2 m

The following types of waterways are used:

1. Branch drains

The branch channel is a small dimensioned water with a top surface width of 3 m, with a depth of 0.8 m and a base surface width of 1 m. This branch channel will drain surface runoff water from the two slopes leading to the branch channel.

2. Branch drains

The branch channel is a medium dimension water channel with a top surface width of 3.5 m with a depth of 1 m and a base surface width of 1.5 m. This branch channel also follows the confluence of the foot of the slope and is the mouth of the branch channel or as a channel meeting two or more hillsides with an area of more than or equal to 5 Ha, this branch channel can also be a meeting of two back slope lines. This branch channel will empty into the main channel.

3. Main waterways

The main water channel is a medium dimension water channel with a top surface width of 5.5 m with a depth of 2 m and a base surface width of 2 m. The main channel is the channel where the branch channels converge or is a valley of 2 or more slopes with an area of more than 10 Ha. The shape of this channel also follows the foot of the slope, so it looks natural. This main channel is the final disposal that empties into settling ponds or natural channels.

Figure 8 Actual photo of drainage on the Central Pinnacle roundel

Journal of Geology & Exploration
Vol. 2, No. 1, June 2023 :13 –23
E-ISSN 2963-2869

Sowing Topsoil, Contour Drain and Planting Holes and Plant Types.

This activity is no less important, namely sowing top soil, making contour drains and making planting holes, this activity is carried out after the drainage and pocket pond construction is completed.

1. Topsoil management in the Konde central Pinnacle area

Figure 9 Condition of Konde Central Pinnacle area before topsoil sowing process

In reclamation activities, the sowing of topsoil is carried out after the land arrangement work is completed and the final shape of the land has been formed according to the plan. Topsoil is spread over the entire land surface evenly with a thickness of 50 cm, especially on rocky land and a dike is made at the top of the hill to prevent water runoff from the top (access road), so that the erosion rate can be reduced. Sowing was carried out in the Konde Central Pinnacle area with an area of 1.24 H, for an estimated 6339.8 tonnes of top soil required (Sukamto et al, 2023).

Figure 10 Aerial photo of part of the area that has been sprinkled with topsoil

Journal of Geology & Exploration
Vol. 2, No. 1, June 2023 :13 –23
E-ISSN 2963-2869

2. Contour Drain

The topsoil sowing activity at Konde Central Pinnacle can be said to be ideal with the realisation of the objectives of this activity, namely that topsoil has been sown in all directions on Konde Central Pinnacle, the reason I say that the topsoil sowing activity at Konde Central Pinnacle is ideal is that the construction of the activity still pays attention to the reference of PT Vale Indonesia's reclamation instructions, namely sowing is carried out with a thickness of 50 cm so that plants can grow optimally.

The actual contour drain situation is obtained from direct observation in the field using a meter to measure the contour drain distance and trupul setracking for each mound to determine the position of the contour drain and assist in measuring the distance between contour drains against the slope of the land that occurs in the field.

Figure 11 Actual contour drain at Konde Central Pinnacle

3. Making planting holes

Making planting holes is the final stage of land arrangement activities where the making of planting holes in 1 Ha, namely more than 714 soil holes must be made because it has been agreed in the technical instructions for reclamation of PT Vale Indonesia Tbk. After direct observation in the field using metering tools, the average spacing of planting holes is 3.5 m x 4 m by calculating as follows.

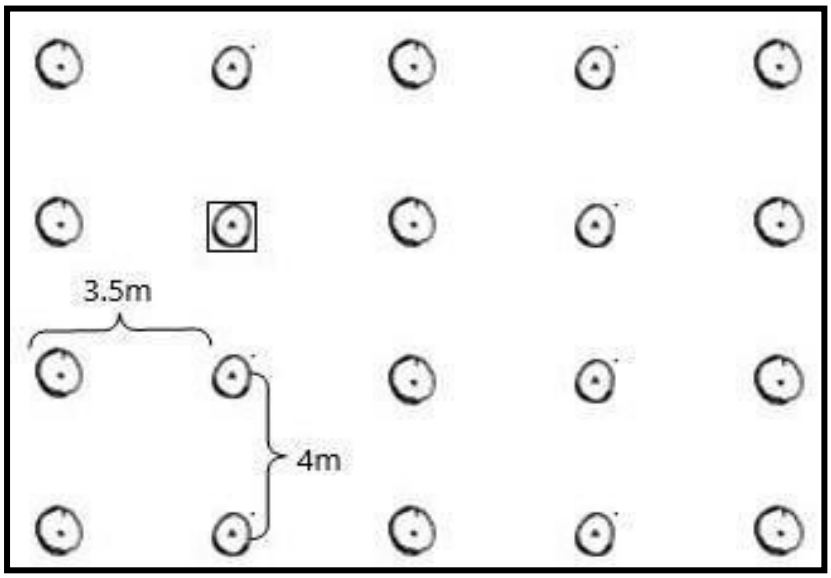

Figure 12 Planting hole pattern in Konde Central Pinnacle

Journal of Geology & Exploration
Vol. 2, No. 1, June 2023 :13 –23
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Then the author analyses by doing the following calculations:

1 Ha = 10,000 M
3,5 x 4 = 14
So = 714 planting holes

So with a spacing of 3.5 m and 4 m it can be ascertained that in 1 Ha of reclaimed land Konde Central Pinnacle can be made 714 planting holes, so it can be concluded that making planting holes in Konde Central Pinnacle is good with a spacing of 3.5 m and 4 m.

4. Plant species

The types of pioneer plants that are proven to be able to adapt and grow well on post-mining land are:

Table 2 Plant species data

Local Name	Latin Name	Information
Trema	*Trema orientalis*	Pioneer lokal
Bonu	*Trichospermum buretii*	Pioneer lokal
Malotus	*Malotus sp*	Pioneer lokal
Kayu angin	*Casuarina sp*	Pioneer lokal
Sengon	*Paraserianthes falcataria*	Pioneer eksotik
Johar	*Cassia siamea*	Pioneer eksotik
Eukaliptus	*Eucalyptus urograndis*	Pioneer eksotik
Sengon buto	*Enterolobium macrocarpum*	Pioneer eksotik

The pioneer species mentioned above are fast-growing species that can accelerate the succession of other local species and do not require intensive maintenance. These pioneer species are intended to improve the microclimate and soil fertility necessary for the growth of primary forest tree species at a later stage.

CONCLUSION

Based on the observations made from the reclamation technical guidelines reviewed by PT Vale Indonesia Tbk, the following conclusions can be drawn:

1. The process of reclamation activities begins with a site review, land structuring, land levelling, making access roads, making drainage channels, spreading top soil and making contour drains, making planting holes and revegetation processes.
2. It can be seen that the area to be reclaimed is 1.24 Ha.
3. Especially on rocky land the land levelling process begins with a blasting process. Topsoil sowing is carried out on the Konde Central Pinnacle.

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