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Identification of Vegetation on 3 Types of Post-Operation Land in Oil and Gas Mining, Riau Province

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Abstract. PT. Pertamina Hulu Rokan (PHR) is conducting activities to restore unproductive lands by revegetating in 3 types of areas. They are (1) areas of ex-well pad facilities where well plug & abandon (P&A) activities have been carried out, including the dismantling of related surface facilities, (2) areas of ex-production facilities that have been dismantled and (3) areas of ex-borrow pits. This research was conducted in PHR's post-operation land area in 5 revegetation sites representing three types of post-operation areas, in Riau Province. The purpose of this study is to identify the types of vegetation found on post-operation land of oil and gas mining and to determine the types of vegetation that grow well on post-operation land based on the revegetation achievement target in each post-operation location in the document of Environmental Impact Analysis. Field research was conducted through the observation method. Observations were made by observing the type of plant, plant height, and plant mortality rate. The results showed that there were ten species of plants found in the 3 types of post-operation land in PHR, namely Cempedak (*Artocarpus integer*), Durian (*Durio zibethinus*), Jelutung (*Dyera lowii*), Jengkol (*Pithecellobium jiringa*), Mahoni (*Swietenia macrophylla*), Mangga (*Mangifera indica*), Matoa (*Pometia pinnata*), Medang (*Litsea sp*), Petai (*Parkia speciosa*), and Pulai (*Alstonia scholaris*). In total, the percentage of living plants was 88.2%. Furthermore, the average plant height in the five post-operation land areas was 169.8 cm. These values also indicate that the percentage of living plants and the height average of each type of plant in location is categorized as good, according to the achievement of the revegetation target in the document of Environmental Impact Analysis.

Keyword: Environmental Impact Analysis, Ex-borrow, Ex-wellpad, Pit, Post-operation, Revegetation

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1 Introduction

Post-operation activities in upstream oil and gas business activities are a series of activities to dismantle equipment, installations, and or supporting facilities including permanent well

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closure, site restoration, and handling the release or removal of equipment, installations, and or facilities in upstream business activities carried out before or at the end of the cooperation contract [1]. PT. Pertamina Hulu Rokan (PHR) has an obligation in the process of environmental restoration such as revegetation programs in post-operation areas by the directives of Law No. 32 of 2009 concerning Environmental Management Protection, Government Regulation No. 27 of 2012 concerning Environmental Permits, references to the post-operation environmental restoration process contained in Minister of Energy and Mineral Resources Regulation No. 15 of 2018 concerning Post-Operation Activities in Upstream Oil and Gas Business Activities, and SKK MIGAS Work Procedure Guidelines No. 040 concerning Abandonment and Site Restoration. PHR is currently restoring unproductive lands by conducting revegetation activities in areas such as (a) ex-wellpad facilities where well plug & abandon (P&A) activities have been carried out, including the dismantling of related surface facilities; (b) ex-production facilities that have been dismantled; (c) ex-borrow pits.

Land restoration activities in the manifestation of revegetation programs are the key to success in the reclamation process [2]. Revegetation programs have produced various positive impacts on post-mining lands [3], but revegetation programs in mining areas often fail due to marginal land conditions, lack of topsoil availability, and heavy metal materials that are still present on the land [4]. Therefore, it is important to document the types of vegetation that exist in the post-operation area of oil mining as data to determine the types of vegetation that are suitable for the characteristics of post-operation land of oil mining. The objective of this study is to identify the types of vegetation found in the post-operation area of oil and gas mining and to determine the types of vegetation that grow well in the post-operation land.

2 Research Method

This study was conducted in the PHR post-operation land area in 5 revegetation sites representing three groups of post-operation areas, in Riau Province, Indonesia in 2022 (Figure 1). The various revegetated areas observed had different area sizes. Minas 01141 (7E-81-NI3) revegetation area has an area of 0.21 Ha, PEMA00003 covering 0.19 Ha, Rantau Bais 15 covering 0.04 Ha, Ubi Sekeladi GS covering 1.97 Ha and Duri 13 – Laban 8 covering 14.56 Ha. Various revegetated plants were planted in June 2020. Thus, the age of the plants at the time of the study was at ± 28 months in August 2022. An overview of the study area distribution of revegetation activities is in Table 1.

Tabel 1. Study location of revegetation activities

No	Location	Coordinates	Types of post operation land	Description
1	Minas 01411 (7E-81NI3)	0^0 44’ 13.8” BT. 101^0 27’ 52.9” LS	ex-wellpad	cut soil
2	PEMA 00003	1^0 17’ 16.2” BT. 101^0 4’ 39” LS	ex-wellpad	backfilled soil
3	Rantau Bais 15	1^0 37’ 17.3” BT.	ex-wellpad	cut and fill soil

No	Location	Coordinates	Types of post operation land	Description
4	Ubi Sekeladi GS	101^0 4’ 51.6” LS 1^0 30’ 32.5” BT. 100^0 57’ 2.6” LS	ex-production facility	cut and fill soil
5	Duri 13 - Laban 8	1^0 24’ 14.1” BT. 101^0 15’ 53.7” LS	Borrow pit	cut soil

Figure 1 Map of research location

Research was conducted through the observation method [5]–[6]. Observations were made on vegetation in post-oil and gas mining operations. This research uses primary and secondary data. The primary data was obtained from field observations such as vegetation species, height, and mortality rates. Meanwhile, secondary data were obtained from the Final Report on Revegetation Activities in the WK Rokan. Then both data were explained descriptively.

3 Result and Discussion

The results showed that PHR made several considerations in vegetation species to run the revegetation program on post-operation land. Considerations of plant species are very influential on the success of revegetation activities such as a) A list of seeds that have been recommended from the results of the Rokan Block Revegetation Activity Soil Suitability Analysis document, b) Vegetation groups that are adaptive to the typology of revegetation land [7], c) Adaptive and fast-growing forestry groups [8], and d) Multi Purpose Tree Species (MPTS) groups that can be utilized by the surrounding community. It aims to minimize the impact of social disturbance. Thus, revegetation activities can be well received and not cut down by the community [9]. e) Availability of local vegetation seedlings in Riau Province. Based on the results of field observations, ten species of vegetation found in five post-operation areas of oil and gas mining

in PHR are presented in Table 2. This observation was carried out by monitoring what types of vegetation were planted and grew well in these areas.

Tabel 2. Vegetation types in the revegetation area

No	Species	Minas 01411 (7E-81NI3)	PEMA 00003	Rantau Bais 15	Ubi Sekeladi GS	Duri 13 – Laban 8	x̄ height of plant species [cm]
		[Ex- Wellpad]			[Ex-Production Facility]	[Borrow Pit]	
1	Cempedak (*Artocarpus sp*)				x	x	131.5
2	Durian (*Durio zibethinus*)		x		x	x	136.8
3	Jelutung (*Dyera lowii*)				x	x	83.7
4	Jengkol (*Pithecellobium jiringa*)	x	x		x	x	207.0
5	Mahoni (*Swietenia macrophylla*)	x	x		x	x	228.6
6	Mangga (*Mangifera indica*)		x		x	x	`64.6
7	Matoa (*Pometia pinnata*)	x	x		x	x	198.0
8	Medang (*Litsea sp*)		x		x	x	144.7
9	Petai (*Parkia speciosa*)	x	x		x	x	260.5
10	Pulai (*Alstonia scholaris*)		x		x	x	187.6

The vegetation in Ex-Wellpad sites such as Minas 01411 (7E-81NI3), PEMA 00003, and Rantau Bais 15 are Jengkol (*Pithecellobium jiringa*), Mahoni (*Swietenia macrophylla*), Mango (*Mangifera indica*), Matoa (*Pometia pinnata*), Medang (*Litsea sp*), Petai (*Parkia speciosa*), and Pulai (*Alstonia scholaris*). Ninety percent of the vegetation in the Ex-wellpad location is well established and the average height reaches 200 cm. The vegetation in the Ex-Production Facility such as Ubi Sekeladi GS is Cempedak (*Artocarpus integer*), Durian (*Durio zibethinus*), Jelutung (*Dyera lowii*), Jengkol (*Pithecellobium jiringa*), Mahoni (*Swietenia macrophylla*), Mango (*Mangifera indica*), Matoa (*Pometia pinnata*), Medang (*Litsea* sp), Petai (*Parkia speciosa*), and Pulai (*Alstonia scholaris*). Ninety percent of the vegetation in the ex-production facility is well established and the average height reaches 145 cm. The vegetation at the Ex Borrow Pit site is similar to the vegetation at the Ubi Sekeladi GS site, such as Duri 13-Laban 8. Eighty percent of the vegetation in the Ex Borrow Pit location is well established and the average height reaches 120 cm.

Based on the results of the land suitability evaluation assessment. It is known overally, the planted land is included in the marginally suitable category (S3) for the ten plant species found

at the study site. The percentage of vegetation survival and vegetation height referred to as the baseline in this monitoring are the targets of revegetation work achievements in the Environmental Impact Analysis (*Analisis Mengenai Dampak Lingkungan/AMDAL*) document for this revegetation program [9], which are: a) The vegetation reaches a minimum of 75% survival rate of the target revegetation area, and b) The vegetation reaches a minimum of 75% plant growth rate of the target revegetation area with an average plant height of 100 cm.

Tabel 3. Percentage of vegetation survival and vegetation height in five post-operation revegetation sites

No.	Location	x̄ Live (%)	x̄ Height (cm)
1	MINA01141 (7E-81-NI3)	86.0	188.4
2	PEMA 00003	87.7	171.3
3	Rantau Bais 15	97.1	223.4
4	Ubi Sekeladi GS	90.0	145.3
5	Duri 13 - Laban 8	80.0	120.3

4 Conclussion

Various vegetation species found post-oil mining operations at PHR are Cempedak (*Artocarpus integer*), Durian (*Durio zibethinus*), Jelutung (*Dyera lowii*), Jengkol (*Pithecellobium jiringa*), Mahoni (*Swietenia macrophylla*), Mangga (*Mangifera indica*), Matoa (*Pometia pinnata*), Medang (*Litsea* sp), Petai (*Parkia speciosa*), and Pulai (*Alstonia scholaris*). Overall, the percentage of living vegetation was 88.2%. Furthermore, the average height in the five post-operation land areas was 169.8 cm. This value also shows that the percentage of living vegetation and vegetation height in each location is categorized as good in compliance with the revegetation target achievement in the AMDAL document of PT. Pertamina Hulu Rokan.

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