Environmental Monitoring Report

PUBLIC

Project Number: 52282-001
Semestral Report
January to June 2023
October 2023

Indonesia: Geothermal Power Generation Project

Prepared by PT Geo Dipa Energi (Persero) for the Asian Development Bank (ADB).

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Semi-Annual Environmental Monitoring Report

INDONESIA

PT Geo Dipa Energi (Persero)

ADB Loan No. 3928/8380-INO

Geothermal Power Generation Project

Reporting Period: *1 January 2023 to 30 June 2023*

Date*:* *31 July 2023*

SEMR Report Number: *05*

VALIDITY SHEET

	Position	Signature
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		Date: 6 October 2023
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		Date: 6 October 2023
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		Date: 12 October 2023

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1 ENVIRONMENTAL SAFEGUARDS SUMMARY

1.1 Summary of Project Progress

This Semi-annual Environmental Monitoring Report (SEMR) 2023 covers the working period from 1st January to 30th June 2023 for ADB Loan No.3928/8380-INO**:** Geothermal Power Generation Project.

The SEMR was prepared to fulfil the safeguard policy requirement of ADB by PMU (PT Geo Dipa Energi or GDE) and PMC (PT AECOM Indonesia or AECOM).

Table 1 briefly summarises the project progress for contract award, construction, and critical activities in this reporting period.

Table 1. Project Progress Summary

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</td></tr>
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	15	PMC General	PT AECOM Indonesia	05 July 2021	05 October 2025

Construction Progress to Date

As of 30 June 2023, during this reporting period, construction activities covered five main activities in Dieng and Patuha sites included:

1. Field Activities in Dieng (Civil Work): Well Pad 30 preparations
2. Drilling in Dieng: SLR-G-29B, Well SLR-G-29C and SLR-O-30B (on-going)
3. Well Testing in Dieng: SLR-T-9C well (on-going)
4. Drilling in Patuha: Well PTH-H-2B, PTH-BB-9 and PTH-BB-9A
5. Well Testing in Patuha: Well PTH 2B, Well PTH-G-4D and PTH-G-4C

Field activities in Patuha had been completed since January 2023 which was well pad BB preparation.

Overall actual progress cumulative D2P2 Project as of June 2023 was 36.00%, which is behind the progress plan by 3.90%. Detailed as shown under following table.

Project Description	Weightage (%)	Cumulative This Month Progress (%)		
		Plan	Actual	Var.
Dieng Unit 2	55.32%	33.91%	38.08%	4.17%
Patuha Unit 2	44.68%	47.33%	33.43%	-13.90%
Total	**100.00%**	**39.90%**	**36.00%**	**-3.90%**

Key Sub-project Activities in this Reporting Period

Dieng

The Addendum AMDAL progress achieving 92.15% which is behind the target 96.08 % at the end of June 2023, however, SUCOFINDO still maintain the forecast to obtain the Addendum AMDAL in end of July 2023. Despite of the forecast from SUCOFINDO, there is an indication that the activity might have potential delay. The completion of Addendum AMDAL itself will drive the completion of PPKH for PAD 12, as it is required as part of validation delivery to obtain the PPKH.

Development Well

The drilling rig mobilization from SLR-G-29D to SLR-O-30B continuous in June, and successfully Spud-in at SLR-O-30B on 21-Jun-23. The total rig mobilization recorded 38 days in total with the actual moving within 18 days. At the end of June, the drilling operation achieving 26% with total depth 782m MD out of 3000m MD.

Well Testing

Under the well testing activity, the flow testing continues at SLR-T-9C thru 4" bleed line to mini-AFT, and the monitoring continues at well pad 9 for the brine pond level and intermittently pumping the brine to well pad 29, and LECM mist pad modification. At the end of June 2023, the well test progress at SLR-T-9C was still recorded without any increases at 33%. The next plan is to conduct short term discharge test at SLR-T-9C to mitigate the risk of brine carry over before

	executing the water dilution program which estimated commenced in September 2023. **Patuha** Development Well The drilling operation progress at PTH-BB-9A/ST2 achieved 886.60m MD continuing the activity of time drilling 12-1/4" TCB. The estimated duration to complete the drilling operation at PTH-BB-9A/ST2 targeted at 2200m MD is 83 days from the spud-in, with the forecast completion in July 2023. Well Testing Under the well testing activity, the well testing at PTH-G-4D was completed on 25-Jun-23 and continue commencing the testing facility setup at PTH-G-4C on 26-Jun-23. At the end of June 2023, the setup preparation of well testing facility at PTH-G-4C achieving 87% and estimated to commence the well testing activity in the mid of July 2023. Aside from the well testing preparation activity at PTH-G-4C, the heating up at PTH-BB-9 and the flowing from well 7A and 7B to Unit-1 are continuously ongoing.

1.2 Summary of EMP Implementation

P.T. Geodipa Energi (GDE) has established an Environmental Management Plan (EMP) as an instrument to mitigate the risk and impact that may be generated by Dieng 2 and Patuha 2 (D2P2) project development. EMP of Dieng 2 and Patuha 2 project was documented in the Initial Environmental Examination (IEE) document, as a required document to fulfil ADB Safeguard Policy Statement requirement.

Based on the EMP, then Contractors develop their own EMP which was called as Construction Environmental Management Plan (CEMP) as a document detailing the EMP and the reference or guidance for implementing environmental impact and risk mitigations in the site.

GDE continuously monitors CEMP implementation by the contractor through site inspection, regular reporting (daily, weekly, and monthly) by the contractor to PMU and PMC and consultation with affected people.

1.2.1 Dieng-2 Sub-Project

During this reporting period from January to June 2023, activities have been carried out in Dieng site were well drilling, field activities including civil works of well pad preparation and well testing.

In general, most elements in CEMP were implemented appropriately. Several corrective actions were suggested to improve contractors' performance in implementing EMP. Those were improvement of PPE enforcement, Job Safety Analysis (JSA) improvement, emergency drill implementation, waste segregation, drilling cuttings management, and domestic waste management.

The other potential significant impacts were covered in EMP were H_2S dispersion, noise and vibration during drilling and well testing activity. Given the settlement area being very close to the drilling site, it was unavoidable that the settlement area was impacted by drilling and well testing activity. However, mitigation measures were already in place and beyond the requirements stated in the EMP. H_2S stationary detectors were installed at several spots surrounding well pad that conducted drilling or well testing. Regarding the noise from well testing activity, GDE has installed noise barrier surrounding Low Emission Compact Muffler (LECM), James Tube and Flow Control Valve to reduce noise level. Noise barrier consisted of acoustic foam, geotextile and iron sheet. In addition to that, to prevent brine carry over from well testing activities, GDE covered LECM by geotextile and modified mist pad in the LECM. Furthermore, the intensive monitoring involving local community were also undertaken during well testing, recording the value of noise, H2S and vibration exposure in the area outside the wellpad. Baseline data collection also conducted prior to commenced well testing activity. Data and parameter collected were noise, vibration, odour (H2S and NH3) and potato plantation condition.

Drilling waste and drill cutting were managed in accordance with Waste Management Plant document prepared by Contractor that has been approved by GDE. Drill cutting waste was managed by using it for flooring material in certain areas and converted into bricks, then the bricks are used for GDE purposes or donated to the community.

Hazardous waste was managed by collecting it at temporary storage then transported to approved final disposal site. Domestic waste was segregated by type of waste, then some of them were recycled and other were disposed at approved final disposal site.

1.2.2 Patuha-2 Sub-Project

As mentioned above civil work at Patuha 2 Sub Project's had been completed since December 2022. Hence activities at Patuha 2 Sub Project's were consist of drilling works and well testing. All contractors have consistently implemented CEMP in the project sites.

However, there were corrective actions based several findings of regular inspection that the contractors shall carry out:

1. Used oil stored in the drum at PPL 6 seem not equipped with appropriate secondary containment around the drum. Contractor was instructed to tidy up secondary containment at PPL 6
2. Drainage channel has been made around the well pad BB, however there is no sediment control in the drainage channel to the river. Contractor was instructed to install sediment control
3. Some improvement related to occupational health & safety have been instructed to the Contractors, among others were:
    a. Instal roof/ shelter on APAB (Alat Pemadam Api Besar/Big Fire Extinguisher).
    b. Conduct simulation drill using APAB.
    c. Conduct training using APAB
    d. Repair bund wall,
    e. To add proper safety sign (no sign for emergency shower & eyewash)
    f. To add at least 1 more emergency buoy (buoy at pond only found 1)
    g. Most of Permit to Work has not been closed, need to be completed
4. Secondary containment of temporary hazardous waste storage needs to be repaired to prevent soil contamination. Contractor has been instructed during PMU-PMC Joint Inspection and requested to send the photograph of waste storage condition in CEMP Implementation report every month.

The progress of Biodiversity Action Plan implementation at Pad BB advised that the Contractor implemented their CEMP appropriately. None of incident involving wildlife or natural plants was reported during this semester. Regular monitoring by third party (Sucofindo Indonesia) reported similar finding also. Even canopy bridges were built, though none of primates utilize them. The current drilling activity involving utilization of access road under the bridges may influence primates to avoid canopy bridges.

PMU and PMC have carried out joint inspections at drilling sites; findings and a corrective action list can be seen in **Appendix 1**. PMU regularly supervises this drilling activity, and the drilling contractor regularly reports on CEMP implementation every month.

In general, the contractor's performance in implementing the CEMP can be accepted; however, the contractor was expected to continue to improve their performance on CEMP implementation. Details of CEMP implementation were discussed in **Chapter 3**.

1.3 Summary of EMP Monitoring

Completed EMP monitoring program was summarised in Table 2 for this reporting period

Table 2. Summary of EMP Monitoring

No	Criteria	Dieng	Patuha
1	Number of a visit by PMC and PMU	4	3
2	Number of a visit by PMU EHS Staff on sites	Daily	Daily
3	Number of the visit by GDE management	3	3
4	Number of air quality samples tested	20	23
5	Number of odour samples tested	16	7
6	Number of noise measurement	22	19
7	Number of surface water samples tested	11	10
8	Number of groundwater samples tested	13	-
9	Number of domestic wastewater tested	7	18
10	Number of drainage water tested	5	-
11	Number of produced waters tested	8	1
12	Number of emissions tested	9	-
13	Number of solid waste monitoring (location)	6	2
14	Number of erosion and landslide monitoring (location)	2	8
15	Number of traffic monitoring (location)	6	4
16	Number of flora monitoring location	4	4
17	Number of fauna monitoring location	4	2
18	Number of aquatic biota sampling location	11	10

Note: number of samples tested was including monitoring of Unit 1 and Small Scale in Dieng

1.4 Summary of Complaints, Issues and Corrective Action

1.4.1 Dieng-2 Sub Project

There were seven complaints and issues received due to impact of Dieng 2 Sub Project activity in this reporting period. All complaints reported in the previous monitoring period have been resolved.

Table 3. Summary of Complaint and Issue Dieng-2 Sub Project

Complaint/ Grievance Topic(s)	Number of Complaint/ Grievance Received	Status of Grievance(s) Resolution		
	Number of complaints received within this monitoring period	Resolved	Ongoing	Remark
Water pollution	-	-	-	
Noise	-	-	-	
Air pollution	-	-	-	
Others	7	1	6	

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1.4.2 Patuha-2 Sub Project

There was no complaints and issues relevant to environmental impact for Patuha 2 Sub Project in this reporting period. Complaints and concern were received related to other issue rather than environmental impact issue.

Table 4. Summary of Complaint and Issue Patuha-2 Sub Project

Complaint/ Grievance Topic(s)	Number of Complaint/ Grievance Received	Status of Grievance(s)		
		Resolved	Ongoing	Remark
Water pollution	-	-	-	-
Noise	-	-	-	-
Air pollution	-	-	-	-
Others	4	4	-	-

2 SAFEGUARDS STAFF, TRAINING AND DOCUMENTATION

2.1 Implementation Arrangements

The EMP defines the Environmental Safeguards roles and responsibilities during implementation; the status of key roles was indicated in Table 5.

Table 5. Status of Environmental Safeguard Roles

Safeguards Role	**Status and Comment**			
GDE PMU – HSE	**Date Started:**	Various	Full Time/ Part Time	11 FT
	Comment	A. PMU Head Office 1. HSE and Safeguards Manager – Bintang L. Sasongko 2. Health and Safety Assistant Manager – Rudi Salam Nasution 3. Health and Safety Staff - Sannita Debora Ambaritha 4. Environment Safeguards Assistant Manager - Sari Ramadhani Putri 5. Environmental Staff – Helmy Hasan B. PMU Dieng-2 6. HSE and Safeguard Superintendent – Sigit Dwi Pamungkas 7. Health and Safety Supervisor – Solimin 8. Environment Safeguards Supervisor – Dian Nur Fibrianto C. PMU Patuha-2 9. HSE and Safeguard Superintendent - Aditya Rahman 10. Health and Safety Supervisor - Bambang Umbara 11. Environment Safeguard Supervisor - Rista Jayanti		
PMC Environmental Safeguards Team	**Date Started:**	5 August 2021/ 1 November 2022	Full Time/ Part Time	3 FT
	Comment	1. Health, Safety, Environmental and Safeguard Specialist – Wahyu Setyawan Minarto 2. Environmental Specialist - Hasbullah Hasan 3. Biodiversity Specialist - Novianto Hadi Suwito		
Environmental Monitoring Firm (Sucofindo)	**Date Started:**	January 2021	Full Time/ Part-Time	18 PT
	Comment	1. Sucofindo Bandung - 9 Staff 2. Sucofindo Semarang - 9 Staff		

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Safeguards Role	Status and Comment			
PMU GRM Focal Point	**Date Started:**	Various	Full Time/ Part Time	4 FT
	Comment	1. Dieng-2 – Slamet Riyadi 2. Dieng-2 – Galan Alifin Novan 3. Patuha-2 – Ananda Riana 4. Patuha-2 – Viosy Tederickbrata		
Contractor Environment Health and Safety Staff at Dieng Unit 2 (each company will appoint one staff for GRM representative)	**Date Started:**	March 2021	Full Time/ Part-Time	4 FT
	Comment	• PT. PRA - 1 HSE Staff • PT. Depriwangga - 1 HSE Staff • PT. Halliburton Indonesia - 1 HSE Staff • PT Supraco - 1 HSE Staff • PT Air Drilling - 0 HSE Staff • PT. Prima Hidrokarbon Indonesia - 0 HSE Staff • PT Baker Hughes Indonesia - 0 HSE Staff • JV-Tiger-NESR - 0 HSE Staff • PT. NMS - 0 HSE Staff		
Contractor Environment Health and Safety Staff at Patuha Unit 2	**Date Started:**	March 2021	Full Time/ Part-Time	4 FT
	Comment	1. JV ADA APS - 1 HSE Staff 2. PT. Depriwangga - 1 HSE Staff 3. PT. Halliburton Indonesia - 1 HSE Staff 4. PT Supraco - 1 HSE Staff 5. PT Air Drilling - 0 HSE Staff 6. PT. Prima Hidrokarbon Indonesia - 0 HSE Staff 7. PT Baker Hughes Indonesia - 0 HSE Staff 8. JV-Tiger-NESR - 0 HSE Staff 9. PT. NMS - 0 HSE Staff		

The project concludes that the environmental safeguards roles were provide sufficient staff members and specialists.

2.2 Training and Capacity Building

The following table gives the environmental safeguards training courses that have been completed during this reporting period and the planned training courses for the next six months:

Table 6. Environmental Safeguards Training Provided and Planned

Name	Training Course Title	Training Date	Provider	Method	Total Hours	Remarks
Rista Jayanti	Gender Responsive Community Facilitation (GRCF)	26 - 27 January 2023	PMC General (AECOM)	Class room and discussion with PMC Gender Lead, facilitated by PMC Social Safeguard Team	16 hours	Completed
Slamet Riyadi	Gender Responsive Community Facilitation (GRCF)	26 - 27 January 2023	PMC General (AECOM)	Class room and discussion with PMC Gender Lead, facilitated by PMC Social Safeguard Team	16 hours	Completed
Reyno Rivelino Duta Muhammad	Gender Responsive Community Facilitation (GRCF)	26 - 27 January 2023	PMC General (AECOM)	Class room and discussion with PMC Gender Lead, facilitated by PMC Social Safeguard Team	16 hours	Completed
Reyno Rivelino Duta Muhammad	TA 9598: Capacity Building for Grievance Redress and Dispute Resolution During Project Implementation Training on Grievance Redress Mechanism and Problem-Solving	10 - 12 May 2023	ADB	Lectures, sharing and discussion, final test	24 hours	Completed
Helmy Hassan	Introduction to AMDAL and ESIA	19 - 23 June 2023	PSLH UGM	Training	40 hours	Completed

Name	Training Course Title	Training Date	Provider	Method	Total Hours	Remarks
Helmy Hassan	First Operational Supervisor Certification (POP)	20 - 21, 24 February 2023	LSP Energi Mandiri	Lectures, sharing and discussion, final test	24 hours	Completed
Aditya Rahman	Middle Operations Supervisor Certification (POM)	20 - 21, 24 February 2023	LSP Energi Mandiri	Lectures, sharing and discussion, final test	24 hours	Completed
Aditya Rahman	TA 9598: Capacity Building for Grievance Redress and Dispute Resolution During Project Implementation Training on Grievance Redress Mechanism and Problem-Solving	10 - 12 May 2023	ADB	Lectures, sharing and discussion, final test	24 hours	Completed
Rudi Salam Nasution	Middle Operations Supervisor Certification (POM)	20 - 21, 24 February 2023	LSP Energi Mandiri	Lectures, sharing and discussion, final test	24 hours	Completed
Yudha Wahyu Pratama	Certified Sustainability Reporting Specialist (CSRS) - GRI Standards	7 - 9 March 2023	National Center for Sustainability Reporting (NCSR)	Lectures, sharing and discussion, final test	24 hours	Completed
Yudha Wahyu Pratama	Project Management (Project Management Development for Middle Experts Project Management)	23 - 26 May 2023	PT Patrari Jaya Utama	Lectures, sharing and discussion, final test	32 hours	Completed

Name	Training Course Title	Training Date	Provider	Method	Total Hours	Remarks
Bambang Umbara	Certified Sustainability Reporting Specialist (CSRS) - GRI Standards	7 - 9 March 2023	National Center for Sustainability Reporting (NCSR)	Lectures, sharing and discussion, final test	24 hours	Completed
Bambang Umbara	Middle Operations Supervisor Certification (POM)	20 - 21, 24 February 2023	LSP Energi Mandiri	Lectures, sharing and discussion, final test	24 hours	Completed
Sigit Dwi Pamungkas	Land Acquisition Process	20 - 21 March 2023	PT Equator Global Internasional	Lectures, sharing and discussion, final test	16 hours	Completed
Sigit Dwi Pamungkas	TA 9598: Capacity Building for Grievance Redress and Dispute Resolution During Project Implementation Training on Grievance Redress Mechanism and Problem-Solving	10 - 12 May 2023	ADB	Lectures, sharing and discussion, final test	24 hours	Completed
Slamet Riyadi	Land Acquisition Process	20 - 21 March 2023	PT Equator Global Internasional	Lectures, sharing and discussion, final test	16 hours	Completed
Sari Ramadhani Putri	TA 9598: Capacity Building for Grievance Redress and Dispute Resolution During Project Implementation Training on Grievance Redress	10 - 12 May 2023	ADB	Lectures, sharing and discussion, final test	24 hours	Completed

Name	Training Course Title	Training Date	Provider	Method	Total Hours	Remarks
	Mechanism and Problem-Solving					

2.3 ADB Approvals

There was no document to be approved and disclosed by ADB during this semester. The information on the latest status of the safeguards documents was presented in Table 7.

Table 7. Status of Environmental Safeguard Documents

Safeguards Documents	Update Issued (Latest Version)	Disclosure date	Remarks
Geothermal Power Generation Project: Dieng Unit 2 Project Component Draft Initial Environmental Examination https://www.adb.org/projects/documents/ino-52282-001-iee	November 2019	November 2019	To be updated due to change of project description and additional project component to be added It was expected that IEE Updated completed in six month after contract awarded. Currently GDE in process to select Consultant to execute IEE Updated. Target completion of updated IEE: before March 2024
Geothermal Power Generation Project: Patuha Unit 2 Project Component Draft Initial Environmental Examination https://www.adb.org/sites/default/files/project-documents/52282/52282-001-iee-en_0.pdf	October 2019	October 2019	On going process to be updated due to change of project description and additional project component to be added Current status of Patuha IEE updating was Final Draft has been submitted to ADB for review and approval. Additional review & assessment was being conducted to address project changes and additional project components that were

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Safeguards Documents	Update Issued (Latest Version)	Disclosure date	Remarks
			not included in the existing IEE Target completion of updated IEE: December 2023
EMP for Dieng-2 https://www.adb.org/sites/default/files/project-documents/52282/52282-001-iee-en_1.pdf	November 2019	November 2019	To be updated due to change of project description and additional project component to be added Target completion of updated IEE: March 2024
EMP for Patuha-2 https://www.adb.org/sites/default/files/project-documents/52282/52282-001-iee-en_2.pdf	October 2019	October 2019	On-going process to be updated due to change of project description and additional project component to be added. Target completion of updated EMP: December 2023

2.4 National Approvals

There was no environmental document to be approved during this semester. Referring to GDE's decision to relocate proposed D2 power plant from Pad 38 to Pad 12, an addendum AMDAL documents of Dieng 2 was on-going since November 2022 and expected to be completed in July 2023. Table 8 summarized the latest national approvals required for the project which have been proceed.

Table 8. Status of National Approvals for Environmental Documents

Documents	Submitted to MoEF	Approved By MoEF	Status – if not approved	Comment
SIPPA (Water Extraction Permit) Dieng-2	N.A.	N.A.	Approved	Approved for Sidolok River by Ministry of Public Work and Public Housing May 24, 2021
AMDAL Addendum for Dieng-2	Revised Document was submitted, and MOEF was held	December 2021	Completed and approved	GDE has received approval letter of AMDAL Addendum of Dieng 1, 2, 3 and 4 and its Feasibility Letter from Ministry of Environment & Forestry

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Documents	Submitted to MoEF	Approved By MoEF	Status – if not approved	Comment
Borrowing and Use of Forest Area Permits (IPPKH) – Patuha-2	April 2020	18 January 2021	Approved	Izin Pemanfaatan Kawasan Hutan was granted.
SIPPA (Water Extraction Permit) Patuha-2	N.A.	N.A.	Approved	Completed In 2020, extended in 27 April 2022 valid until May 3 2024
AMDAL Addendum for Patuha-2	November 2009	17 February 2010	Approved	The scope of this AMDAL Addendum covered units 1 to 7 and was still valid for development; therefore, GDE did not apply new Amdal.
AMDAL Addendum for Dieng-2	N.A	N.A	N.A	Currently, Addendum AMDAL document has been submitted to Ministry of Environment & Forestry (MEoF). As of 30 June 2023 the status was in clarification process at MEoF and waiting for hearing schedule.
Borrowing and Use of Forest Area Permits (IPPKH) – Dieng-2	N.A	N.A	N.A	The recommendation from the governor of Central Java province has been obtained on 28 July 2023 and is currently in the process of preparing to submit an IPPKH application to the MoEF.

2.5 Construction Environmental Management Plan (CEMP) Approvals

There was no change of CEMP to be approved during this semester. CEMP approval status and implemented during this semester was summarized in Table 9.

Table 9. CEMP Approval Status

No	Contractor	Work Contract	CEMP Status
1	PT Plumpang Raya Anugrah	Rig Bundling (Lot Dieng)	Dieng: Approved by GDE - 17 October 2021

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No	Contractor	Work Contract	CEMP Status
2	JV PT Air Drilling Associate - PT Asia Petrocom Services	Rig Bundling (Lot Patuha)	Patuha: Approved by GDE- 8 November 2021
3	PT Air Drilling	Aerated	Patuha and Dieng: Approved by GDE - 3 November 2021
4	PT Halliburton Logging Services Indonesia	Cementing and Casing (lot Dieng)	Dieng: Approved by GDE- 8 November 2021
5	PT Halliburton Logging Services Indonesia	Cementing and Casing (lot Patuha)	Patuha: Approved by GDE- 8 November 2021
6	PT Halliburton Logging Services Indonesia	Directional Drilling (Lot Dieng)	Dieng: Approved by GDE- 9 November 2021
7	PT Halliburton Logging Services Indonesia	Directional Drilling (Lot Patuha)	Patuha: Approved by GDE- 9 November 2021
8	JV PT Tiger Energy Services and NPS Bahrain for Oil and Gas Well Services	Wireline Logging Services	Patuha: Approved by GDE - 3 November 2021 Dieng: Approved by GDE - 3 November 2021
9	PT Baker Hughes Indonesia	Fishing Milling	Patuha and Dieng: Approved by GDE - 19 November 2021
10	PT Baker Hughes Indonesia	Mud Engineering (Lot Dieng)	Dieng: Approved by GDE - 19 November 2021
11	PT Prima Hidrokarbon Internusa	Mud Engineering (Lot Patuha)	Patuha: Approved by GDE- 3 November 2021
12	PT Depriwangga	Well testing	Patuha and Dieng: Document has been approved (Patuha 18 February 2022, Dieng 5 April 2022
13	PT Supraco Indonesia	Civil Work	Patuha: Approved by GDE- 9 November 2021
			Dieng: Approved by GDE 22 November 2021
14	NMS	Wellhead	Patuha and Dieng: The document has been approved February 2022

3 EMP IMPLEMENTATION

Description of EMP implementation in this report including environmental management and monitoring during this period for the current D2P2 Project activity in Dieng and Patuha consists of civil work (well pad preparation) and drilling activity (including well testing activity). Reporting structure of

Environmental Health and Safety performance was divided into environmental performance and health and safety performance as recommended in the ADB report template.

Table 10 to table 15 provide detailed information on implementation of **environmental** impact mitigation measures outlined in EMP and the correlated CEMP during the January – June 2023 period.

Table 16 – table 19 provide detailed information on implementation of **health & safety** risk/impact mitigation measures outlined in EMP and the correlated CEMP during the January – June 2023 period

Meanwhile, mitigation measures defined in the Biodiversity Action Plan (BAP) were detailed in a separated Table 20.

3.1 Environmental Performance

As described before in previous chapter on going activities of Dieng 2 were civil work (well pad 30 preparation, drilling well and well testing. Meanwhile activities of Patuha 2 were drilling well and well testing, civil work had been completed since December 2022 which was preparation of well pad BB.

Mitigation measures that already implemented during the mobilisation stage, had been reported in the previous semi-annual report, therefore it was not reported any more in this report. Mitigation measures in the EMP related to EPC construction were not included in the report due to the activity not starting yet.

The evidence for the compliance of EMP implementation was through a combination of:

- Site visits/inspection to observe site practices;
- Consultation with affected people;
- Regular environmental reporting form; and
- Collecting available documentation i.e. monitoring reports.

EMP of the project (GDE) has been utilised as a reference to develop the Contractor's specific CEMP. As a part of their commitment, all contractors shall submit a CEMP implementation report to PMU and PMC every month. PMC and PMU have made a regular schedule to inspect CEMP implementation by contractors. The latest inspection for this reporting period was conducted on **11 January 2023 and 5 April 2023** for Patuha Unit 2 and **22 February 2023** for Dieng Unit 2. Inspection to Dieng conducted only once for this reporting period due to some reasons, one of them were delay on readiness of well pad 30. However, second inspection had been conducted on July 2023 and will be reported in next reporting period. The report of the joint site inspection was attached in **Appendix 1**.

3.1.1 Environmental Performance of Dieng-2 Sub Project

The monitoring of environmental performance of Dieng-2 Sub Project was conducted based on quarterly and semesterly monitoring conducted by third party (PT Sucofindo) and join site inspection by PMU and PMC. The following table shows summary of environmental performance of Dieng-2 Sub Projects.

Table 10. Status of EMP Compliance in Dieng-2

No	Key Activities/Environmental Impact	EMP Requirement (Mitigation Measure)	Compliance and Description (Yes, No, Partial)	Comment or Further Explanation if Needed	Reasons for Not Full Compliance
1	**Civil Works: Preparation of Well Pad 30**				
1A. Mobilization and Demobilization					
1	Increased vehicular emissions and noise due to mobilization of equipment and materials	C.1 Truck that will deliver dust-generating construction materials will be covered with canvas or other suitable material to minimize dust dispersion	Yes	Delivery trucks (basecourse) were covered with a tarpaulin.	None
2	Increased vehicular emissions and noise due to mobilization of equipment and materials	C.2 Contractor will ensure regular maintenance and inspection of construction vehicles, including emissions testing certificate	Yes	No further comments.	None
3	Increased vehicular emissions and noise due to mobilization of equipment and materials	C.3. Use multi-passenger vehicles to transport workers to and from the well sites	Yes	No further comments.	None
4	Increased vehicular emissions and dust due to mobilization of equipment and materials	C.4. Stockyard will be covered during the non-working period	Mitigation measure is not applicable	Not applicable	None
5	Increased vehicular emissions and noise due to mobilization of equipment and materials	C.5 Vehicles and equipment will not be allowed to sit and idle for more than 30 minutes	Yes	Briefing for drivers and co-drivers before the commencement of work. Discussion not allowing the vehicle to idle for 30 minutes was included in the briefing.	None

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No	Key Activities/Environmental Impact	EMP Requirement (Mitigation Measure)	Compliance and Description (Yes, No, Partial)	Comment or Further Explanation if Needed	Reasons for Not Full Compliance
1B Waste Management					
1	Generation of waste	C.22. Contractor to prepare waste management plan (as part of CEMP), approved by PMC	Yes	Waste Management Sub-Plan has been developed and attached as a supplementary document in the SPC CEMP. PMU has approved waste MPS.	None
	Generation of waste	C.23. Provide garbage bins at basecamp	Yes	The garbage bins were available at the drilling site. Contractor to provide segregated garbage bins once site office was installed.	None
2	**Rig Mobilization from Pad 29 to Pad 30**				
	Generation of dust and vehicular emissions from earthworks and movement of vehicles to and from the construction sites.	C.6. Regularly inspect and maintain heavy equipment C.7. Use of high-occupancy service vehicles to transport workers C.8. Emissions testing certificate of service vehicles will be required and monitored by PMU C.9. Install temporary fencing and/or enclosures at least 3-m high at construction sites	Yes Yes Yes C.9 is not applicable Yes		

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No	Key Activities/Environmental Impact	EMP Requirement (Mitigation Measure)	Compliance and Description (Yes, No, Partial)	Comment or Further Explanation if Needed	Reasons for Not Full Compliance
		C.10. Water will be sprayed daily in opened land areas or in other areas where dust was generated	Yes		
		C.11. Stockyard will be covered during non-working hours			
		C.12. Vehicles and equipment will not be allowed to sit and idle for more than 30 minutes	Yes	Idle was allowed at designated place only that would not affect the public traffic	
		C.13. Cover trucks that deliver dust-generating construction materials	Yes		
		C.14. No burning of solid or liquid wastes and other combustible materials will be allowed within the construction sites and labor camps	Yes		
		C.15. Provide PPE to operators of heavy equipment	Yes		
		C.16. Limit noise-generating activities during daytime and provide temporary enclosures to stationary noise sources	Yes		
		C.17. Drivers and operators must strictly follow road regulations particularly speed and excessive blowing of horns will not be allowed	Yes		
		C.18. Provide ear plugs/muffs to workers exposed to high-level noise and rotate schedule of these workers every two hours	Yes		

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No	Key Activities/Environmental Impact	EMP Requirement (Mitigation Measure)	Compliance and Description (Yes, No, Partial)	Comment or Further Explanation if Needed	Reasons for Not Full Compliance
3	**Well Development**				
1	Operation of drilling rig causing intermittent release of H2S	C.39. Provide workers with masks C.40. Conduct ambient air quality monitoring quarterly C.41. Provide adequate ventilation in confined spaces	Yes Yes Yes	Ambient air quality monitoring by third party (Sucofindo)	
2	Operation of drilling rig and equipment generating noise	C.42. Use of mobile rock muffler or silencer during well venting C.43.Provide workers with earplug/muffs C.44. Rotate workers every two hours to prevent discomfort C.45. Inform nearby communities of well drilling schedule	Yes Yes Yes Yes		
3	Waste generated from drilling activities	C.46. Construct sump to hold produced water and waste drilling fluids C.47. The sumps should be lined with impermeable material to prevent soil and water contamination. C.48. Oil-water separator shall be provided for oily washings in the drilling equipment and trucks C.49. Provide garbage bins at basecamp C.50. Contractor to prepare waste management plan (as part of CEMP), approved by PMC	Yes Yes C.48 Not applicable ` Yes Yes	NA	

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No	Key Activities/Environmental Impact	EMP Requirement (Mitigation Measure)	Compliance and Description (Yes, No, Partial)	Comment or Further Explanation if Needed	Reasons for Not Full Compliance
4	Water requirements for drilling	C.51. Use of condensate from Unit 1 during dry season as primary source with an average flow rate of 30 L/s	Yes	Implemented during dry season	
		C.52. Use existing pipelines in Sikidang area to convey the condensate to Pad 24 where pond of about 1,800 m3 capacity was available but requires rehabilitation	Yes	In progress, the pond will be utilized during operation phase and plan to be constructed during EPC	
		C.53. Reuse water-bentonite based mud to reduce water requirement	Yes		
		C.54. Use aerated fluid drilling (clay-free) for the production-zone of the wells	Yes		
		C.55. No water extraction during the dry season (July to September) so that irrigation of agricultural land by farmers will not be affected	Yes	Extraction of existing stream was conducted according to applicable permit	
		C.56. Construction of additional reservoir at new power plant site (Unit 2) of 5,000 m3 to supply peak water demand (including construction of power plant)	C.56 Not applicable		New power plant will be constructed at Pad 12
		C.57. Drilling services contractors to keep a record of daily	Yes		

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No	Key Activities/Environmental Impact	EMP Requirement (Mitigation Measure)	Compliance and Description (Yes, No, Partial)	Comment or Further Explanation if Needed	Reasons for Not Full Compliance
		operations to include volume of water used segregated by source of water			
		C.58. Drill only 1 well at once (only 1 rig will be installed)	Yes		
		C.59. Ensure sufficient flows (e-flows) remain in any stream where water abstraction occurs to minimize impacts to the freshwater snail, (*Gyraulus terraesacrae*). A flow meter was installed to measure water abstraction.	Yes		
5	Discharge of steam during well testing - release of H_2S higher than the occupational limit of 150 µg/m^3 set by WHO. Elevated noise may affect hearing of workers during well testing	C.60. Workers assigned will be provided with PPE such as earplugs, mask and H_2S detector, and personal H_2S dosimeter with alarm system	Yes		
		C.61. Install mobile rock muffler as silencer	NA		Used LECM (Low Emission Compact Muffler) instead of rock muffler
		C.62. Use of SCBA's in the immediate area of well testing	Yes		
		C.63. Conduct regular calibration of monitoring equipment to ensure accurate readings of H_2S	Yes		

No	Key Activities/Environmental Impact	EMP Requirement (Mitigation Measure)	Compliance and Description (Yes, No, Partial)	Comment or Further Explanation if Needed	Reasons for Not Full Compliance
		C.64. Safety and medical personnel will be available on-site.	Yes		
6	Occupational health risks during drilling works	C.65. Base camp to be provided with sanitary facilities, wash areas, safe drinking water, and garbage bins to contain waste generated by workers	Yes		
		C.66. Location of base camp shall not be close to settlements and water bodies	Yes		
		C.67. Local hiring shall be a priority to minimize number of workers in base camp	Yes		
		C.68. Fuel requirements in onsite fuel tanks and generators shall be located in designated contained areas to prevent leaks	Yes		

For all 'Partial' or 'No' compliance issues in the table above, the actions needed to solve the compliance issues were summarized in Table 11.

Table 11. EMP Actions Needed for Compliance – Dieng-2

No	EMP Requirement	Further Action to Take	Date for Action	Who will Implement Action
01	None	None	None	None

Table 12 provides information on environmental performance issues from previous Environmental Monitoring Reports. This table confirms that the action was completed or that the step was outstanding.

Table 12. EMP Compliance Outstanding Issues from Previous Report – Dieng-2

No	EMP Requirement	Further Action to Take	Responsibility and Timing	Resolution	Required Action
1	A.7 Include silica management in the SOP of hazardous material waste management.	Develop Silica management	Dieng 1, after the silica test results, was released.	Completed, Silica Management Procedure has been developed	None
2	A.8 Improve access control to existing wells pads 7, 9, 30 and 31, including fencing, gate and security guard.	Install fencing, gate, and security guard in Pad 9	GDE, End of February 2022	Completed	None

3.1.2 Environmental Performance of Patuha-2 Sub Project

Summary of environmental performances of Patuha 2 sub project was presented in Table 13.

Table 13. Status of EMP Compliance at Patuha-2

No	Key Activities/Environmental Impact	EMP Requirement (Mitigation Measure)	Compliance and Description (Yes, No, Partial)	Comment or Further Explanation if Needed	Reasons for Not Full Compliance
1	**Drilling Work**				
1	Increased vehicular emissions and noise due to mobilization of equipment and materials	C.1 Truck that will deliver dust-generating construction materials will be covered with canvas or other suitable material to minimize dust dispersion	Yes		None
		C.2 Contractor will ensure regular maintenance and inspection of construction vehicles, including emissions testing certificate	Yes,	GDE and the drilling contractor has inspected the vehicles that will be used during mobilization and drilling operation All vehicles used for mobilization have certificate emission testing	None
		C.3 Use multi-passenger vehicles to transport workers to and from the well sites	Yes	Vehicles used for transport workers were multi-passenger vehicles such as minibuses and MPV cars.	None
		C.4 Stockyard will be covered during the non-working period.	Yes		None
		C.5 Vehicles and equipment will not be allowed to sit and idle for more than 30 minutes	Yes	Due limited area of the drilling site, vehicles were not allowed to park in the drilling site. Vehicles enter the drilling site only for loading and unloading material.	None

No	Key Activities/Environmental Impact	EMP Requirement (Mitigation Measure)	Compliance and Description (Yes, No, Partial)	Comment or Further Explanation if Needed	Reasons for Not Full Compliance
2	Increased dust in the form of PM10 and PM2.5 may come from excavations in the new wells, other construction support facilities like the basecamp	C.6 Install temporary fencing and/or enclosures at construction sites to contain dust levels	Yes	The drilling site was located in the existing well pad; the fence was already in place, the area of a drilling site was far away from the settlement area	None
		C.7 Spray water in dusty areas, where applicable	Yes	Currently, it was raining in Patuha almost every day; spraying water was implemented situationally if needed	None
3	Increased level of noise during well drilling and testing	C.8 Inform staff and communities before well drilling.	Yes	General induction (Basic Safety Training/BST) was conducted for all workers before the drilling activity started. BST was conducted on 11 and 12 November 2021. Photograph and attendance list have been archived. Communities were informed through public consultation and spud in ceremony before drilling activity was conducted. Spud in ceremony in Patuha was conducted on 18 November 2021, attended by community representatives and local authorities.	None
		C.9 Use of mobile rock muffler or silencer during well venting	NA	Well Testing use LECM (Low Emission Compact Muffler) as silencer instead of rock muffler	None

No	Key Activities/Environmental Impact	EMP Requirement (Mitigation Measure)	Compliance and Description (Yes, No, Partial)	Comment or Further Explanation if Needed	Reasons for Not Full Compliance
		C.10 Provide workers with earplug/muffs	Yes	Safety devices were provided for all workers, including earplugs/earmuffs for those who work in a noisy area	
		C.11 Rotate workers every two hours to prevent discomfort	Yes		None
		C.12. Implement actions (BAP) as defined in Table 9.2 of this EMP	Yes		None
4	Release of H2S during well testing	C. 13 Provide workers assigned to well testing with personal protective equipment (PPE) like mask and H2S alarms and personal dosimeter	Yes		None
		C.14. Conduct ambient H2S monitoring	Yes		None
		C.15. Provide adequate ventilation in confined spaces	Yes		None
5	Use of water for drilling	C.16 Reuse water-bentonite based mud on reducing water requirement	Yes	Water containing bentonite from well pumped to the water pond then water from water pond utilize for drilling	None
		C.17 Use aerated fluid drilling (clay-free) for the production zone of the wells.	Yes	GDE has contracted PT Air Drilling to provide Aerated Drilling Services	None
		C.18 Drilling services contractors to keep a record of daily operations to include the volume of water used segregated by the source of water	Yes		None

No	Key Activities/Environmental Impact	EMP Requirement (Mitigation Measure)	Compliance and Description (Yes, No, Partial)	Comment or Further Explanation if Needed	Reasons for Not Full Compliance
		C.19 Secure water use permit for use of surface water	Yes	SIPPA (water use permit) has been approved No.10/031042d/DPMPTSP/2022 tentang "Perizinan Berusaha Untuk Menunjang Kegiatan Usaha Izin Pengusahaan Sumber Daya Air " on 27 April 2022	None
6	Generation of waste	C.20 Construct sump/pond to hold produced water and waste drilling fluids	Yes		None
		C.21 The sumps should be lined with impermeable material to prevent soil and water contamination.	Yes		
		C.22 Oil-water separator shall be provided for oily washings in the drilling equipment and trucks	NA		The drilling site was located in the existing well pad. Due to limited area, there was no oily washing of the truck in drilling site.
		C.23 Provide garbage bins at basecamp	Partial	No waste segregation according to available bins with colour codes (green, yellow, red and black)	None

No	Key Activities/Environmental Impact	EMP Requirement (Mitigation Measure)	Compliance and Description (Yes, No, Partial)	Comment or Further Explanation if Needed	Reasons for Not Full Compliance
		C.24 Contractor to prepare waste management plan (as part of CEMP), approved by PMC	Yes		None

For all 'Partial' or 'No' compliance issues in the table above, the actions needed to solve the compliance issues were summarized in Table 14.

Table 14. EMP– Actions Needed for Compliance – Patuha-2

No	EMP Requirement	Further Action to Take	Date for Action	Who will Implement Action
01	C.23 Provide garbage bins at basecamp and rig area	Contractor to provide garbage bins with readable label for waste segregation (Green – Organic Waste, Yellow – Non Organic Waste and Recyclable Waste, Red – Non Organic Waste and Non-Recyclable Waste, and Black – Hazardous Waste)	Completed	Waste Management Contractor (PT. ETI)

Table 15 provides information on environmental performance issues from previous Environmental Monitoring Reports. This table confirms that the action was completed or that the step was outstanding.

Table 15. EMP Compliance Outstanding Issues from Previous Report - Patuha 2

No	EMP Requirement	Further Action to Take	Responsibility and Timing	Resolution	Required Action
1	None	None	None	**None**	None

3.2 Health and Safety Performance

This chapter describes health & safety compliance management of all sub project.

3.2.1 Health and Safety Compliance of Dieng-2 Sub Project

Table 16 outlines the Health and Safety impact mitigation measures in the EMP and how the project implements the mitigation measures for all subprojects in Dieng-2. There was not any accident during reporting period, HSE performance of drilling Contractor's period Januari - June 2023 for Dieng 2 & Patuha 2 shown in **Appendix 2**.

Table 16. Status of Health and Safety Compliance All Subprojects in Dieng-2

No	Key Activities/Environmental Impact	EMP Requirement (Mitigation Measure)	Compliance and Description (Yes, No, Partial)	Comment or Further Explanation if Needed	Reasons for Not Full Compliance
1. Civil Work – Well Pad 30 Preparation					
1	Occupational health risks	C.30. Conduct training on safety and health hazards at least monthly	Partial	HSE training related has been conducted, for example: first aid, CEMP introduction, firefighting. Need to include improve the frequency and topics of HSE related trainings and waste segregation to be implemented in the site, particularly to local hire worker which was lack of exposure to health and safety requirements	None
2	Occupational health risks	C.31 Provide sanitary facilities and safe drinking water at the construction site and the workers' camp	Yes	Bottled water was provided at the basecamp and construction site.	None
3	Occupational health risk	C.32. Provide workers with PPEs such as goggles, safety shoes, etc. and its use will be mandatory	Yes	No further comments	None

No	Key Activities/Environmental Impact	EMP Requirement (Mitigation Measure)	Compliance and Description (Yes, No, Partial)	Comment or Further Explanation if Needed	Reasons for Not Full Compliance
4	Occupational health risks	C.33. Workers who will be assigned to high-level noise-generating works (100 dB(A) will be rotated every two hours aside from wearing of PPEs.	Not applicable	No noise generation works (including machinery, equipment, etc.) were observed from July to December 2022. However, earplugs were made available onsite.	None
5	Occupational health risks	C.34. Conduct daily toolbox meetings to emphasize safety and health procedures	Yes	Toolbox meeting was conducted daily. Briefing for drivers and co-drivers before the commencement of work. This item was included in the briefing.	None
6	Occupational health risks	C.35. Site Engineers to encourage brief exercise routine to highlight the value of health in the workplace	Yes	Routine briefing of site engineers for occupational health and safety training	None
7	Occupational health risks	C.36. Employees of the contractor(s) will be required to have an annual physical and medical examination. Health records will be kept confidential in the employee file.	Yes	An annual medical check-up was conducted for all personnel	None
8	Occupational health risk	C.32. Install clear and visible warning signs as well as sufficient lighting	Not applicable	Night-time work was not allowed.	
8	Occupational health risks	C.37. Contractors will be required to follow relevant HSE SOPs of GDE and applicable IFC-EHS General Guidelines 2007 (Section 2)	Yes	CEMP of SPC was developed following the IEE, ADB SPS, and relevant regulatory frameworks (IFC HSE Guidelines, etc.). PMU has approved the CEMP.	None

2. Drilling Work					
1	Occupational health risks during drilling works	C.19. Contractor to assign staff continuously to manage traffic and to ensure public safety dissemination to affected people in the villages/sub-villages	Yes	It was stated in Journey Management Plan approved by PMU Road traffic arrangements involving residents/locals hire an escort by Police	None
		C.20. Temporary public crossing points will be provided accommodating children, the elderly, and persons with disabilities	NA	Mobilization was mostly carried out at night when there was no public activity, so Temporary public crossings were not provided to accommodate children, the elderly, and persons with disabilities. but if anyone wants to cross, they will be guided by assigned personnel.	Assigned staff continuously to monitor traffic and to ensure public safety especially at current crossing points
		C.21. Clear and visible traffic warning signs will be installed, and adequate lighting will be provided.	Yes		None
2	Occupational health risks	C.30. Conduct training on safety and health hazards at least monthly	Yes	Attendance list and photograph have been recorded and available.	None
		C.31. Provide sanitary facilities and safe drinking water at the construction site and the workers' camp	Yes	Contractor has developed Hygiene and Sanitation Procedure to be implemented for this project	None
		C.32. Provide workers with PPEs such as goggles, safety shoes, etc., and its use will be mandatory	Yes	Contractor has provided PPE for all workers involved in this project and monitor PPE Compliance	None
		C.33. Workers who will be assigned to high-level noise-generating works (100 dB(A) will	Yes		None

		be rotated every two hours aside from wearing of PPEs.			
		C.34. Conduct daily toolbox meetings to emphasize safety and health procedures	Yes		None
		C.35. Site Engineers to encourage brief exercise routine to highlight the value of health in the workplace	Yes	here was a routine briefing on safety issues to all workers, i.e. briefing on H2S issue, briefing on safety lesson learned, etc	None
		C.36. Employees of the contractor(s) will be required to have an annual physical and medical examination. Health records will be kept confidential in the employee file.	Yes	All workers involved in the drilling activities have been screened on their health condition by medical check-up. Workers medical check-up data have been reviewed, and GDE keeps the result	None
		C.37. Install clear and visible warning signs as well as sufficient lighting	Yes		None
		C.38. Contractors will be required to follow relevant HSE SOPs of GDE and relevant IFC-EHS General Guidelines 2007 (Section 2)	Yes .		None
3	Occupational health risks during drilling works	C.65. Base camp to be provided with sanitary facilities, wash areas, safe drinking water, and garbage bins to contain waste generated by workers	Yes		None
		C.66. Location of the base camp shall not be close to settlements and water bodies	Yes	Most workers were live-in homestay in Dieng area, some of them live in base camp	None

		C.67. Local hiring shall be a priority to minimize the number of workers in base camp	Yes		None
		C.68. Fuel requirements in onsite fuel tanks and generators shall be located in designated contained areas to prevent leaks	Yes		None

3.2.2 Health and Safety Compliance of Patuha-2 Sub Project

Table 17 outlines the Health and Safety impact mitigation measures in the EMP and how the project implements the mitigation measures for all subprojects in Patuha-2.

Table 17. Status of Health and Safety Compliance of All Subprojects in Patuha-2

No	Key Activities/Environmental Impact	EMP Requirement (Mitigation Measure)	Compliance and Description (Yes, No, Partial)	Comment or Further Explanation if Needed	Reasons for Not Full Compliance
Drilling Work and Well Testing					
1	Increased community health and safety risks, i.e., contact with vehicles and equipment, increased access to restricted sites, increased dust and gas exposure	B.14 Develop occupational and community health and safety management plan for subsequent dissemination at the EHS induction and dissemination to affected people in the villages/sub-villages	Partial	GDE has carried out EHS induction to the affected village through the Socialization of Masyarakat Tanggap Bencana (Community Responsive Disaster) on May 17 2023. The socialisation objective was to increase community awareness of disasters and emergencies. GDE need to establish Community Health and Safety Management Plan	In fact, there was no evidence that community health and safety risks increased due to contact with vehicles and equipment and dust and gas exposure as well. However, GDE realizes that the community need to educate and familiarize themselves with the Geothermal process

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No	Key Activities/Environmental Impact	EMP Requirement (Mitigation Measure)	Compliance and Description (Yes, No, Partial)	Comment or Further Explanation if Needed	Reasons for Not Full Compliance
					and the risks.
2	Occupational health risks	C.25. Conduct training on safety and health hazards at least monthly	Yes	Attendance list and photograph have been recorded and archived.	
		C.26. Provide sanitary facilities and safe drinking water at the construction site and the workers' camp	Yes	Contractor has developed Hygiene and Sanitation Procedure to be implemented for this project	None
		C.27. Provide workers with PPEs such as goggles, safety shoes, etc., and its use will be mandatory	Yes	Contractor has provided and distributed PPE to all workers involved in this project and monitor PPE Compliance	None
		C.28. Workers who will be assigned to high-level noise-generating works (100 dB(A) will be rotated every two hours aside from wearing of PPEs.	Yes		In general workers who assigned in the noisy area do not stand by at the area for more than two hours. Exposure to noise level in working area shall refer to Ministry of Manpower Decree No 5 year 2018

No	Key Activities/Environmental Impact	EMP Requirement (Mitigation Measure)	Compliance and Description (Yes, No, Partial)	Comment or Further Explanation if Needed	Reasons for Not Full Compliance
		C.29. Conduct daily toolbox meetings to emphasize safety and health procedures	Yes		None
		C.30. Site Engineers to encourage brief exercise routine to highlight the value of health in the workplace	Yes	There was a routine briefing on safety issues to all workers, i.e., briefing on H2S issue, briefing on safety lesson learned, etc	
		C.31. Employees of the contractor(s) will be required to have an annual physical and medical examination. Health records will be kept confidential in the employee file.	Yes	All workers involved in the drilling activities have been screened on their health condition by medical check-up. Workers medical check-up data have been reviewed, and GDE keeps the result	None
		C.32. Install clear and visible warning signs as well as sufficient lighting	Yes		None
		C.33. Contractors will be required to follow relevant HSE SOPs of GDE and relevant IFC-EHS General Guidelines 2007 (Section 2)	Yes .	GDE has established an Occupational Health and Safety Management System consisting of policy, manual, plan, and procedure. These OHS-MS requirements, including ADB Safeguard requirements, were mandated to all Contractors in the contract document.	None
3	Community safety risk during equipment mobilization	C.34. Clear and visible danger and warning signs/posters will be installed temporarily in areas affected by mobilization (i.e.,	Yes	Contractor already developed Journey Management Plan before mobilization activity and implemented during mobilization activity. Journey Management Plan was included in CEMP	None

No	Key Activities/Environmental Impact	EMP Requirement (Mitigation Measure)	Compliance and Description (Yes, No, Partial)	Comment or Further Explanation if Needed	Reasons for Not Full Compliance
		Kampung Alam Endah, Sugih Mukti, and Panundaan)			
		C.35. Provide temporary crossing that will accommodate women, children and persons with disabilities	N/A.	Mobilization was mostly conducted during the night; no need to provide quick crossing	None
		C.36. Will coordinate with village head on the schedule of mobilization of heavy equipment and machinery	Yes	Contractor submitted information letter to the village head. Documentation of communication with village head was recorded in JMP	None
		C.37. Staff/workers will be assigned to manage traffic within the communities affected	Yes		None
		C.38. Emergency system and equipment such as fire-fighting, ambulance, etc., will be made available during mobilization along Kampung Alam Endah and Panundaan, including the provincial road in Bandung that will be used during mobilization in case of an accident	Yes		None
4	Disruption to local traffic	C.39. Contractor will be required to prepare a traffic management plan in consultation with local authorities in Panundaan, Sugih Mukti, and Alam Endah and the provincial agency in Bandung	Yes	Contractor already developed Journey Management Plan and implemented during mobilization activity	None

No	Key Activities/Environmental Impact	EMP Requirement (Mitigation Measure)	Compliance and Description (Yes, No, Partial)	Comment or Further Explanation if Needed	Reasons for Not Full Compliance
		C.40. Conduct public consultations on the route that will be taken for mobilization	Yes	Public consultation was held on 21 September 2021	None
		C.41. Conduct a pre-mobilization survey of the route to be taken to assess if adequate space or corridor was available, load capacity of bridges, the condition of public roads including buildings/houses close to the roads (~100 m), the situation of public roads and dwellings along the routes as the baseline for road rehabilitation or damage claims	Yes	Contractor conducted pre-mobilization survey prior to developing Journey Management Plan/JMP and survey result recorded in JMP	None
		C.42. Staff will be designated to manage traffic along the route for mobilization	Yes	It was stated clearly in JMP	None

3.2.3 Further Actions To be Taken

For all 'Partial' or 'No' compliance issues in the table above (applicable for drilling and civil works), the actions needed to solve the compliance issues were summarized in Table 18.

Table 18. Status of Health and Safety Actions Needed for Compliance - All subprojects

No	Health and Safety Requirement	Further Action to Take	Date for Action	Who will Implement Action
1	B.14 Develop occupational and community health and safety management plan for subsequent dissemination at the EHS induction and dissemination to affected people in the villages/sub-villages	To develop Occupational and Community Health and Safety Management Plan	ASAP	PMU

There were no outstanding health and safety issues in the previous SEMR; therefore, no actions needed to be taken from the last SEMR reports were reported.

Table 19. EMP Compliance Outstanding Issues from Previous Report(s) – All subprojects

Issue	Required Action	Responsibility and Timing	Resolution	Required Action
N.A.	N.A.	N.A.	N.A.	N.A.

3.3 Biodiversity Action Plan Implementation

3.3.1 BAP Implementation in Dieng 2

Referring to the GDE's initiative for relocation of proposed Dieng 2 Power Plant from Pad 38 to Pad 12, a biodiversity rapid assessment of Pad 12 was conducted by PT Sucofindo Indonesia. This assessment focused on avifauna especially migratory birds. Given the Pad 12 and its surrounding area was categorized in protected forest according to the Indonesian Government's Ministry of Environment and Forestry, the main objective of this assessment was to understand the baseline of biodiversity at Pad 12 and identify the potential risks and impacts to the existing biodiversity.

The results of the assessment will be incorporated once the final report was received from PT Sucofindo Indonesia.

3.3.2 BAP Implementation in Patuha 2

The most BAP implementations in Patuha 2 were similar with the activities as conducted during previous semester. The summary of those activities was seen below.

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Table 20. Biodiversity Action Plan Implementation for Patuha 2

No	Impact	Mitigation Measure	Compliance and Description (Yes, No, Partial)	Comment or Further Explanation if Needed	Reasons for Not Full Compliance
1	Modification and fragmentation of habitat due to loss of vegetation cover	Install appropriate canopy bridges to increase connectivity over the road for primates.	Yes	Two canopy bridges were installed to increase connectivity over the road for primates.	None
2	Displacement of species due to noise, presence of machinery and equipment, presence of staff, and operation and/or maintenance activities	Regularly maintain and inspect/certificate all vehicles, equipment, and machinery to ensure that noise levels conform to prescribed standards.	Yes	All vehicles were checked before use, including the build year, regular service evidence and emission test. Inspected tools and equipment were labelled.	None
3	Mortality of individuals from poaching by construction workers.	Mortality of individuals from poaching by construction workers. Mortality of individuals from poaching by construction workers.	Yes	Poaching was prohibited, and the Contractor has disclosed and induced poaching policy and socialized to all workers Installation of temporary warning signs of no hunting, poaching of wildlife, and open flame at the working sites	None
4	Mortality of individuals, owing to induced access	Install staffed access control on new road to well pad BB, allowing access to no- one except GDE or company	Yes	Access control was protected with installation of	None

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No	Impact	Mitigation Measure	Compliance and Description (Yes, No, Partial)	Comment or Further Explanation if Needed	Reasons for Not Full Compliance
	for poachers/ hunters via project roads.	staff, or government officials, and inspecting departing vehicles for poached wildlife.		fence along the perimeter of well pad.	

4 EMP MONITORING

4.1 Environmental Quality Monitoring

Environmental quality monitoring requirements were discussed in Section 9.4 of EMP in Draft IEE of Dieng 2 2019 and Final IEE of Patuha 2 2019.

The following table provides information on the environmental quality monitoring implemented for each subproject Dieng 2 and Patuha 2 during this reporting period. Maps, photos and detailed results compared to relevant national and/or international standards were presented in **Appendix 3**.

Table 21. Implemented EMP Environmental Quality Monitoring

Subproject	Environmental Issue Monitored	Location	Monitoring Period	Monitoring Status/Progress	Responsible Organisation
Dieng-2 Sub-Project	**Corrective Action for Unit 1**				
	improvements to existing facilities in measures A.1. to A.8.	Well pads 7, 9, 10, 30, 31	During DED and initial stage of construction	Completed,	PMC and PMU
	Front End Engineering Design/Detailed Engineering Design				
	DED includes measures B.4. – B.10	Power Plant Unit 2	After the EPC contract awarded	To be conducted	EPC Contractor
	Working GRM, information centre set up, updated GDE website, availability of project-related flyers and other social media (measures B.11. – B.13.)	Power Plant Unit 2	Before the start of construction works	Completed	PMC and PMU
	Well Drilling and Development				
	Site-specific EMP (CEMP) prepared by contractors reflecting requirements as defined in measure B.14.	N/A	Before the start of construction works	All Site-specific EMP (CEMP) have been approved	PMC and PMU
	Ocular inspection of road condition, temporary enclosures along the affected road	Road intersection at Kejajar market and transport station, and Garung, Dieng Wetan and Dieng Kulon intersection	Quarterly during well development	Conducted before rig move from Pad 29 to Pad 30	PMC and PMU
	Certificate of service vehicles on emissions testing			Completed	PMC and PMU

Subproject	Environmental Issue Monitored	Location	Monitoring Period	Monitoring Status/Progress	Responsible Organisation
	Conducted regular ambient air quality monitoring: NO_2, PM_{10}, $PM_{2.5}$	Monitoring points defined in the EMP report's Figure 4.3 (or **Appendix 3 - Figure 1**)	Quarterly during well development	Conducted in January and April 2023	PMU and Sucofindo
	Conduct ambient noise monitoring in settlements along the affected roads		Quarterly during well development	Conducted in January and April 2023	PMU and Sucofindo
	Ocular inspection of transportation routes to confirm the adequacy of temporary road crossings, traffic warning signs, Presence of designated staff to manage traffic	Road intersection at Dieng Kulon, Bakal, Karang Tengah, Kepakisan, Dieng Wetan	Quarterly during well development	Conducted January and April 2023	Contractor
	Contractor's documents on payment for damages to affected people (if any).	Road intersection at Karang Tengah, Bakal, Dieng Kulon -	Quarterly during well development	No damage caused by transportation/mobilization during this period	Contractor
	Ocular inspection of availability of garbage bins; condition of location of temporary collection area; disposal method, MSDS, etc	Pad #7, Pad #9, Pad#10, Pad #30, Pad #31, Loc I	Once a month	Conducted on 21 February 2023	PMC and PMU
	Drilling contractors' list of chemicals, paints, lubricants, etc. used			Conducted on 21 February 2023	PMC and PMU
	Ocular inspection of working condition and maintenance of sump/pond	Pad #7, Pad #9, Pad#10, Pad #30, Pad #31, Loc I	Twice a month	Conducted on 21 February 2023	PMC and PMU
	Record of workers that attended orientation on environmental requirements of GOI and ADB;	Pad #7, Pad #9, Pad#10, Pad #30, Pad #31, Loc I	Start of drilling	Conducted on December 2021, and January 2023	PMC and PMU

Subproject	Environmental Issue Monitored	Location	Monitoring Period	Monitoring Status/Progress	Responsible Organisation
	workers attended HSE orientation and training (if any)			next training will be July or August 2023	
	Availability of emergency power and safety kit.			Conducted before mobilization	PMC and PMU
	Ocular inspection of workers wearing PPE; Availability of PPE and first aid kits (hard hats, safety shoes, masks, H2S detectors and alarms, etc.); Presence and condition of sanitary facilities; Clear signs and safety warnings; Housekeeping at base camp		Weekly	Conducted weekly by Drilling Contractor	Contractor
	Record of water quantity used for drilling	Tulis River, Cidolog River, Urang River (as relevant)	Daily	Conducted daily by Drilling Sub Contractor	Contractor
	Ocular inspection of river condition (e.g., muddy)	Upstream and downstream of water extraction point at Tulis River, Cidolog River, Urang River (as relevant)	Weekly	Conducted weekly by Drilling Contractor	Contractor
	Surface water quality (pH, H_2S, BOD, COD)	Upstream and downstream of water extraction point at Tulis River, Cidolog River, Urang River (as relevant)	Quarterly	Completed Conducted in January and April 2023	PMU and Sucofindo
	Ambient H_2S monitoring	Pad #7, Pad #9, Pad#10, Pad #30, Pad #31, Loc I	Quarterly	Completed Conducted in January and April 2023	

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Subproject	Environmental Issue Monitored	Location	Monitoring Period	Monitoring Status/Progress	Responsible Organisation
Patuha-2 Sub-Project	**Corrective Action for Unit 1**				
	Record on community counselling/simulation to handling H2S (measure A.1)	GDE Patuha	Conducted before drilling activity	Socialization and simulation of H2S gas handling were held on October 8, 2021, and participated by 26 females and 26 male community members.	PMC and PMU
	Front End Engineering Design/Detailed Engineering Design				
	DED includes measures B.1. – B.6	PP Unit 2	After EPC Contract awarded	To be conducted	EPC Contractor
	Working GRM, information centre set up, updated GDE website, availability of project-related flyers and other social media (measures B.10. – B.13.)	PP Unit 2	Before drilling activity	B.10 – B.13 measures has been established	PMC and PMU
	Site-specific EMP prepared by contractors, reflecting requirements as defined in measure B.15.	N/A	Before field activity	All Site-specific EMP (CEMP) have been approved	Contractor
	Well Drilling and Development				
	Ocular inspection of road condition, temporary enclosures along the affected road	Road intersection at Panundaan, Sugihmukti, and Alamendah to the	Quarterly during well development	Conducted in March and June 2023	Contractor

Subproject	Environmental Issue Monitored	Location	Monitoring Period	Monitoring Status/Progress	Responsible Organisation
		the project site, and with the main Ciwidey-Rancabali (provincial road).			
	Certificate of service vehicles on emissions testing	N/A	NA	Certificates of emission testing have been recorded and archived	Contractor
	Conduct regular ambient air quality monitoring: NO2, PM10, PM2.5	Monitoring points defined in the EMP report's Figure 4.4 and Table 4.5 (AQ) (or Appendix 2 - Figure 3 in **Appendix 2**)	Quarterly during well development	Conducted in March and June 2023	PMU and Sucofindo
	Conduct ambient noise monitoring in settlements along the affected Roads		Quarterly during well development	Conducted in March and June 2023	PMU and Sucofindo
	Record of a road accident, number and type of vehicles, and damages to the road and associated infrastructure	Road intersection at Panundaan, Sugihmukti, and Alamendah to the the project site, and with the main Ciwidey-Rancabali (provincial road).	• Once before the start of mobilization • Quarterly during well development	Conducted in March and June 2023	PMU and Sucofindo
	Ocular inspection of transportation routes to confirm the adequacy of temporary road crossings, traffic warning signs, Presence of designated staff to manage traffic			Conducted in March and June 2023	PMU and Sucofindo
	Contractor's documents on payment for damages to affected people (if any).			NA	Contractor
	Ocular inspection of availability of garbage bins; condition of location of	PTH-1C, PTH-4B, PTH-4C, PTH-4D, PTH-5A,	Once a month	Conducted in well pad 4 on 11 January	PMC and PMU

Subproject	Environmental Issue Monitored	Location	Monitoring Period	Monitoring Status/Progress	Responsible Organisation
	the temporary collection area; disposal method, MSDS, etc.	PTH-6A, PTH-6B, PTH-7A, PTH-7B, PTH-9, PTH-9B, PTH-9A		2023 and well pad BB on 5 April 2023	
	Drilling contractors' list of chemicals, paints, lubricants, etc. used			Conducted in well pad 4 on 11 January 2023 and well pad BB in 5 April 2023	PMC and PMU
	Ocular inspection of working condition and maintenance of sump (pond) for drilling	PTH-1C, PTH-4B, PTH-4C, PTH-4D, PTH-5A, PTH-6A, PTH-6B, PTH-7A, PTH-7B, PTH-9, PTH-9B, PTH-9A	Twice a month	Conducted in well pad 4 on 11 January 2023 and well pad BB in 5 April 2023	PMC and PMU
	Record of workers that attended orientation on environmental requirements of GOI and ADB; workers attended HSE orientation and training (if any)	PTH-1C, PTH-4B, PTH-4C, PTH-4D, PTH-5A, PTH-6A, PTH-6B, PTH-7A, PTH-7B, PTH-9, PTH-9B, PTH-9A	Once at the start of construction, then quarterly	Conducted on 11 and 12 November 2021 attended by all workers	Contractor
	Availability of emergency power and safety kit	N/A	Before field activity	Has been provided	
	Ocular inspection of workers wearing PPE; Availability of PPE and first aid kits (hard hats, safety shoes, masks, H2S detectors and alarms, etc.); Presence and condition of sanitary facilities; Clear signs and safety warnings; Housekeeping at base camp	PTH-1C, PTH-4B, PTH-4C, PTH-4D, PTH-5A, PTH-6A, PTH-6B, PTH-7A, PTH-7B, PTH-9, PTH-9B, PTH-9A	Weekly	Conducted every week by Contractor	Contractor
	Record of water quantity used for drilling	Rivers: Cipaku, Citiis, Cipadarum, Ciputri (as relevant)	Daily	Water usage was recorded daily by the	Drilling Contractor

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Subproject	Environmental Issue Monitored	Location	Monitoring Period	Monitoring Status/Progress	Responsible Organisation
				drilling sub-contractor	
	Ocular inspection of river condition (e.g., muddy)	Upstream and downstream of water extraction point at Cipaku, Citiis, Cipadarum, Ciputri river (as relevant)	Weekly	Cipaku river condition was checked regularly and if it was deemed necessary to carry out the dredging process which was carried out by the PMU team every Saturday/Sunday	PMU
	Surface water quality (pH, H_2S, BOD, COD)	Upstream and downstream of water extraction point at Cipaku, Citiis, Cipadarum, Ciputri river (as relevant)	Quarterly	Conducted on March and June 2023	PMU and Sucofindo
	Ambient H_2S monitoring	PTH-1C, PTH-4B, PTH-4C, PTH-4D, PTH-5A, PTH-6A, PTH-6B, PTH-7A, PTH-7B, PTH-9, PTH-9B, PTH-9A	Quarterly	Conducted on March and June 2023	PMU and Sucofindo

Besides environmental, health and safety aspects, this report also includes Biodiversity Action Plan Monitoring requirements related to civil work activities. The following table summarizes the Monitoring of Biodiversity Action Plan Requirement.

Table 22. Monitoring Biodiversity Action Plan Requirement of Patuha 2

Impact	Mitigation action	Parameter to be monitored	Location	Monitoring Procedure	Frequency	Monitoring Status/Progress	Responsible Organisation
Loss of vegetation cover in specific areas of the project	Minimise forest clearance alongside rights of way and around well pads.	Vegetation clearance by Project staff and contractors was as minimal as legally and technically necessary	Project Area of Influence	Review of Project incident logbook; visual inspection	Unannounced inspections at least quarterly, during preparation and construction phases	During the period of January – June 2023, there was no activity affected the area outside current drilling site on Pad BB and entire IPPKH boundary (around well pad). The monitoring was conducted by Sucofindo as part of regular monitoring according to RKL-RPL document and EMP of IEE. The semi quantitative observation during the 1st quarter monitoring in March 2023 advised that there is no significant different of flora species composition on the surrounding forest area of Pad BB area compared to	PMC and PMU

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Impact	Mitigation action	Parameter to be monitored	Location	Monitoring Procedure	Frequency	Monitoring Status/Progress	Responsible Organisation
						previous monitoring results during 2nd quarter monitoring of 2022 (*Laporan Pelaksanaan Izin Lingkungan Tri Wulan I 2023*, page 2-180). There is a new record of flora species, namely *Balanophora fungosa* taken during observation which was not observed during the previous monitoring. Therefore, total number of species observed during this quarter is 33 species. It is slightly higher than total numbers of flora species observed during previous quarter monitoring results (32 species). The latest monitoring in 2nd quarter of 2023	

Impact	Mitigation action	Parameter to be monitored	Location	Monitoring Procedure	Frequency	Monitoring Status/Progress	Responsible Organisation
						provides better profile of flora species composition where 58 species (including two vulnerable species as listed in IUCN Red List, *Lithocarpus indutus* and *Saurauia bracteosa* were observed during the field monitoring in June 2023 (*Laporan Pelaksanaan Izin Lingkungan Tri Wulan II 2023*, page 2-184 - 186). It is significantly higher than total numbers of flora species observed during 2nd quarter of 2022 and 1st quarter of 2023. Summary of biodiversity monitoring results are provided in **Appendix 3**.	

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Impact	Mitigation action	Parameter to be monitored	Location	Monitoring Procedure	Frequency	Monitoring Status/Progress	Responsible Organisation
	Source construction materials from outside of forested areas.	Sourcing of materials	Project Area of Influence	Review of records for sourcing of materials; inspections	Unannounced inspections at least quarterly, during preparation and construction phases	In this period, drilling work was the current activity on Pad BB. No record of sourcing materials was reported by the Contractor (based on CEMP Implementation Report).	PMC and PMU
Introduction of invasive alien species	Take care to avoid the introduction of new invasive species to, and spread of existing invasive species within the Project area through: - washing of vehicles, equipment and supplies before entry to the Project area; - monitoring for invasive species; and - control/eradication of invasive species where found.	Washing of vehicles, equipment and supplies before entry to Project area	Transit site outside Project Area of Influence	Inspections	Unannounced inspections at least quarterly during preparation and construction phases	Given the current activity on Pad BB is drilling work, no potential introduction of invasive alien Species was monitored. Mobilization of drilling equipment and materials used the existing gravel access road. Therefore, no direct contact of vehicle or heavy equipment's tires with area where the native species are living outside the well pad.	PMC and PMU

Impact	Mitigation action	Parameter to be monitored	Location	Monitoring Procedure	Frequency	Monitoring Status/Progress	Responsible Organisation
		Abundance/spread of invasive alien species in Project area	Project Area of Influence	Surveys by specialist sub-contractor	Annually, in summer, during preparation and construction phases	Similar as above, the monitoring activity during this period observed that no potential spreading of invasive alien species in Project area.	PMC and PMU
		Control of new/spreading areas of invasive alien species in Project area	Project Area of Influence	Records of invasive species control; inspections	Quarterly, during preparation and construction phases	Similar as above	PMC and PMU
Modification and fragmentation of habitat due to loss of vegetation cover.	Retain tree canopy connectivity over the new road wherever possible.	Canopy connectivity along the proposed RoW was identified, options for preservation identified, and connectivity preserved wherever possible	Project area	Review of Project incident logbook; visual inspection	Unannounced inspections at least quarterly, during preparation and construction phases	On-going monitoring (1st and 2nd quarter monitoring report) during this period observed that there is no indication of significant fragmentation of habitat due to loss of vegetation cover. The affected area (due to land clearing for access road and pad BB) is relatively small compared to the	PMC and PMU

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Impact	Mitigation action	Parameter to be monitored	Location	Monitoring Procedure	Frequency	Monitoring Status/Progress	Responsible Organisation
						entire forest area surrounding of Project site. It was reported that three key mammal species and critically endangered (CR)/endangered (Ed) species, Javan slow loris (*Nycticebus javanicus),* Surili (*Presbytis comata*) and Javan Leopard (*Panthera pardus melas*) were recorded during the field monitoring. Surili was always recorded during 1st and 2nd quarterly monitoring in 2021 to 2023. While, Javan slow loris and Javan Leopard was recorded through interview during 1st and 2nd quarter monitoring of 2023.	
	Install appropriate canopy bridges to increase connectivity	Appropriate canopy	Project area	Inspections	Unannounced inspections at least quarterly	No indication or record of broken installed canopy	PMC and PMU

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Impact	Mitigation action	Parameter to be monitored	Location	Monitoring Procedure	Frequency	Monitoring Status/Progress	Responsible Organisation
	over the road for primates.	bridges installed over the new road within one month of clearance of RoW			during preparation and construction phases, until complete	bridges was observed during on-going monitoring.	
Displacement of species due to noise, machinery and equipment and presence of staff.	Regularly maintain and inspect/certificate all vehicles, equipment and machinery to ensure that noise levels conform to prescribed standards	Noise levels of Project vehicles, equipment and machinery against prescribed standards	Project area	Review of certificates; inspections	Unannounced inspections quarterly during preparation and construction phases	On-going monitoring (based on CEMP Implementation Inspection in January 2023) observed that the noise levels of Project vehicles, equipment and machinery is comply to prescribed standards (see inspection record in **Appendix 1**)	PMC and PMU
Mortality of individuals from poaching by construction workers.	Implement a strict code of conduct forbidding hunting/trapping and purchasing wildlife, with heavy penalties. Train all personnel on this code of conduct, and its justification	Staff adherence to best practice	Project area	Review of training records; review of Project incident logbook. inspections	Unannounced inspections quarterly during preparation and construction phases	On going monitoring (based on CEMP Implementation Inspection in January 2023) observed that no record of individuals' mortality due to poaching by construction workers	PMC and PMU

4.1.1 Summary of Results – Noise Monitoring

1. Dieng Unit 2

The noise monitoring was conducted quarterly in the well pad, project infrastructure and nearest settlement area. Noise monitoring was conducted in 11 sampling location. The table below shows noise measurement result first and second quarter 2023.

Table 23. Noise Measurement Result Dieng Unit 2

No.	Location	Unit	QI			Q II			Threshold Value	IFC Guidelines	
			Ls	Lm	Lsm	Ls	Lm	Lsm		Day Time	Evening Time
1	PAD 7	dBA	52.6	40.2	51.2	53.4	45.2	52.6	70	70	70
2	PAD 9	dBA	53	35.5	51.4	56.5	47.5	55	70	70	70
3	PAD 30	dBA	52.5	37.5	51	57.2	55	58.3	70	70	70
4	PAD 31	dBA	52.6	35.5	53	51.5	38.2	50	70	70	70
5	PAD 29	dBA	56.4	49.3	55.8	53.4	57.1	58.4	70	70	70
6	PAD 38	dBA	-	-	-	48.8	36.5	47.5	70	70	70
7	Temporary Office	dBA	-	-	-	52.3	37.5	50.8	70	70	70
8	Nearest Settlement	dBA	-	-	-	52.5	45	51.8	55	55	45
9	Portacamp Workshop	dBA	-	-	-	53.4	43.2	52.1	70	70	45
10	Booster Pump	dBA	51.5	36.5	50	62	66	51	70	70	70
11	Water Pump Station	dBA	-	-	-	53.4	57.1	58.4	70	70	70

Source: Sucofindo Laboratory, 2023

Threshold Value refer to Decree of the Minister of Environment No. 48 of 1996

Note:

- *Ls : Measurement at an interval of 06.00 – 22.00*
- *Lm : Measurement at an interval of 22.00 – 06.00*
- *Lsm : Measurement during 24 hour activity*

In some locations, noise levels were not measured during Q1 monitoring, as indicated by dash markings. This exclusion was due to the revised selection of sampling locations, which was informed by an evaluation of previous monitoring data. Consequently, these locations have been included in the Q2 monitoring

The noise monitoring results during the 1st and 2nd quarter of 2023 advised that the noise ambient show no measurement results that exceed the noise level threshold value in accordance with the Decree of the Minister of Environment No. 48 of 1996 **.**

Table 24 Noise Measurement at Village Area Semester 1 2023

No	Location	units	Q I			Q II			Threshold Value	IFC Guidelines	
			Ls	Lm	Lsm	Ls	Lm	Lsm		Day Time	Evening Time
1	Kepakisan	dBA	51,3	39,6	50	54.8	40.8	53.3	55	55	45
2	Simpangan Village	dBA	48,7	36,5	47,3	**55.6**	40.5	54	55	55	45
3	Karang Tengah Village	dBA	52,3	43,5	51,4	51.7	39.6	50.3	55	55	45
4	Pawuhan	dBA	53,4	40,6	52	**55.4**	**45.2**	54.2	55	55	45
5	Karangsari	dBA	48,4	38,4	47,3	**55.8**	41.7	54.3	55	55	45
6	Ngandam	dBA	48,5	38,5	47,4	49.7	38.9	48.5	55	55	45
7	Sikunang village	dBA	48	40,5	47,3	**55.8**	42.1	54.3	55	55	45

Source: Laboratory Analysis Result PT. Sucofindo 2023

Exceed the limit

Note:

- *Ls : Measurement at an interval of 06.00 – 22.00*
- *Lm : Measurement at an interval of 22.00 – 06.00*
- *Lsm : Measurement during 24 hour activity*

The data presented in the table above indicates that noise levels in multiple villages exceeded permissible limits during daytime, with one instance at Pawuhan village also surpassing the IFC Guidelines limit at night-time. Nonetheless, noise measurements taken over a 24-hour period adhered to the standard limits set by National regulations. The daytime noise exceedances are likely attributed to project-related activities as well as human-generated sources like traffic and other activities.

2. **Patuha Unit 2**

Based on the 24 hours noise measurements at 10 sampling points during the period of January - June 2023, there was no exceeding noise threshold at all sampling locations, except at the sampling points Well Pad H/PPL 2. This exceedance was due to noise generated from well testing activity (noise measurement conducted in March 2023). Eventhough noise level was high, workers were working at Pad 2 follow the GDE policy and applicable regulation such as wearing PPE (ear plug/earmuff), regulate exposure to high noise level.

Table 25. Noise Measurement Result Patuha Unit 2

No	Code Sample	Location	Unit		Result		Threshold Limit
					Q1	Q2	
1	KB-4	Patuha Unit 2 Power Plant	dB (A)	L-s	64,1	64,5	70
			dB (A)	L-m	62,0	62,5	
			dB (A)	L-sm	63,5	64,0	
2	KB-9	Ciwidey – Rancabali Road	dB (A)	L-s	63,0	64,2	70
			dB (A)	L-m	43,4	49,0	
			dB (A)	L-sm	61,3	62,5	
3	KB-10	The road that connects the project site with the Ciwidey – Rancabali road	dB (A)	L-s	61,3	63,1	70
			dB (A)	L-m	44,6	48,5	
			dB (A)	L-sm	59,6	61,4	
4	KB-11	*Temporary Office*	dB (A)	L-s	58,7	58,0	70
			dB (A)	L-m	55,0	55,8	
			dB (A)	L-sm	57,8	57,4	
5	KB-12	Well Pad BB/ PPL 9	dB (A)	L-s	68,6	68,4	70
			dB (A)	L-m	69,3	67,5	
			dB (A)	L-sm	68,8	68,1	
6	KB-13	Kendeng Village	dB (A)	L-s	45,3	44,9	55
			dB (A)	L-m	44,1	44,1	
			dB (A)	L-sm	44,9	44,7	
7	KB-14	Camara Village	dB (A)	L-s	43,4	46,5	55
			dB (A)	L-m	43,6	44,0	
			dB (A)	L-sm	43,4	45,8	
8	KB-15	Pasir Waas Village	dB (A)	L-s	45,3	45,7	55
			dB (A)	L-m	42,7	42,5	
			dB (A)	L-sm	44,6	44,9	
9	KB-16	Well Pad H/ PPL 2	dB (A)	L-s	**93,3**	62,7	70
			dB (A)	L-m	**92,4**	59,3	
			dB (A)	L-sm	**93,1**	61,8	
10	KB 17	Well Pad U/ PPL 6	dB (A)	L-s	**-**	60,6	70
			dB (A)	L-m	**-**	56,2	
			dB (A)	L-sm	**-**	59,5	

Source: Sucofindo Laboratory, 2023

Threshold Value refer to Decree of the Minister of Environment No. 48 of 1996

Bold	*Exceed the limit*

Note:

- *Ls : Measurement at an interval of 06.00 – 22.00*
- *Lm : Measurement at an interval of 22.00 – 06.00*
- *Lsm : Measurement during 24 hour activity*

4.1.2 Summary of Results – Surface Water Quality

1. Dieng Unit 2

There were six locations of surface water quality monitoring during this period including Sidendang River, Situlu River, Tulis River, Siputih/Sikunang River, Sidolok River and Siranthi River.

The assessment criteria of surface water monitoring were according to surface water quality standards according to the Indonesian Government Regulation No. 22 of 2021 concerning Water Quality Management and Water Pollution Control Class II - Water Quality Standards for Recreation, Freshwater Fish Cultivation, Cultivation, Vegetation Irrigation, and Other Needs Requiring the Same Standard.

The monitoring results advised that the water quality of Situlu River, Sidendang River rand Siranthi River was still good. Most of parameters were below the standard limit except nitrate and nitrite were exceeding the water quality standards. Similar with above explanation, parameter that exceeded the limit in upstream and downstream Tulis River, Siputih/Sikunang River and Sidolok River were nitrate, phosphate, zinc and in fecal coliform. High concentration of nitrate, phosphate, zinc and fecal coliform might be significant indication that the water quality of those rivers was influenced by the anthropogenic activities such as agricultural and toilet waste disposal. Similar result was indicated in the environmental

baseline of Addendum Amdal 2021. Baseline data used was regular monitoring since 2017 to 2019. The baseline data shown that nitrate concentration in several monitoring location of river water was exceeded the standard limit. Likewise regular monitoring since 2020 to 2022 indicated high concentration nitrate & nitrite in river water. Result of regular monitoring is consistently proofed the affect of agricultural activity at surrounding Dieng Project location.
The detailed monitoring results were shown in **Appendix 3**.

2. **Patuha Unit 2**

The surface water quality monitoring was conducted in 5 locations within the four sub watersheds including Ciwidey, Cibuni, Cipandak and Cikahuripan Sub-Watershed. The monitoring results of the 1st and 2nd quarter of 2023 advised that that some parameters in several monitoring locations were exceeding the limit of quality standards according to the Indonesian Government Regulation No. 22 of 2021 concerning the Implementation of Environmental Protection and Management, Appendix VI concerning National Water Quality Standards. Parameter that was exceeding the limit including pH, BOD, total coliform and phosphate. The results of surface water quality monitoring were presented in **Appendix 3**.

4.1.3 Summary of Results – Groundwater Quality.

1. **Dieng Unit 2**

First semester of 2023 monitoring location of groundwater were carried out in 3 locations. The locations of groundwater quality sampling points were in the Simpangan spring, Situlu spring, and Sidendang springs. The monitoring results of the 1st and 2nd quarter of 2023 advised that that pH and nitrate in several monitoring locations were exceeding the limit of quality standards according to the Minister of Health of the Republic of Indonesia Decree Number 32 of 2017, Appendix I A. Concerning Environmental Health Quality Standards and Water Health Requirements for Sanitation Hygiene purposes. The complete results of groundwater quality monitoring were presented in **Appendix 3**. Trend analysis of water quality is discussed in the next chapter.

2. **Patuha Unit 2**

During this period of report, measurement of spring water quality conducted at 2 (two) location namely Cihaliwung and Cidamar Springwater Monitoring result for the first semester of 2023 show that the all analyzed parameters, still fulfill the quality standards required by Minister of Health Regulation No. 32 year 2017 concerning Environmental Health Quality Standards and Water Health Requirements for Sanitary Hygiene, Swimming Pools, Solus Per Aqua, and Public Baths as a reference for spring water quality (Appendix I Point A) The result of groundwater quality monitoring was presented in **Appendix 3**.

4.1.4 Summary of Results – Air Quality and Odour

1. **Dieng Unit 2**

The air quality monitoring conducted in Quarterly and Semester basis. Quarterly monitoring was conducted at similar locations of noise monitoring. For this reporting period quarterly monitoring of air quality and noise was conducted at well pad 7 and well pad 9. Pad 30, Pad 31, Pad 29, and Nearest Settlement with drilling activities. The semesterly monitoring was conducted at similar locations of noise monitoring also including nine locations: 1) Kepakisan Village, 2) Simpangan Village, 3) Karang Tengah Village, 4) Pawuhan Village, 5) Karangsari Village, 6) Ngandam Village, 7) Sikunang Village, 8) Dieng 1 Office and 9) Power Plant Dieng Unit 1. Following was summary of noise monitoring results at each monitoring location.

Quarterly Monitoring
Based on monitoring results, all ambient air quality parameters were below the standard of maximum limits according to Government Regulation No 22 of 2021 concerning Environmental Protection and Management Implementation, Appendix VII Ambient Air Quality Standards.

In comparison, odour measurement was conducted at 6 (six) locations. Based on the monitoring results, odour at all locations were below the standard of maximum limit according to the Ministry of Environment Decree No.50 of 1996 concerning Odor Standard. The results of air quality and odor monitoring were provided in **Appendix 3**.

Semesterly Monitoring:
Based on the monitoring measurement results within the 1st semester of 2023, there was no exceeding parameters of ambient air quality threshold at all sampling locations. The results of air quality monitoring were provided in **Appendix 3**.

2. **Patuha Unit 2**
The ambient air quality quarterly monitoring was conducted during the 1st semester of 2023 at 12 sampling locations distributed within the surrounding areas of the project site. Results for all parameters in all sampling stations still meet the required environmental quality standards based on the Indonesia Government Regulation Number 22 of 2021 concerning Implementation of Environmental Protection and Management, Appendix VII concerning Ambient Air Quality Standards, while odour level referring to Ministry of Environment Decree No. 50 of 1996 concerning Odor Level Standards. In overall, the ambient air quality the surrounding areas of the project site was good. No exceeding parameters of ambient air quality threshold was observed. The results of air quality monitoring were provided in **Appendix 3.**

4.2 Trend Analysis of Environmental Quality Monitoring

Trend analysis is a crucial process aimed at identifying and analyzing patterns of changes in environmental quality within a specific time and spatial context. To conduct such analysis effectively, monitoring data over time (time series data) is essential, as assessing trends requires consistent data from the same location at various monitoring intervals.
Time series data provides a more comprehensive depiction of the activity's progression and its impact on environmental quality. This is important because activities may not always operate under normal or optimal conditions, and understanding their trends necessitates considering varying states over time.

4.2.1 Dieng 2 Sub Project

The following is an analysis of environmental quality trends in Dieng 2, focusing on key parameters

A. Ambient Air Quality

Comparison of the results of monitoring Ambient Air Quality parameters PM10 and PM2.5 for Semester I 2023 cannot be displayed due to different monitoring points from the previous semester.

B. Surface Water Quality

Comparison of the results of monitoring the surface water quality of the Situlu River and the Sidandang River for the first semester of 2023 can be seen in the following explanation.

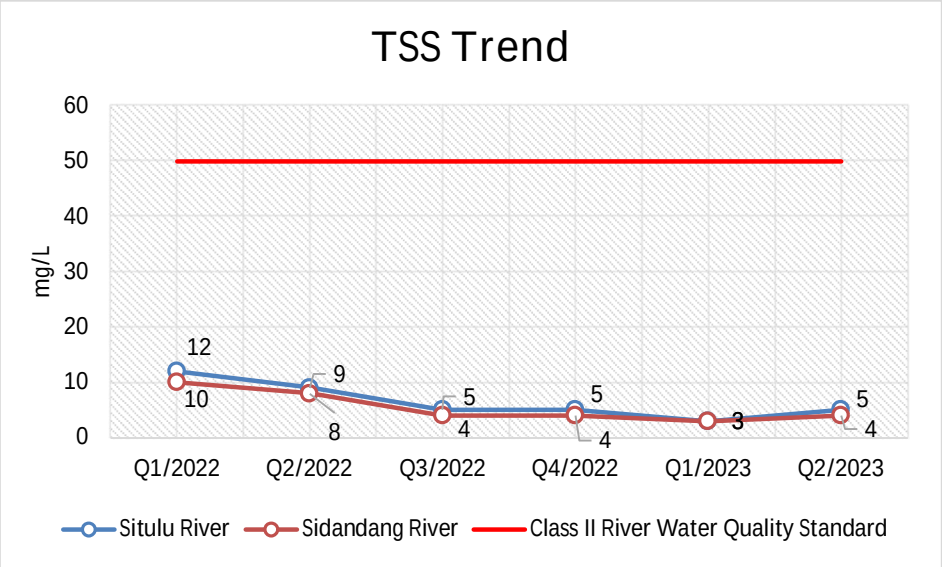


Figure 1. TSS Trend of Surface Water

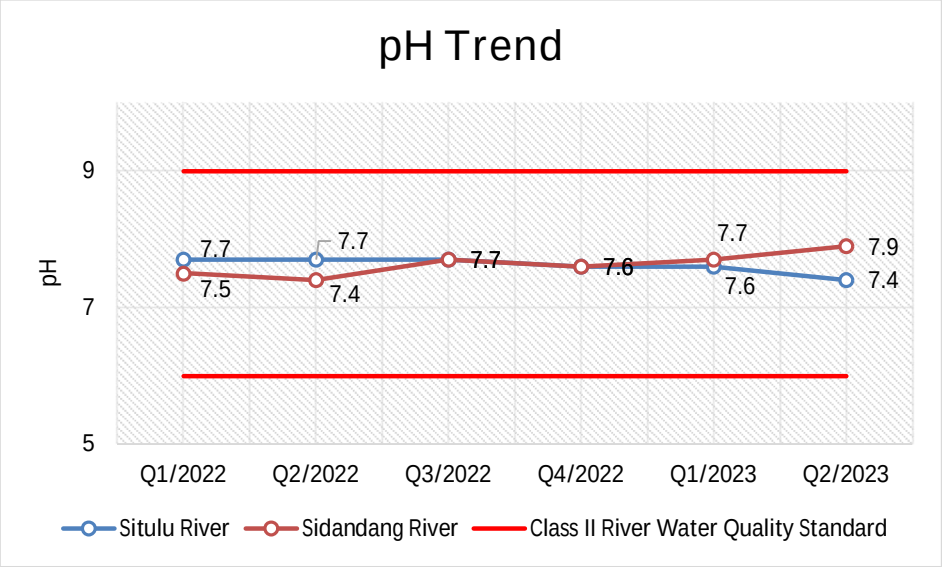


Figure 2. pH Trend of Surface Water

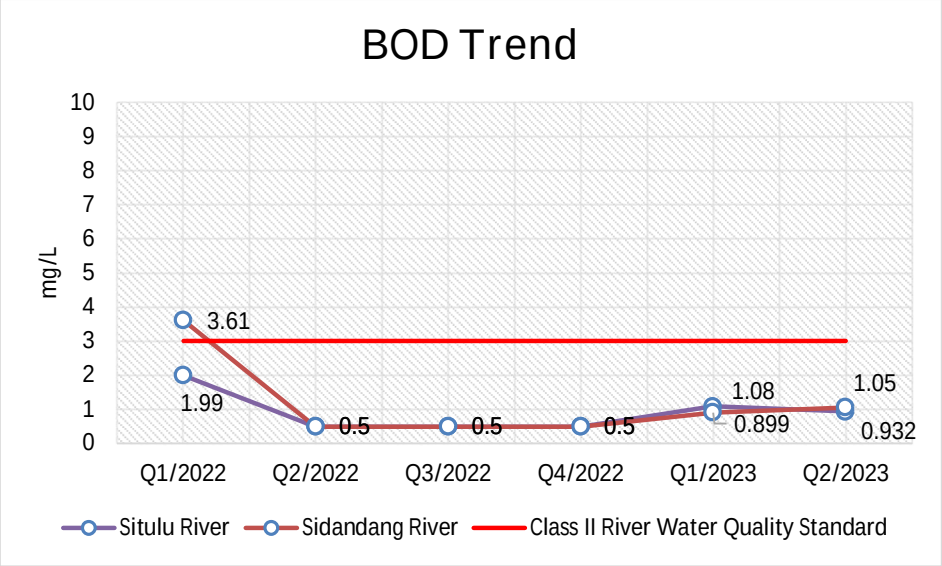


Figure 3. BOD Trend of Surface Water

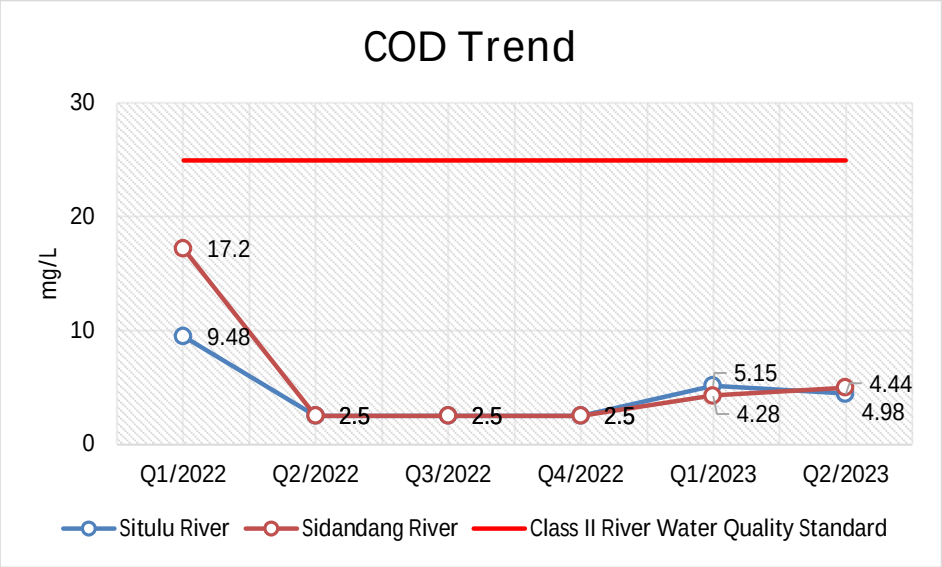


Figure 4. COD Trend of Surface Water

Based on the surface water quality monitoring results from the first quarter of 2022 to the second quarter of 2023, key parameters of river water quality have shown a decrease. The Total Suspended Solid (TSS) parameter exhibited a relatively stable trend, with a tendency to slightly lower than the first quarter of 2022. There was a slight increase in the second quarter at two monitoring point locations. However, the concentration of TSS in the Situlu and Sidandang Rivers remains within the established quality standards.

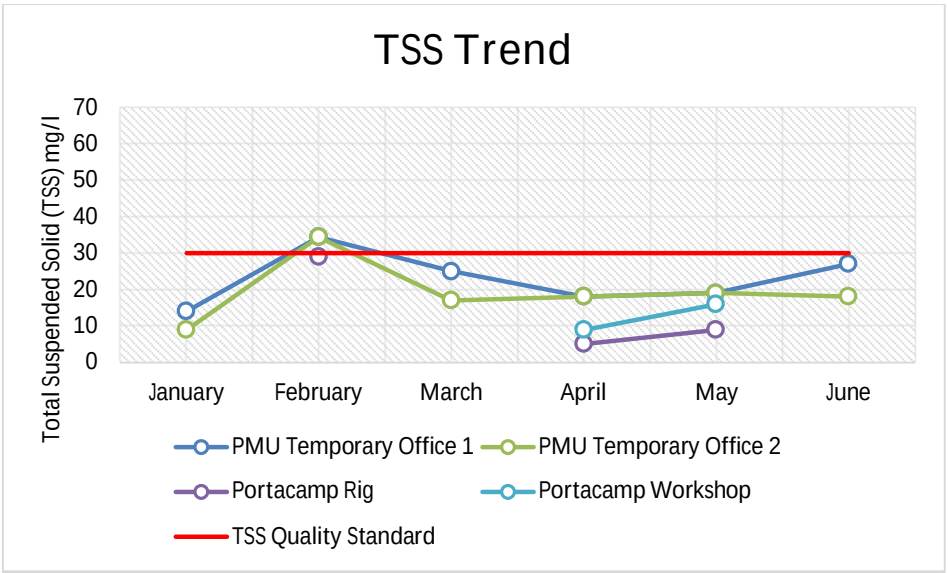
Regarding the level of acidity (pH) of river water, both upstream and downstream of the Tulis River, the trend is relatively stable, with pH values still falling within the neutral range of 6.0-9.0. In the first quarter of 2022, the results at the Sidandang and Silulu river monitoring points were 7.7 and 7.5, respectively. By the second quarter, the pH values in the Sidandang and Sidandang rivers still met the quality standards, with the Sidandang river recording a value of 7.4 and Sidandang's value at 7.9.

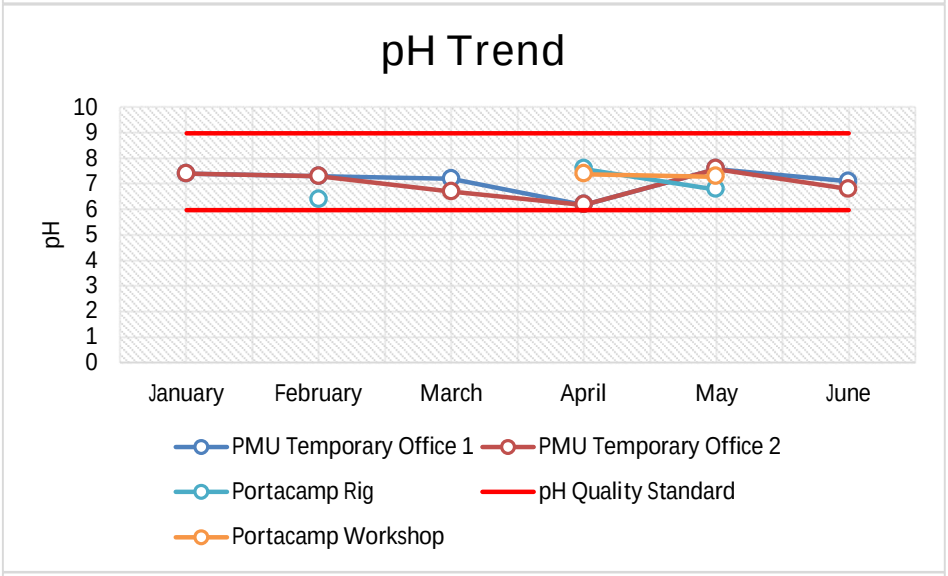
The parameter of Biological Oxygen Demand (BOD) in the Situlu and Sidandang Rivers tends to decrease. In the Situlu River, the BOD concentration decreased from 1.08 mg/L in the first quarter of 2023 to 1.05 mg/L in the second quarter of 2023. Meanwhile, in the Sidandang River, there was a slight increase from 0.899 mg/L in the first quarter of 2023 to 0.932 mg/L in the second quarter of 2023. There were some test results that exceeded the quality standard, specifically in the Sidandang River during the first quarter of 2022.

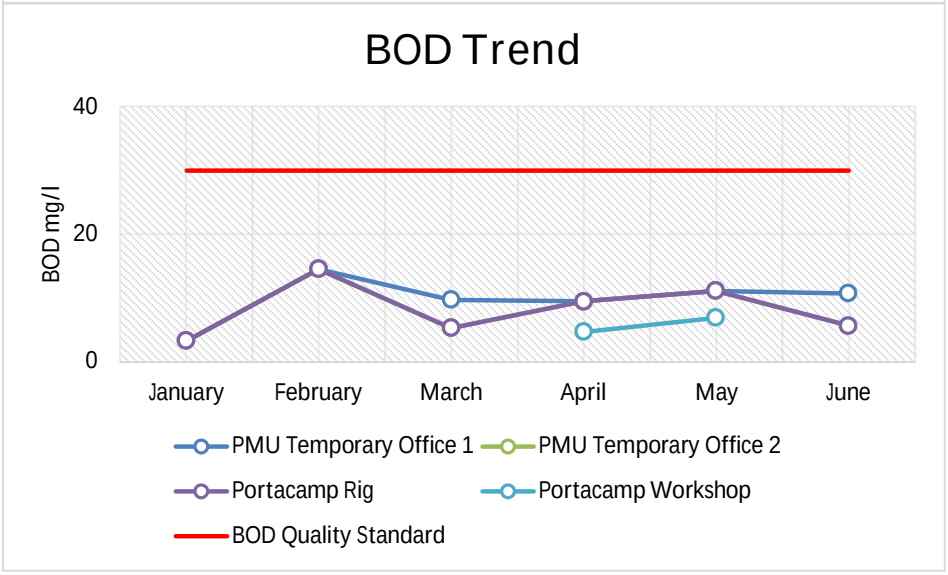
Similarly, there is a downward trend in the Chemical Oxygen Demand (COD) parameter. In the Situlu River, there was a decrease from 17.2 mg/L in the first quarter of 2022 to 2.5 mg/L in the second quarter of 2022 to the fourth quarter of 2022. In the first quarter of 2023, the value was 5.15 mg/L, with a slight decrease in the second quarter of 2023 to 4.44 mg/L. For the Sidandang River, there was a decrease in concentration from 9.48 mg/L in the first quarter of 2022 to 2.5 mg/L in the second quarter of 2022 to the fourth quarter of 2022. The first quarter of 2023 showed an increase with a value of 4.28 mg/L, followed by another increase in the second quarter of 2023 to 4.98 mg/L. Despite these fluctuations, the overall results are still below the established quality standards.

C. Quality of Domestic Wastewater

The figure below presents a comparison of the quality monitoring results for domestic wastewater during the Semester I of 2023 and an evaluation of trends at the PMU Temporary Office and Portacamp locations.


TSS Trend
Total Suspended Solid (TSS) mg/l
70
60
50
40
30
20
10
0
January
February
March
April
May
June
PMU Temporary Office 1
PMU Temporary Office 2
Portacamp Rig
Portacamp Workshop
TSS Quality Standard


pH Trend
pH
10
9
8
7
6
5
4
3
2
1
0
January
February
March
April
May
June
PMU Temporary Office 1
PMU Temporary Office 2
Portacamp Rig
pH Quality Standard
Portacamp Workshop


BOD Trend
BOD mg/l
40
20
0
January
February
March
April
May
June
PMU Temporary Office 1
PMU Temporary Office 2
Portacamp Rig
Portacamp Workshop
BOD Quality Standard

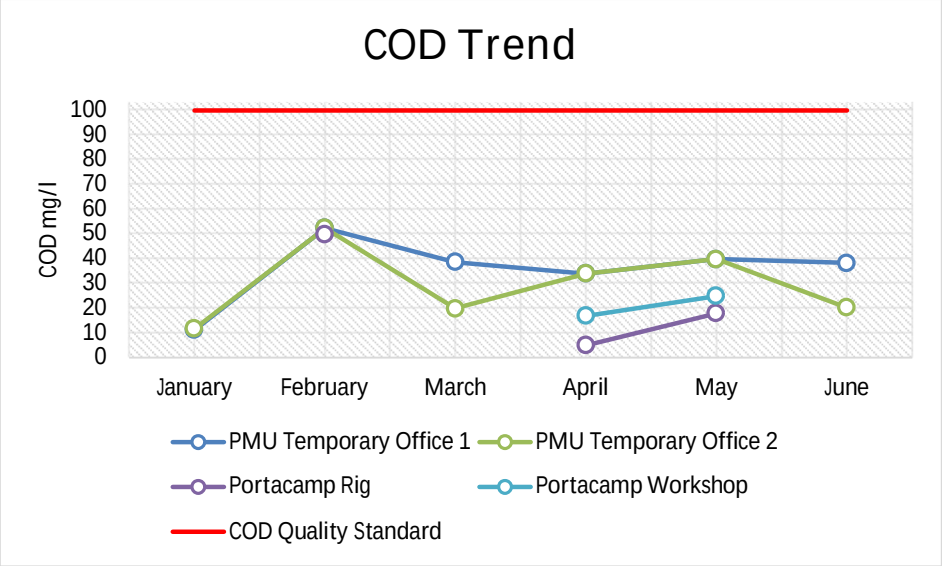


Figure 5. Domestic Wastewater Quality Trends

Based on Regional Regulation of Central Java Province Number 5 of 2012, pertains to the amendments of Regional Regulation of Central Java Province Number 4 of 2004 concerning Changes in Wastewater Quality Standards for Geothermal Exploration and Production Businesses and/or Activities, the monitoring results at PMU Temporary Office 1 and 2 locations during Semester I of 2023 showed certain parameters that exceeded the domestic wastewater quality standards, including Total Suspended Solids (TSS), Ammonia, and Total Coliform. However, at the location points of the Portacamp rig and portacamp workshop, all parameters remained within the quality standards. Several parameters of domestic wastewater quality exhibited fluctuating trends.

Specifically, the Total Suspended Solid (TSS) parameter showed an increasing trend in February for testing the quality of domestic wastewater at PMU Temporary Office 1, PMU Temporary Office 2, and Portacamp Rig. Subsequently, there was a decline in TSS from March to May, followed by a slight increase in June. In February, TSS values at Temporary Office 1 and 2 locations exceeded the quality standard.

The acidity level (pH) parameter displayed a fluctuating trend at all monitoring points, although the pH in the two domestic wastewater treatment plants remained within the neutral pH range (6.0-9.0).

On the other hand, the Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) parameters showed a downward trend at sampling points in all locations. In February, there was an increase in BOD and COD at the front office, back office, and portacamp rig sampling points, followed by a decrease in March, which then increased until May and decreased again in June. Nevertheless, the BOD and COD parameters at all monitoring points still meet the established quality standards.

D. Produced Water Quality

The figure and table below present a comparison of the results from monitoring the quality of produced water for Semester I of 2022 to Semester I 2023.

Figure 6. Produced Water Quality Trends

According to Regional Regulation of Central Java Province Number 5 of 2012, which covers Amendments to Regional Regulation of Central Java Province Number 4 of 2004 concerning Changes in Wastewater Quality Standards for Geothermal Exploration and Production Businesses and/or Activities, the laboratory analysis results of produced water quality for the first semester of 2023 indicate a decreasing trend in the Ammonia parameter and a decline in the pH parameter. It was evident that both the Ammonia and pH parameters do not meet the environmental quality standards at the Pond Pad 31 monitoring point location. However, produced water will be injected into injection well to avoid contamination to water surface.

E. Air Quality (Odor)

The figure below illustrates a comparison of the monitoring results for the Ambient Air Quality parameter of Hydrogen Sulfide (H2S) from the third quarter of 2021 to the second quarter of 2023.

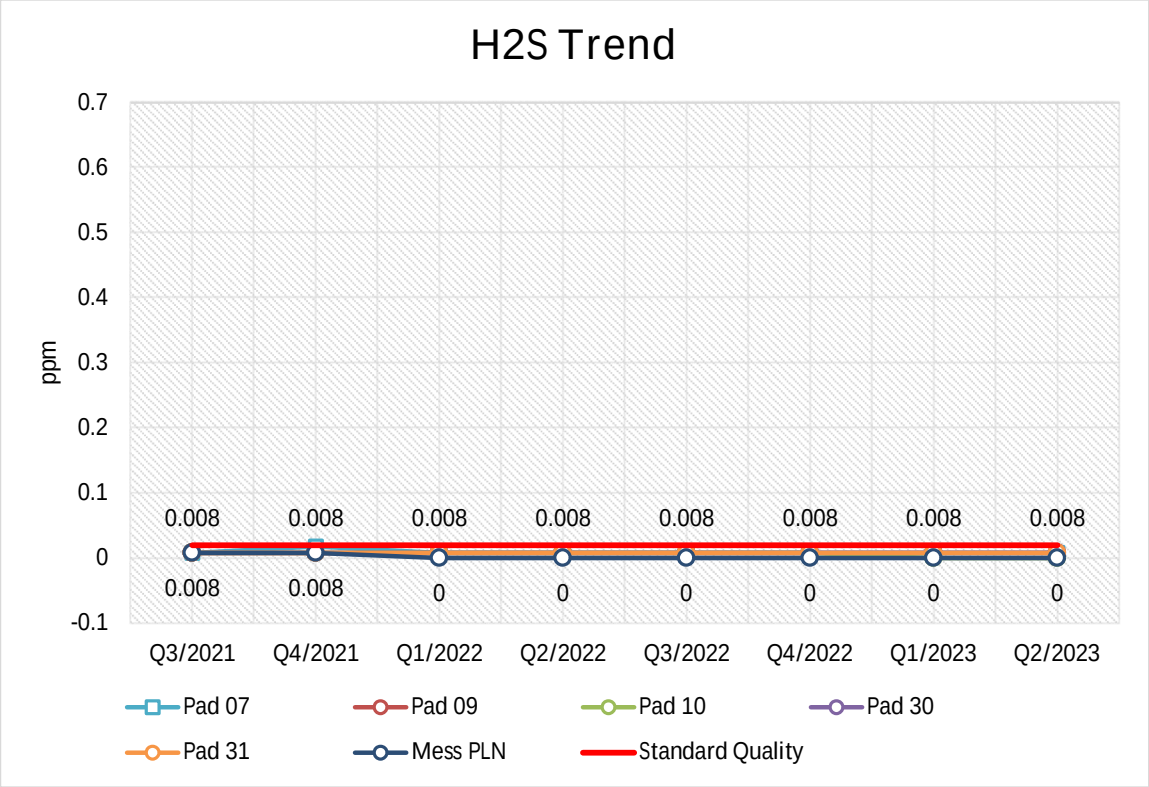


Figure 7. Air Quality (Odor) Trends

Based on the Decree of the Governor of Central Java No. 8 of 2001, April 23, 2001, Kep.MENLH No.Kep. 50/MENLH/11/1996, dated November 25, 1996, regarding Odor Level Quality Standards, the measurement results for the Hydrogen Sulphide (H2S) parameters indicate a stable trend, and all test parameters still meet the environmental quality standards.

4.2.2 Patuha 2 Sub Project

The subsequent discussion presents a trend analysis of the occurring change in environmental quality within the Patuha 2 project area. This analysis specifically looks into the examination of various key parameters that play a crucial role in determining the overall state of the environment in this project area.

A. Ambient Air Quality

Data on the trend of changes in ambient air quality in the construction activities of PLTP Patuha Unit 2 are presented in **Figure 8** to **Figure 10,** the figure show how the quality of the air in the Patuha Unit 2 project area has been changing over a specific period.

During the implementation of the construction Patuha Unit 2 in the first quarter of 2023, there were concerns about potential changes in ambient air quality stemming from drilling and well testing activities. Upon investigation, it was observed that the impact of well testing activities on ambient air quality appeared to be minimal. This conclusion is drawn from the fact that the concentration values of the monitored parameters continue to remain within the stipulated quality standards, indicating that the well testing activities have not caused any significant deviations.

Note TW 1-2021 = Quarter 1 - 2021

Figure 8.Fluctuations in the Concentration of SO2 and NO2 in Ambient Air

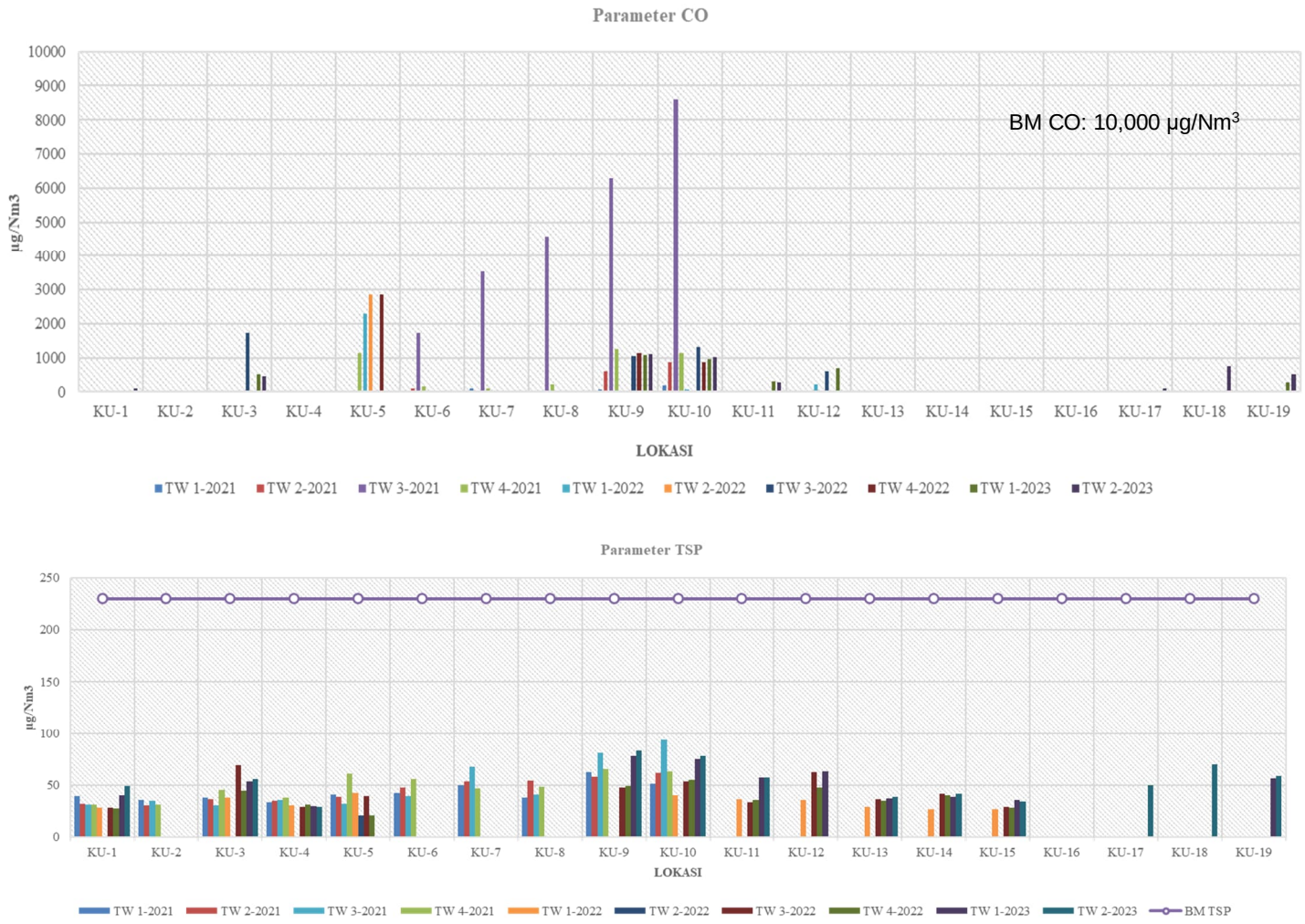


Figure 9 Fluctuations in CO and TSP Concentrations in Ambient Air

Figure 10 Fluctuations in PM $_{10}$ and PM$_{2.5}$ Concentrations in Ambient Air

B. Noise Intensity

Trend of noise intensity during period Q1 2021 up to Q2 2023 is presented in the figure 11. The Figure 11 indicated that mostly all sampling location of noise measurement still fulfil the standard limit except several location. The noise exceedance particularly due to transportation impact (location close to the main road) and noise due to project activity such as drilling and well testing. However, in the project area all worker shall follow GDE Policy on noise protection and applicable regulation such as regulate exposure to high noise level.

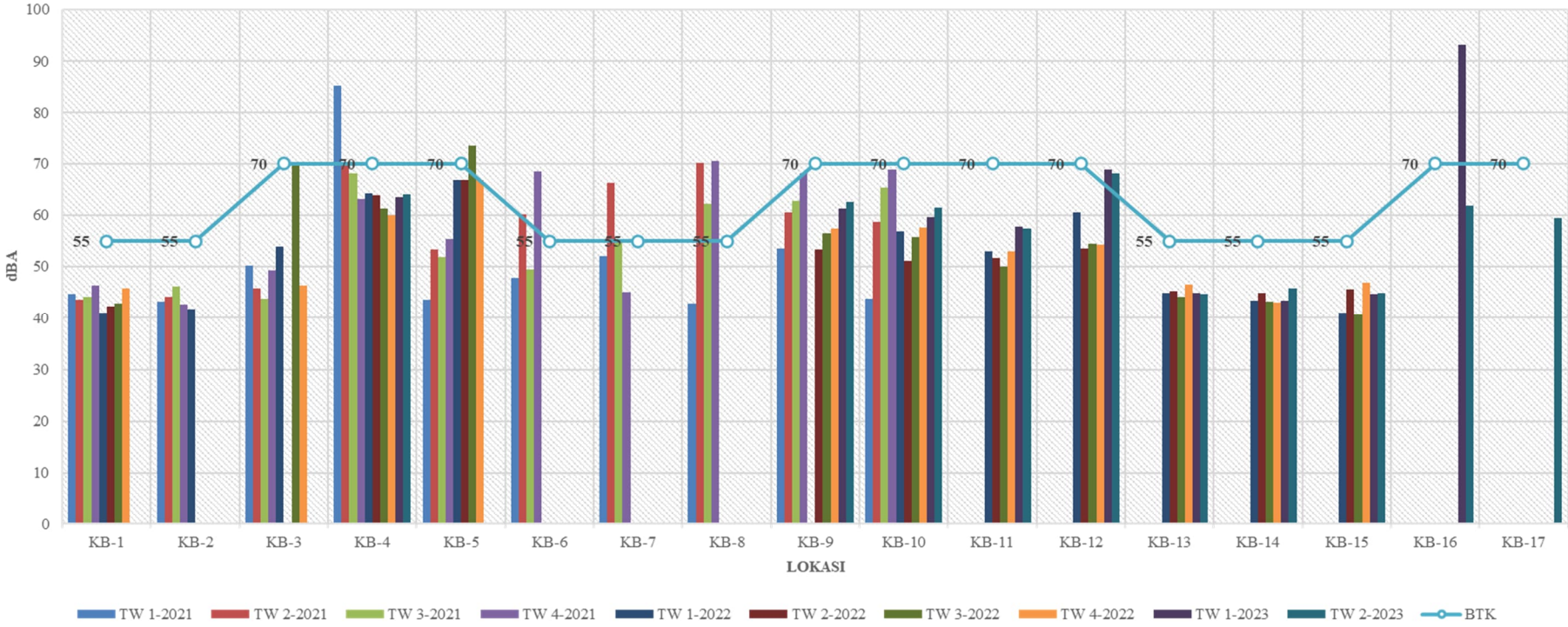


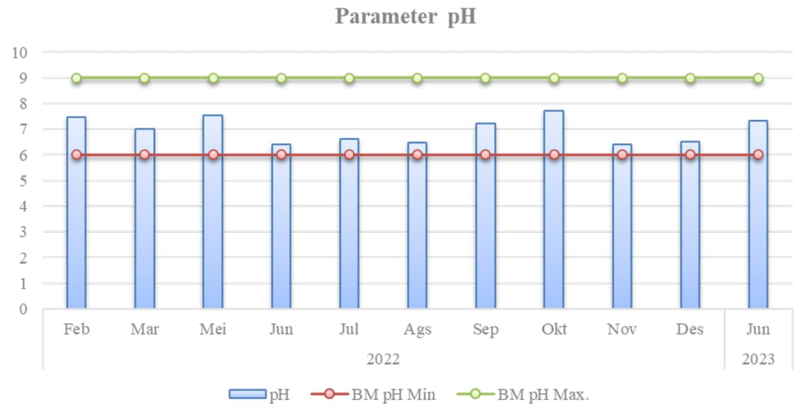
Figure 11 Fluctuation in Average Day-Night Noise Level (L-sm) of - Patuha Unit 2 Project Activity

C. Water Quality

1. Evaluation of Trends in Source (Domestic Wastewater)

Monitoring of domestic wastewater during the implementation of steam field development and the construction of PLTP Patuha Unit 2 has been in progress since the first quarter of 2022. This enables a comprehensive comparison of domestic wastewater quality conditions in the first quarter of 2023 with those observed during previous monitoring periods. To assess trends in domestic wastewater quality, a meticulous evaluation is conducted by comparing the outcomes of laboratory analysis with the domestic wastewater quality standards outlined in Minister of Environment and Forestry Regulation No. 68 of 2016.

In the second quarter of 2023, an evaluation of the wastewater quality generated from activities in the Temporary Office was carried out, considering parameters such as pH, TSS, BOD_5, COD, NH_3, and Total Coliform. Remarkably, the collective results conform to the quality standards mandated by PermenLHK No. 68 of 2016, which focuses on Domestic Wastewater Quality Standards**. It's important to note that domestic wastewater generated from all the construction activities related to PLTP Patuha Unit 2 was regularly transferred to outside area, ensuring that it does not pose a pollution threat to the surface water in the vicinity of the Patuha area**. The evaluation of the alignment of produced domestic wastewater with the designated domestic wastewater quality standards is comprehensively presented in the figures that follow. The figures indicated that in certain month quality of domestic waste water decreased compared to other month, it was probably due to season affect, during dry season usually quality of domestic waste water was decreased.



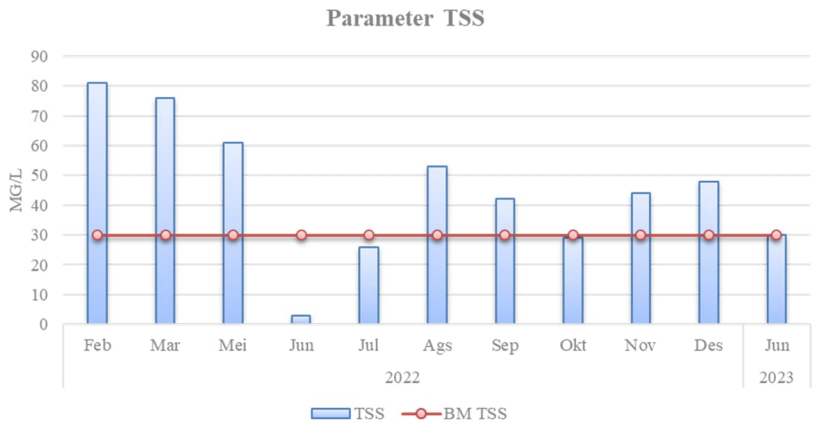
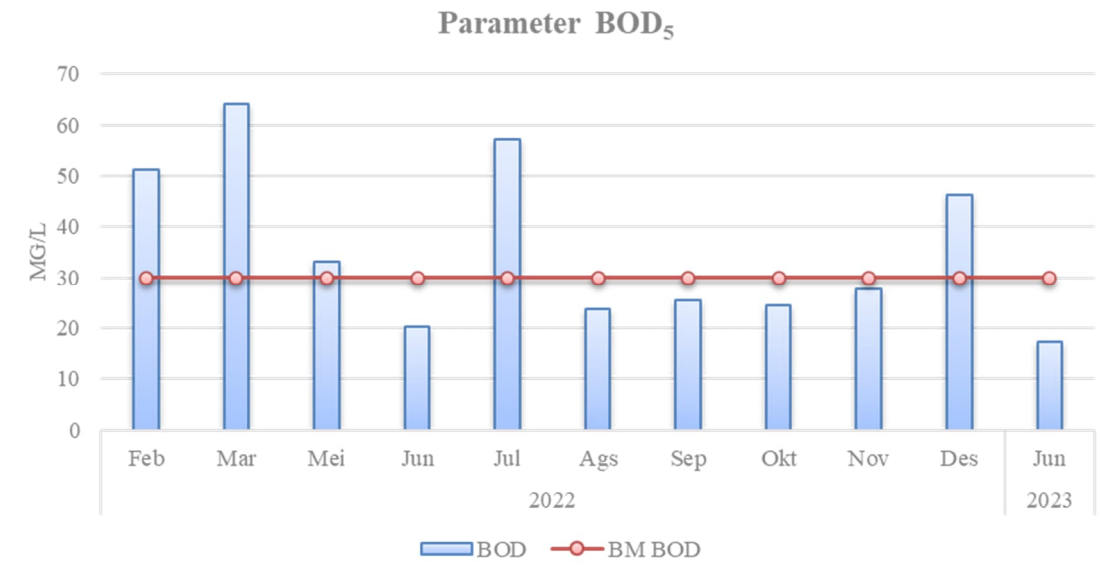


Figure 12 Fluctuations in pH and TSS Parameters in Domestic Wastewater From WWTP Temporary Office Outlets



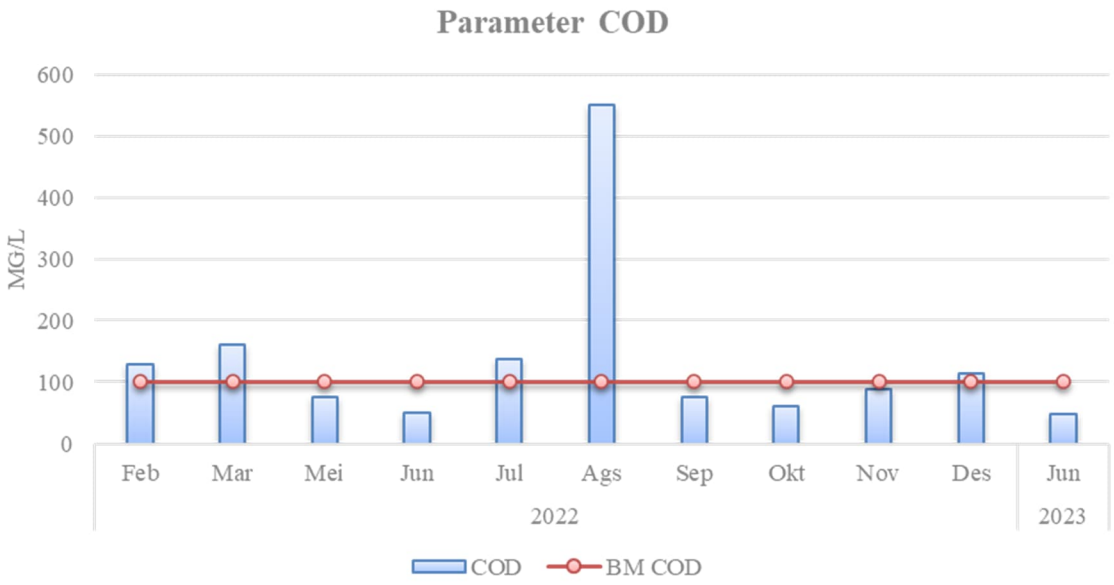


Figure 13 Fluctuation of BOD_5 and COD Parameters in Domestic Wastewater From WWTP Temporary Office Outlet

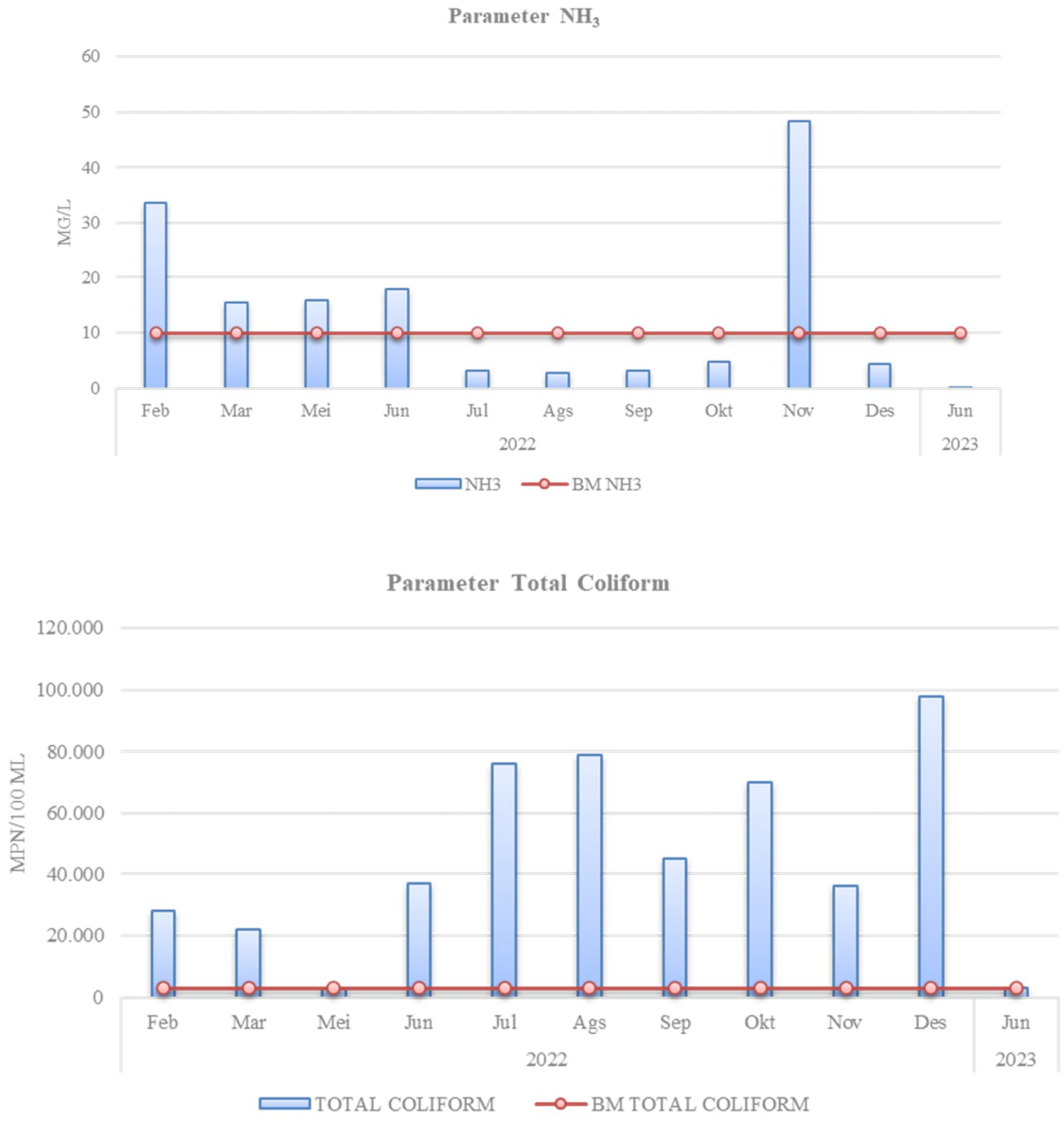


Figure 14 Fluctuations in NH_3 Parameters and Total Coliform in Domestic Wastewater From WWTP Temporary Office Outlets

2. Evaluation of Surface Water Trends

The River Water Pollution Index (IP) during the pre-construction and initial construction phases of Patuha Unit 2 are summarized in **Table 25**. During the second quarter of 2023, all five water bodies showed a relatively low pollution index. The trend of surface water IP for these rivers is presented in Figure 14. In particular, the monitoring conducted in the second quarter of 2023 showed a consistent pattern of river water IP at five monitoring locations showed the lightly contaminated category.

Table 26 Results of Calculation of Surface Water Quality Status of Patuha Unit 2 Activities

Year	Monitoring Period	CIWIDEY HULU River		CIBUNI HULU River		CIPANDAK WETAN River		CIKAHURIPAN River		CIPAKU River	
		IP	Status	IP	Status	IP	Status	IP	Status	IP	Status
2021	Q-1	0,56	Good	0,82	Good	1,55	Lightly contaminated	0,90	Good	-	-
	Q-2	1,01	Lightly contaminated	0,84	Good	0,49	Good	0,53	Good	-	-
	Q-3	0,53	Good	0,54	Good	1,58	Lightly contaminated	1,56	Lightly contaminated	-	-
	Q-4	0,60	Good	0,85	Good	0,77	Good	2,17	Lightly contaminated	-	-
2022	Q-1	-	-	-	-	0,54	Good	-	-	-	-
	Q-2	0,50	Good	0,52	Good	0,51	Good	0,56	Good	-	-
	Q-3	0,59	Good	0,53	Good	1,86	Lightly contaminated	0,58	Good	-	-
	Q-4	0,57	Good	3,43	Lightly contaminated	0,53	Good	0,53	Good	-	-
2023	Q-1	2,16	Lightly contaminated	0,91	Good	1,64	Lightly contaminated	0,53	Good	1,80	Lightly contaminated
	Q-2	2,35	Lightly contaminated	2,29	Lightly contaminated	1,66	Lightly contaminated	3,54	Lightly contaminated	2,10	Lightly contaminated

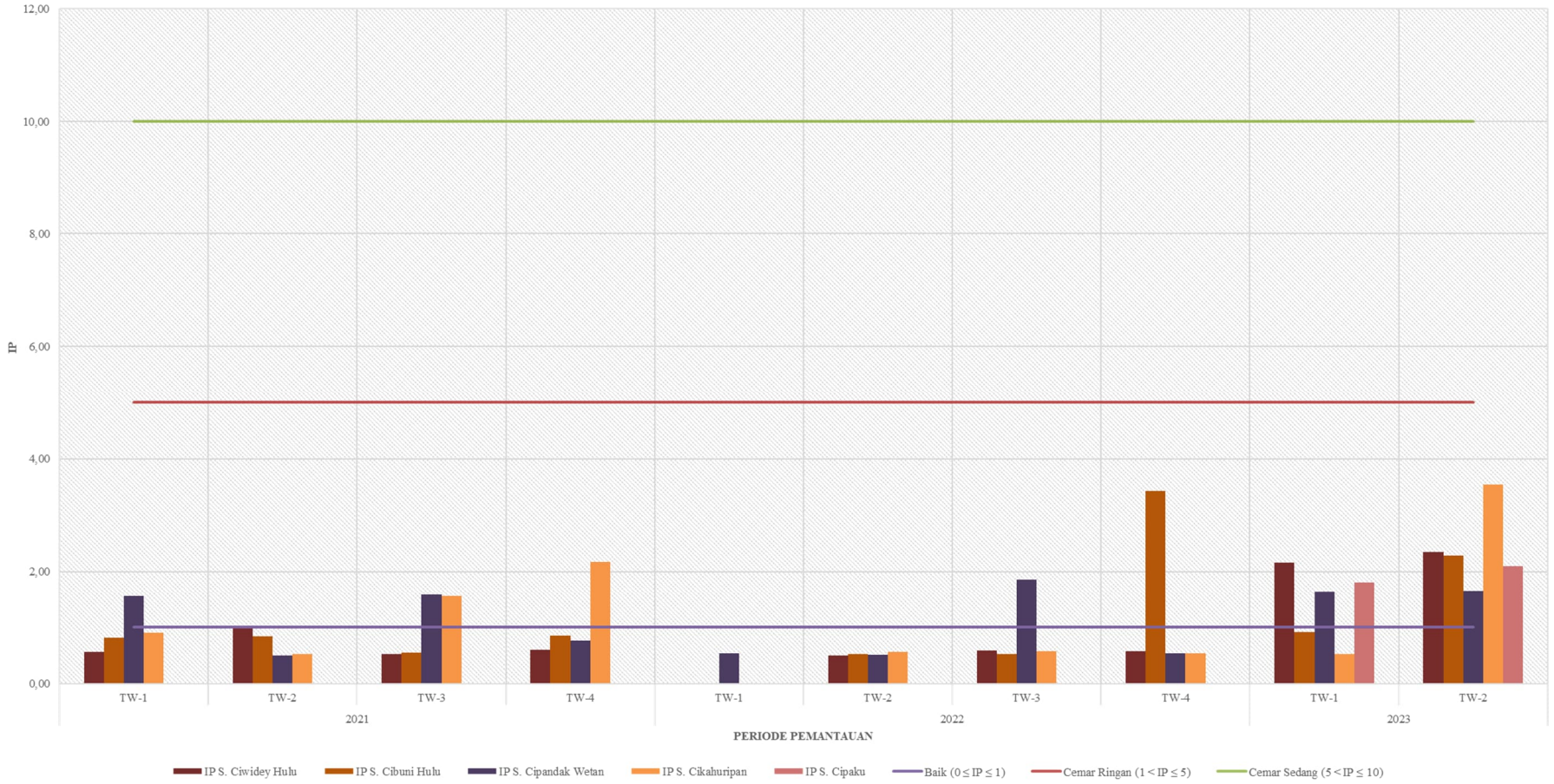


Figure 15 Trend of Tendency of Surface Water Pollution Index (IP) of Patuha PLTP Unit 2 Activities

D. Flora

The vegetation community present at the BB locations and access roads comprises a montane zone mountain natural forest (van Steenis, 2006). The ongoing activity at the Patuha 2 site involves the construction of a new well. This new well's establishment involved clearing forest cover over an area of 2.85 hectares.

Results obtained from vegetation sampling at the Loc BB revealed the presence of 107 species of plants. Through vegetation analysis, it was estimated that a land clearing of approximately 580 meters occurred for access points and BB areas, covering a total area of 0.58 hectares. In the BB areas, a vegetation exposure of 2.2 hectares was recorded, accounting for 2,856-3,512 individual stands across 107 plant species (including 35 tree species) (RKL-RPL Report Quarter 4, 2022).
This clearing activity led to increased growth of shrubs along the edges of the land openings, often followed by the proliferation of invasive shrubs and wild plants (IAPS). The emergence of these invasive species could potentially compete with seedlings in the natural forest. However, in the monitored area, the growth of edge shrubs has not significantly disrupted the natural forest vegetation due to the intricate nature of the forest's composition. The monitored natural forests in this area are secondary forests in a state of ongoing transition (succession) towards stability.

The vegetation categorizes at Loc BB are stakes, shrubs, seedlings, and bottom plants. However, changes in the tree category are relatively less discernible due to the gradual average increase in tree diameter, which is typically around 0.49-0.79 cm/year for hardwood trees (Qirom, 2022), resulting in relatively stable conditions.

Assessments of vegetation conditions at BB locations are facilitated by the species diversity index (H') within categories such as stakes, shrubs, seedlings, and undergrowth for each quarter. Generally, by comparing the species diversity index (H') values using the Shannon & Wiener index, notable changes in flora conditions at the Loc BB site can be observed:

- **Tree category**: Quarter-1 of 2023 to Quarter-2 of 2023 is classified as medium (1<H'<3).
- **Pole category**: From 2022 to Quarter-1 of 2023 to Quarter-2 of 2023 is classified as medium (1<H'<3).
- **Stake category**: From 2022 to Quarter-1 of 2023 to Quarter-2 of 2023 was classified as medium (1<H'<3).
- **Shrub category**: For Quarter-1 of 2022, there was no H' value, while H' values for Quarters 2 to 4 of 2022 were classified as medium (1<H'<3), and for Quarter-1 of 2023, H' is low, whereas for the 2nd quarter of 2023, it is classified as medium (1<H'<3).
- Seedling and undergrowth category: From 2022 to Quarter-1 of 2023 to Quarter-2 of 2023 was classified as moderate (1<H'<3).

For further details, please refer to the provided table and figure.

Table 27 Biodiversity Index (H') at Loc BB

Location	Time		Diversity Index (h')				
			Tree	Pole	Stake	Bush	Seedling &; undergrowth
LOC BB	2021	Q-1	2,60	2,39	2,34	2,17	2,22
		Q-2	2,60	2,39	2,34	2,17	2,22
		Q-3	2,60	2,39	2,34	2,17	2,22
		Q-4	2,60	2,39	2,22	1,95	1,56

Location	Time		Diversity Index (h')				
			Tree	Pole	Stake	Bush	Seedling &; undergrowth
	2022	Q-1	2,60	2,39	2,18	2,21	2,38
		Q-2	1,76	2,34	2,27	1,33	1,60
		Q-3	1,76	2,34	2,27	1,46	2,06
		Q-4	1,76	2,36	2,30	1,52	2,06
	2023	Q-1	1,33	1,83	2,65	0,41	2,8
		Q-2	1,64	2,02	2,79	1,23	2,12

Source: Compilation of Monitoring Data, 2021 – Second Quarter of 2023

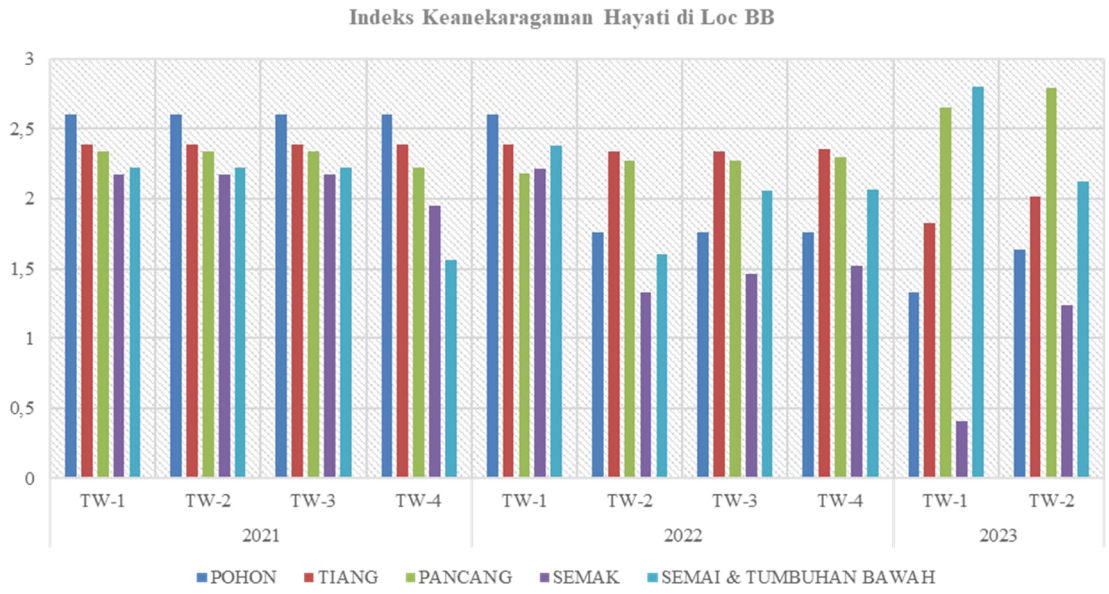


Figure 16 Biodiversity Index (H') in Loc BB Area

E. Fauna

Trends in the diversity of fauna species shows dynamic of diversity indices and findings of the species number. In general, population dynamics is the portion of ecology that deals with the variation in time and space of population size and density for one or more species1.

Monitoring of fauna diversity in the proposed area of Patuha Unit 2 Power Plant has been carried out continuously since 20 21. In general, there are fluctuations both in terms of diversity index and the number of findings of fauna species in each monitoring period. The fluctuations that occur do not have a significant impact. Fluctuations that occur as a result of different responses to habitat conditions. The following is an explanation of faunal conditions based on taxa:

[1] Begon M, Harper JL, Townsend CR. Ecology: Individuals, populations, and communities. 2. Blackwell Scientific Publications; Boston MA: 1990

a. Avifauna

The presence of various types of avifauna at each monitoring period describes the diverse conditions of habitation and the conditions in which the land cover has changed. Based on the results of monitoring at the Loc BB in the second quarter of 2023, 52 species from 32 families were found. Successful changes to the stock of security are recorded in monitoring in 2021 to quarterly 2 in 2023, along with the diversity of security patterns that can be seen in the **Figure 17**.

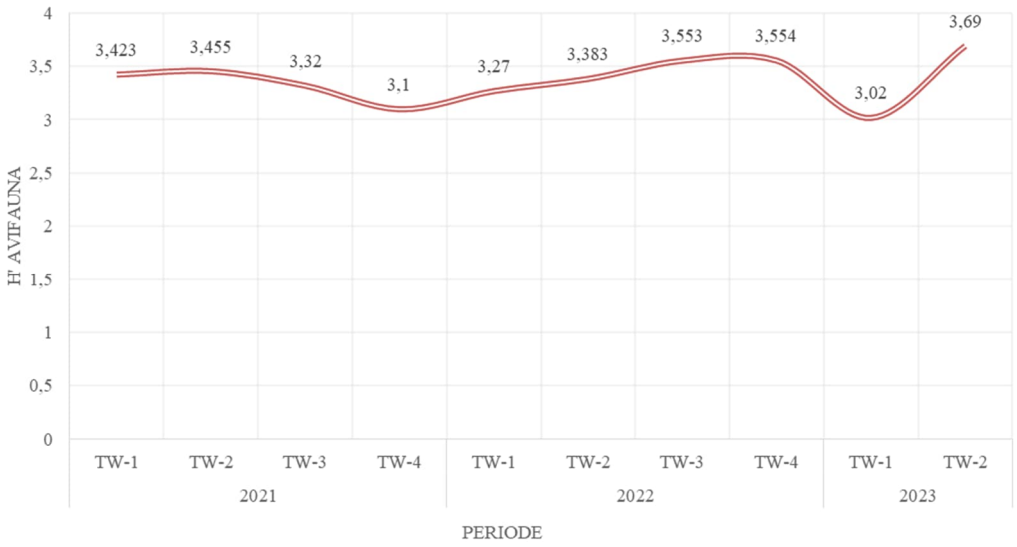


Figure 17 Avifauna Diversity Index (H') Trend at Loc BB Area

In each monitoring period, the encounter of types and values of avifauna diversity index (H') moves dynamically. This is common and one of them is due to different responses to different habitat conditions such as plant phenology, climate and ecological conditions. In general, the diversity index of avifauna in this semester is higher than 3 which showed the high diversity. Generally, the monitoring results showed high diversity of avifauna in this area. During semester 1, 2023 number of avifauna observed was higher than previous semester.

Table 28 Bird Species, Endemicity, and Protection Status, at Loc BB

No	Family	Scientific Name	Local Name	Conservation Status			
				Endemic	RI	CITES	IUCN
1	Accipitridae	*Spilornis cheela*	Elang Ular-bido		D	II	LC
2		*Ictinaetus malayensis*	Elang Hitam		D	II	LC
3	Aegithinidae	*Aegithina tiphia*	Cipoh Kacat				LC
4		*Psaltria exilis*	Cerecet Jawa	J			LC
5	Alcedinidae	*Halcyon chloris*	Cekakak Sungai				LC
6	Apodidae	*Collocalia linchi*	Walet Linci				LC
7	Campephagidae	*Hemipus hirundinaceus*	Jinjing Batu				LC

No	Family	Scientific Name	Local Name	Conservation Status			
				Endemic	RI	CITES	IUCN
8		*Lalage nigra*	Kapasan Kemiri				LC
9		*Pericrocotus miniatus*	Sepah Gunung				LC
10	Cuculidae	*Cacomantis merulinus*	Wiwik Kelabu				LC
11		*Cacomantis sepulcralis*	Wiwik Uncuing				LC
12		*Cuculus saturatus*	Kangkok Ranting				LC
13	Dicaeidae	*Dicaeum sanguinolentum*	Cabai Gunung				LC
14		*Dicaeum trigonostigma*	Cabai Bunga-api				LC
15	Dicruridae	*Dicrurus leucophaeus*	Srigunting Kelabu				LC
16	Hirundinidae	*Hirundo tahitica*	Layang-layang Batu				LC
17	Leiotrichidae	*Alcippe pyrrhoptera*	Wergan Jawa	J			LC
18	Megalaimidae	*Psilopogon armilaris*	Takur Tohtor	J&B	D		LC
19	Motacillidae	*Motacilla cinerea*	Kicuit batu				LC
20	Muscicapidae	*Culicicapa ceylonensis*	Sikatan Kepala Abu				LC
21		*Eumyias indigo*	Sikatan Ninon				LC
22		*Ficedula hyperythra*	Sikatan Bodoh				LC
23		*Ficedula mugimaki*	Sikatan Mugimaki				LC
24		*Ficedula westermanni*	Sikatan Belang				LC
25		*Muscicapa dauurica*	Sikatan Bubik				LC
26		*Myiomela diana*	Berkecet Biru-tua				LC
27	Nectarinidae	*Aethopyga eximia*	Burung Madu-gunung				LC
28		*Aethopyga mystacalis*	Burung Madu-jawa		D		LC
29		*Arachnothera affinis*	Pijantung Gunung				LC
30	Paridae	*Grate cinereus*	Gelatik Batu				LC
31	Pellorneidae	*Pnoepyga pussila*	Berencet kerdil				LC
32		*Turdinus sepiarius*	Pelanduk Semak				LC
33	Phasianidae	*Arborophila javanica*	Puyuh-gonggog Jawa	J			LC
34	Phylloscopidae	*Phylloscopus trivirgatus*	Cikrak Daun				LC
35	Pycnonodidae	*Pycnonotus aurigaster*	Cucak Kutilang				LC
36	Rhipiduridae	*Rhipidura phoenicura*	Kipasan Ekor-merah				LC
37	Scotocercidae	*Tesia superciliaris*	Tesia Jawa	J			LC
38	Sittidae	*Sitta frontalis*	Munguk Beledu				LC
39	Strurnidae	*Acridotheres javanicus*	Kerak Kerbau				VU
40	Timaliidae	*Cyanoderma melanothorax*	Tepus Pipi-perak	J&B			LC
41	Turdidae	*Brachypteryx leucophrys*	Cingcoang Coklat				LC
42	Vireonidae	*Pteruthius aenobarbus*	Ciu Kunyit	J			LC
43	Eurilaimidae	*Eurylaimus javanicus*	Sempur-hujan rimba				NT
44	Falconidae	*Falco moluccensis*	Alap-alap sapi		D	II	LC
45	Picidae	*Reinwardtipicus validus*	Pelatuk kundang				LC
46		*Dendrocopus macei*	Caladi ulam				LC
47		*Dendrocopus moluccensis*	Caladi tilik				LC
48	Trogonidae	*Harpactes oreskios*	Luntur harimau		D		LC
49	Muscicapidae	*Ficedula dumetoria*	Sikatan dada merah				NT
50	Timaliidae	*Pellorneum capistratum*	Pelanduk topi hitam				LC
51		*Pteruthius flaviscapis*	Ciu besar				LC
52	Coraciidae	*Eurystomus orientalis*	Teong-lampu biasa				LC

Source: Primary Data, June 2023
Information:

1. *RI: Law No. 106 concerning Plant and Protected Animals*
2. *IUCN (International Union for Conservation of Natur) EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern; DD = Data Deficient; CR= Critically Endangered*

3. *CITES (Convention of International Trade in Endangered Species of Wild Fauna and Flora). Appendices II: List of internationally tradable wildlife species with specific quota restrictions based on accurate data on populations and their natural tendencies*
4. *END =Endemicity : J = Java ; B = Bali ; K = Kalimantan ; S = Sumatra; I= Indonesia, D= Protected*

b. Mammal

Monitoring biodiversity, especially mammals in the Patuha Unit 2 Power Plant area, has been carried out since 2021 to the second quarter of 2023. **Table 29** shows results of monitoring on mammal during the period of 2021 to 2023. It seems the dynamic of species composition during the monitoring period where the number of species ranges between 13 and 18. There are two species were commonly observed during the monitoring period including Javan Surili *Presbytis comate*) and Bajing Kelapa (*Callosciurus notatus*). Of noted, several key or protected species were recorded also based on camera trapping, interview and direct observation, including Javan Leopard (*Panthera pardus melas*), Javan Langur (*Trachypithecus auratus*), Muntjak Deer (*Muntiaus muntjak*), Javan Slow Loris (*Nycticebus javanicus*), Banded Linsang (*Prionodon linsang*), Sunda Pangolin (*Manis javanica)*, and Sunda porcupine (*Hystrix javanica*).

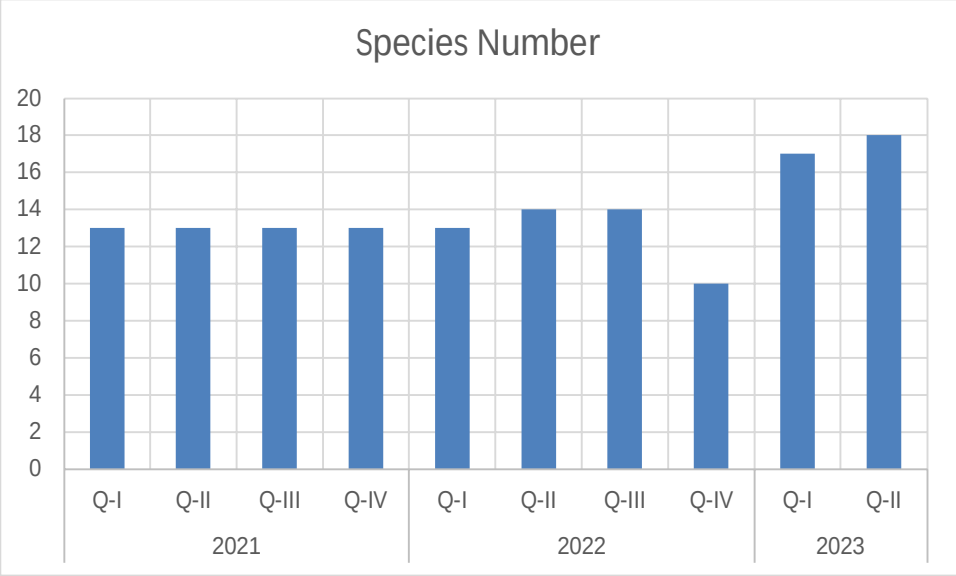


Figure 18 Number of Mammal Species recorded in the Loc BB Area

Table 29 List of Species and Conservation Status of Mammals at Loc BB Area

NO	LOCAL NAME	SPECIES	CONSERVATION STATUS			MONITORING PERIOD									
			RI	CITES	IUCN	2021				2022				2023	
						Q-I	Q-II	Q-III	Q-IV	Q-I	Q-II	Q-III	Q-IV	Q-I	Q-II
1	Babi hutan	*Sus scrofa*			Lc	W	W	W	W	W	W	W	W	F	W
2	Bajing kelapa	*Callosciurus notatus*			Lc	O,W	O,W	O,W	O,W	O,W	O	O	O	O	O
3	Garangan	*Herpestes javanicus*			Lc	W	W	W	W	W	W	W	W	W	W
4	Kelelawar/codot	*Cynopterus minutus*			Lc	W	W	W	W	W	W	W	-	-	-
5	Kijang	*Muntiaus muntjak*	P	II	Lc	-	-	-	-	-	-	-	CT	W	W
6	Kucing hutan	*Prionailurus bengalensis*	P	II	Lc	W	W	W	W	W	W	W	CT	W	W
7	Linsang	*Prionodon linsang*	P	II	Lc	W	W	W	W	W	W	W	-	-	-
8	Lutung	*Trachypithecus auratus*	P	II	Vu	W	W	W	W	W	O	O	O	W	W
9	Monyet ekor panjang	*Macaca fascicularis*		II	En	W	W	W	W	W	O	W	-	-	-
10	Musang Luwak	*Paradoxurus hermaphroditus*		III	Lc	W	W	W	W	W	W	W	W	W	W
11	Sigung	*Mydaus javanensis*			Lc	W	W	W	W	W	W	W	-	-	-
12	Surili	*Presbytis comate*	P	II	En	O,W	O,W	O,W	O,W	O,W	O	O	O	O	O
13	Tikus	*Rattus exulans*			Lc	W	-	-	-	-	W	W	-	-	-
14	Tikus belukar	*Rattus tiomanicus*			Lc	W	O,W	O,W	O,W	O,W	O	W	W	W	W
15	Tupai kekes	*Tupaia javanicus*		II	Lc	-	W	W	W	W	W	W	O	O	O
16	Trenggiling	*Manis javanica*	P	I	Cr	-	-	-	-	-	-	-	-	W	W
17	Macan tutul Jawa	*Panthera pardus melas*	P	I	EN	-	-	-	-	-	-	-	-	W	W
18	Landak	*Hystrix javanica*	P	II	Lc	-	-	-	-	-	-	-	-	W	W
19	Sero	*Amblonyx cinerea*		I	Vu	-	-	-	-	-	-	-	-	W	W
20	Kukang	*Nycticebus javanicus*	P	I	Cr	-	-	-	-	-	-	-	-	W	W

INO: Geothermal Power Generation Project

21	Musang Pandan	*Viverricula indica*		III	Lc	-	-	-	-	-	-	-	-	W	W
22	Careh bulan	*Paguma larvata*		III	Lc	-	-	-	-	-	-	-	-	W	W
23	Biul	*Melogale orientalis*			Lc	-	-	-	-	-	-	-	-	W	W
TOTAL SPECIES						13	13	13	13	13	14	14	10	17	18

Source: Primary Data, June 2023
Information:

1. *RI: Government of Indonesia Law No.106 concerning Protected Plant and Animal Species*
2. *IUCN (International Union for Conservation of Nature): EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern; DD = Data Deficient; CR= Critically Endangered*
3. *CITES (Convention of International Trade in Endangered Species of Wild Fauna and Flora). Appendices II: List of internationally tradable wildlife species with specific quota restrictions based on accurate data on populations and their natural tendencies.*
4. *CT = Camera Trap, D= Protected*
5. *W= Interview, O=Observed, J= Footprint*

c. Herpetofauna (Amphibians & Reptiles)

Monitoring biodiversity, including herpetofauna, in the Patuha Unit 2 Power Plant area has been carried out from 2021 to Q2 of 2023**. Figure 19** shows results of monitoring on herpetofauna during the period of 2021 to 2023. It seems the dynamic of species composition during the monitoring period where the number of species ranges between 14 and 20. None of them is categorized in protected species. The positive trend is seen when the number of species in Q-2 2023 is high compared with the Q-I 2021. There are three species were commonly observed during the monitoring period including Kodok Tegalan or rice field frog (*Fejervarya limnocharis*), Kadal kebun or Common Sin Skink (*Eutropis multifasciata*), and Kadal rumput or Asian grass lizard (*Takydromus sexlineatus*).

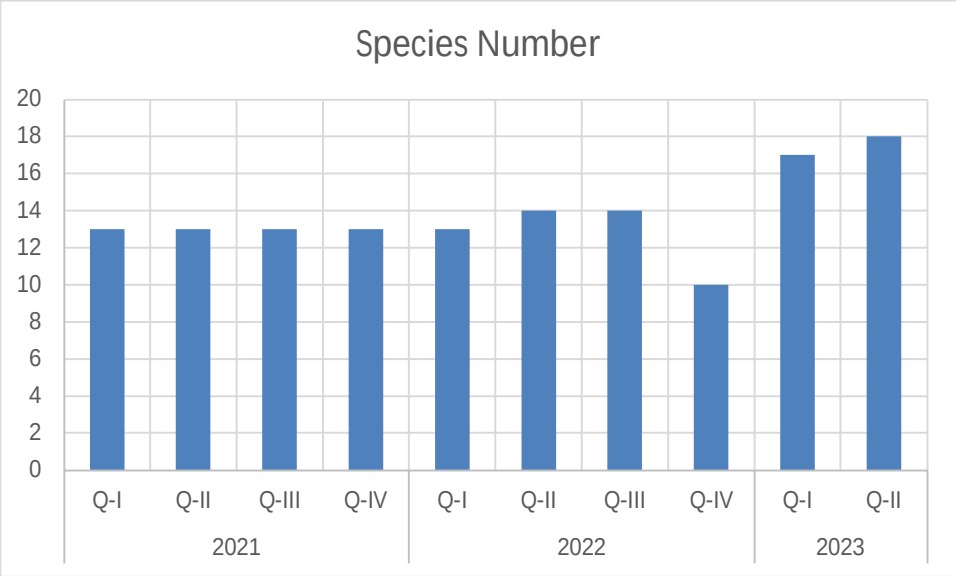


Figure 19 Number of recorded Herpetofauna Trend at Loc BB Area

Table 30 List of Herpetofauna at Loc BB during the Period 2021 to the Q-II of 2023

No	Local Name	Scientific Name	Monitoring Period									
			2021				2022				2023	
			Quarter									
			I	II	III	IV	I	II	III	IV	I	II
Amphibians												
1	Bangkong Kolong	*Bufo melanostictus*	O	-	-	-	-	O	O	-	O	O
2	Katak bibir putih	*Chalcorana chalconota*	-	O	O	O	O	-	-	O	-	-
3	Katak pohon bergaris	*Polypedates leucomystax*	-	O	-	-	-	-	-	-	O	O
4	Katak Tanduk	*Megophrys montana*	-	-	-	-	-	O	-	O	-	-
5	Kodok Tegalan	*Fejervarya limnocharis*	O	O	O	O	O	O	O	-	O	O
Reptile												
6	Bunglon	*Bronchocela cristatella*	O	-	-	-	-	-	-	O	O	O
7	Cecak rumah	*Hemidactylus frenatus*	O	O,W	O,W	O,W	O,W	O	O	O	O	-
8	Cekibar	*Draco volans*	O	O,W	O,W	O,W	O,W	O	W	O	O	O
9	Kadal kebun	*Eutropis multifasciata*	O	O	O	O	O	O	O	O	O	O
10	Kadal rumput	*Takydromus sexlineatus*	O	O	O	O	O	O	O	O	O	O
11	Sanca bodo	*Python morulus*	W	W	W	W	W	W	W	W	O	O
12	Sanca kembang	*Python reticulatus*	W	W	W	W	W	-	W	W	W	W
13	Tokek	*Gekko gecko*	W	O,W	O,W	O,W	O,W	O	W	O	W	W
14	Ular cabe	*Calliophis intertinalis*	W	W	W	W	W	-	W	-	W	W

No	Local Name	Scientific Name	Monitoring Period									
			2021				2022				2023	
			Quarter									
			I	II	III	IV	I	II	III	IV	I	II
15	Ular gibug	*Agkistrodon rodhostoma*	W	W	W	W	W	W	W	-	W	W
16	Ular jail	*Ptyas korros*	W	-	-	-	-	O	-	-	W	W
17	Ular pelangi	*Xenopeltis unicolor*	W	W	W	W	W	W	W	-	W	W
18	Ular picung	*Rhabdophis subminiatus*	W	W	W	W	W	O	W	-	W	W
19	Ular pucuk	*Ahaetulla prasina*	W	W	W	W	W	O	W	W	W	W
20	Ular sapi	*Coelognathus radiatus*	W	W	W	W	W	-	W	-	W	W
21	Ular sendok jawa	*Naja sputatrix*	W	W	W	W	W	W	W	W	W	W
22	Ular tambang	*Dendrelaphis pictus*	W	-	-	-	-	O	-	W	W	W
23	Ular weling	*Bungarus candidus*	W	W	W	W	W	W	W	W	W	W
Sum			20	18	17	17	17	17	17	14	21	20

Source: Primary data, 2021 – 2022 (QI – QIV) and 2023 (QI – QII)
Note: W= Interview, O=Observed, F= Footprint

F. Aquatic Biota

The influence of steam field development activities and the construction of Patuha Unit 2 on the diminishing productivity of aquatic biota is evident through the examination of biological impact indicators, focusing specifically on the diversity index of monitored aquatic biota, including plankton and benthos. Analyzing the monitoring results from the first quarter of 2023, the plankton diversity index remained relatively stable when compared to previous monitoring periods. Likewise, the benthic conditions have persisted as observed in the first quarter of 2023, with no benthos detected. However, when observing the trend across all monitoring years, both plankton and benthos exhibit a tendency to fluctuate, leading to variations in the diversity index. This suggests an ongoing dynamic interaction between the development activities and the aquatic ecosystem, resulting in shifting diversity patterns over time.

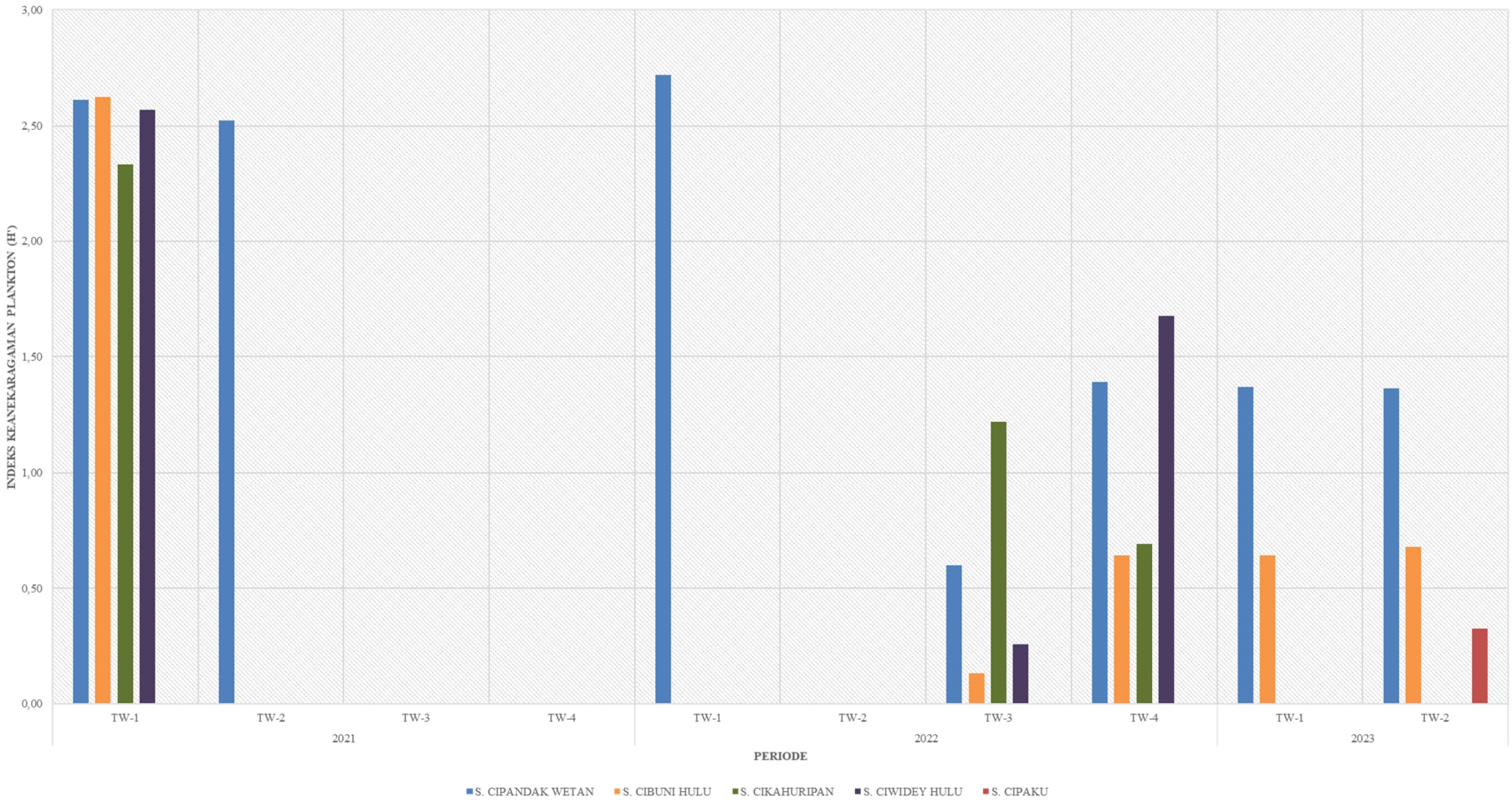


Figure 20 Trend of Plankton Species Diversity Index in Steam Field Development Activities and Patuha Unit 2 Power Plant Construction

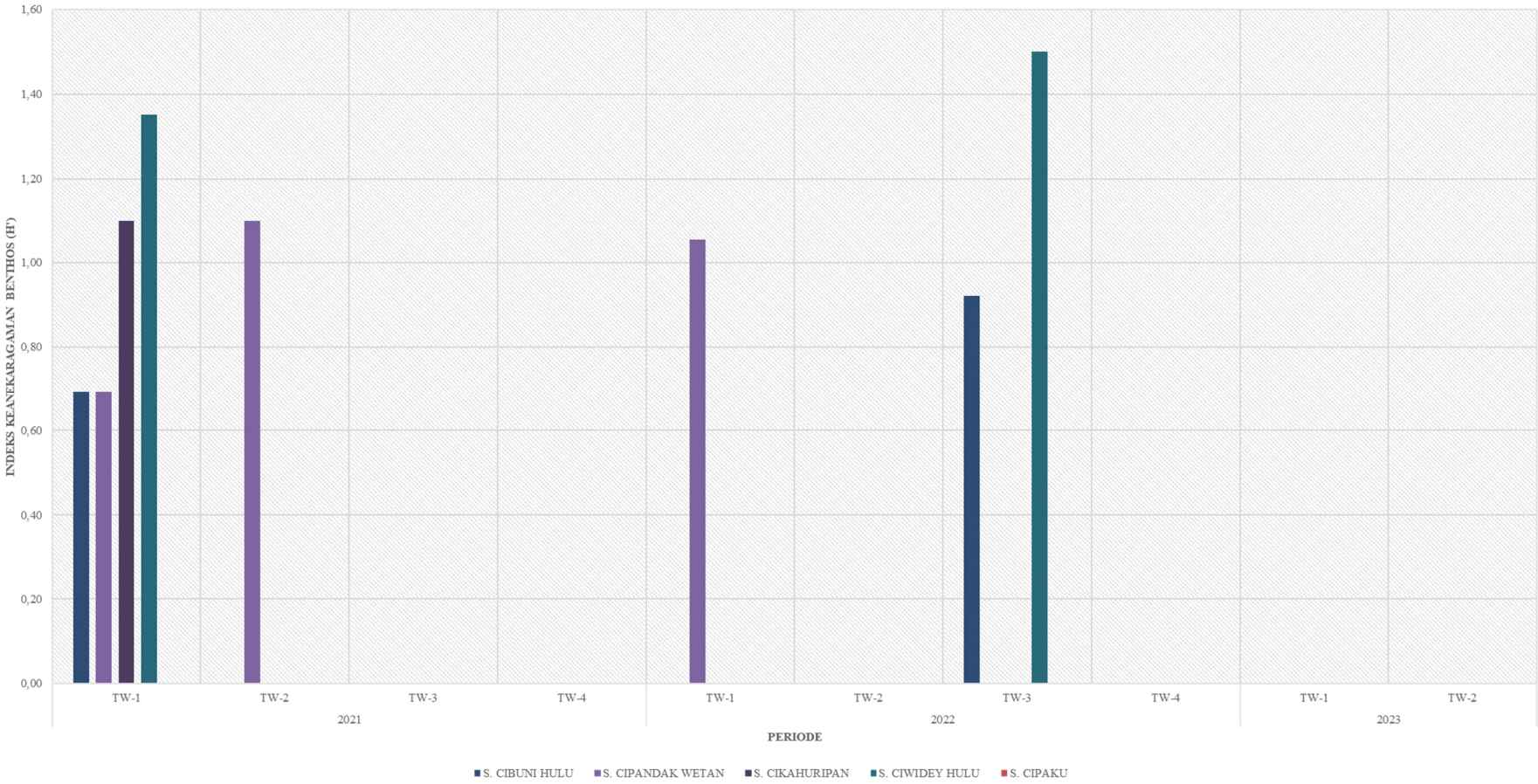


Figure 21 Benthos Type Diversity Index Trend in Steam Field Development Activities and Patuha Unit 2 Power Plant Construction

During the sampling period semester 1 2023, the river flow exhibited swiftness, leading to a decrease in substrate and food availability for the benthic organisms, whose nourishment primarily constitutes plankton. The limited availability of substrate and food might induce a slight decline or even potential disappearance of the benthic population hence bentos not appear during 2023 sampling, a phenomenon attributed to prevailing environmental conditions.

4.3 Construction Phase Affected People Consultation and Information Disclosure

From January to June 2023, 54 meetings at Dieng and 13meeting at Patuha have been conducted with the local community and leader. The meeting was aimed to disclose project information to the stakeholders. The meeting topics were various, including project updates, safety drilling and well testing, and grievances.

During the construction phase, the following table gives information on the consultations undertaken to understand the impact of the project on Affected People and how effective the EMP Mitigation measures were for residents, businesses, and other affected people around the construction sites.

PMU Social and Environmental Safeguard team has conducted numerous consultations by socialization, and direct approaches regarding Land Acquisition, RP Implementation, Grievance Redress Mechanism, Project Updates, Local Worker, Occupational Discussion, Occupational Community Development, etc. The following table summarized the consultation conducted during the January – June 2023 period at Dieng and Patuha.

Table 31. Construction Phase Affected People Consultation Dieng-2 Sub Project

No.	Date	Topic	Key Issues	Meeting Type/ Method	Venue	Count of Participants		Key Person Present (PMU/PMC/ Stakeholders)
						Female	Male	
1	02-Jan-23	Drilling plan for Pad 30	Coordination Meeting with Head of Karang Tengah Village on planned drilling at Pad 30	Coordination	Temporary Dieng 2 Project Office	0	5	PMU Dieng Unit 2, Karang Tengah Village government, contractor
2	02-Jan-23	Mobilization of contractor	Coordination meeting with Village Government related to mobilization of contractor at Pad 30	Coordination	Temporary Dieng 2 Project Office	0	5	PMU Dieng Unit 2, Karang Tengah Village government, contractor
3	02-Jan-23	PT Supraco work timeline	PMU meeting with Supraco regarding the plan to enter PAD 30, and requesting a work timeline from PT Supraco	Coordination	Temporary Dieng 2 Project Office	0	5	PMU Dieng Unit 2 and contractor
4	10-Jan-23	COMDEV	Presentation of the 2023 COMDEV to the Batur District	Meaningful Consultation	Resto SR4 Banjarnegara			Camat of Batur District
5	11-Jan-23	Addendum AMDAL for pad 12	Discuss the questionnaire used in the Addendum AMDAL for Pad 12	Discussion	GDE Office Dieng 1	3	7	PMU and AMDAL Team from Sucofindo
6	11-Jan-23	Building materials	Handover of iron from Ex Building Mess PLN Pad 38	Coordination	Well Pad 38	1	6	PMU, contractor, Government of Karang Tengah Village

No.	Date	Topic	Key Issues	Meeting Type/ Method	Venue	Count of Participants		Key Person Present (PMU/PMC/ Stakeholders)
						Female	Male	
7	11-Jan-23	Request information from a local community related to Pond Leakage at Pad 29	Addressing information request from a local community member who own the land next to the pond at Pad 29 regarding a leak and asking landowner's permission to install pipes and temporary reservoirs on the farmer's land as the preventive action.	Discussion	Village	0	3	PMU and Kepakisan Village Government
8	12-Jan-23	Permission to build on a private property	Request permit to build a retaining wall on Mrs. Nurjanah's land	Discussion	Kepakisan Village	0	4	PMU and Kepakisan Village Government
9	12-Jan-23	Impact of works at Pad 29	Discussions on the Mr. Mahidi's inquiry related alleged collateral damages caused by construction works at pad 29	Discussion	Pad 29	0	3	PMU and residents
10	12-Jan-23	PT Sucofindo's Work Plan on survey activities	Introduction, monographic data survey, physical survey, location of the Dieng 2 PLTP development plan. Delivered by the village head: 1. Saltwater Track Record, which in the past was the Sigogor spring	Coordination	Sikunang Village Office	7	2	PMU and Village Government

No.	Date	Topic	Key Issues	Meeting Type/ Method	Venue	Count of Participants		Key Person Present (PMU/PMC/ Stakeholders)
						Female	Male	
			2. Socialization can involve several related elements 3. There is potential for NGOs to enter, looking at their previous track records 4. Want to have a discussion first through the village government, not directly to the community.					
11	13-Jan-23	Utilization of scrap threaded pipes	Presentation by Enviro Team to Bumdes Karang Tengah regarding disposal of remaining scrap pipes	Meaningful consultation	Temporary Office	6	3	PMU Dieng 2 and BUMDes Karang Tengah
12	16-Jan-23	Water use payment	Payment of compensation to Pemdes Kepakisan for drawing water from Sidolok River	Coordination	Kepakisan Village	0	6	PMU Dieng 2 and Kepakisan Village Government
13	17-Jan-23	Water seepage at Pad 29	Investigation of alleged water seepage from pad 29 pond into the land of Pak Mahidi At the time there was a leak from the mud pond that just seeped into the residents' land...GDE patched the HDPE liner which leaked...but in the end GDE deactivated the	Coordination	Pad 29	0	3	PMU Dieng 2

No.	Date	Topic	Key Issues	Meeting Type/ Method	Venue	Count of Participants		Key Person Present (PMU/PMC/ Stakeholders)
						Female	Male	
			mud pond and finally it was dumped into mega pond 29 mixed with sidolok fresh water. Compllain has been resolved					
14	17-Jan-23	Rojimur and Siaga Teams	Follow up on the continuity of the Rojimur team which will be suspended temporarily	Coordination	Senkom	0	4	PMU Dieng 2, Rojimur and Siaga Teams
15	18-Jan-23	Perhutani Kedu Utara's tree	The tree f belonging to Perhutani on the side of the road near Pad 18 interferes with the movement of equipment	Coordination	Dieng	0	4	PMU Dieng 2 and Perhutani Kedu
16	18-Jan-23	Sale of perforated pipes	Determine market price of scrap perforated pipes	Coordination	Temporary office	1	3	PMU Dieng 2 and Karang Tengah BUMDEs
17	19-Jan-23	Drill cutting management procedures	Handling the Environmental Impact of Drilling Cutting Management Activities in Bitingan Hamlet	Coordination	Banjarnegara	0	5	PMU Dieng 2
18	19-Jan-23	Relocation of Dieng 2 power plant	Discussion of Social Communication Strategy for Power plant Relocation to Sikunang Vilalge	Coordination	Online	1	5	PMU-PMC Safeguard

No.	Date	Topic	Key Issues	Meeting Type/ Method	Venue	Count of Participants		Key Person Present (PMU/PMC/ Stakeholders)
						Female	Male	
19	24-Jan-23	Public consultation plan	Discussion of the development plan of Dieng 2 power plant	Discussion	Sikunang Village Office	1	5	PMU-PMC Safeguard, Head of Sikunang Village
20	25-Jan-23	Request information regarding pad 29 pond	Share the results of laboratory tests conducted	Discussion	Bpk. Berkah's House	0	2	PMU Dieng 2 and residents
21	26-Jan-23	Preparation of Pad 30 construction	Coordination regarding PT Supraco's Community Empowerment Activities at pad 30	Coordination	Pad 30	0	5	PMU Dieng 2 and Contractor
22	26-Jan-23	Land Acquisition	Payment of top-up of compensation for acquired land at Pad 7	Coordination	Ibu Hardati's House	2	2	PMU-PMC Social Safeguard and residents
23	26-Jan-23	Land Acquisition	Payment of top-up of compensation for acquired land at Pad 9	Coordination	Waljono's House	2	2	PMU-PMC Social Safeguard and residents
24	27-Jan-23	Termination of employment at Pad 30	Coordination of PT Supraco activities on Pad 30	Coordination	Pawuhan Sub-Village	0	5	PMU Dieng 2 and contractor
25	27-Jan-23	Power Plan Development Plan	Discuss the plan for preparing an environmental approval addendum document (AMDAL & RKL-RPL) in connection with the transfer of the site of	Meaningful consultation	Sikunang Village Hall	13	20	PMU-PMC, Sikunang Village residents

No.	Date	Topic	Key Issues	Meeting Type/ Method	Venue	Count of Participants		Key Person Present (PMU/PMC/ Stakeholders)
						Female	Male	
			the power plant to Sikunang Village					
26	27-Jan-23	PLN restringing work	Knowledge sharing on ROW compensation procedures in connection with transmission line restringing	Sharing session	PLN UPP JBT 4 office, Semarang	4	6	PMU-PMC Safeguard, PLN
27	30-Jan-23	Activities of Supraco at pad 30 Pawuhan	Community involvement in the procurement of materials for pad 30	Coordination	House of Karang Tengah Village chief	1	7	PMU Dieng 2, contractor, chief of Karang Tengah Village
28	30-Jan-23	Impacts pf well testing at Pad 9	Plant growth survey and follow-up plan	Survey	Farmland near Pad 9	0	4	PMU Dieng 2
29	31-Jan-23	Evaluation of pad 30 activities with Pemdes and Pawuhan Residents	Clarification regarding the replacement ball field, how much is still in the Pawuhan Hamlet area, Request for street light assistance	Coordination	RM Pororojo, Wonosobo	14	50	PMU and Pawuhan residents

No.	Date	Topic	Key Issues	Meeting Type/ Method	Venue	Count of Participants		Key Person Present (PMU/PMC/ Stakeholders)
						Female	Male	
30	31-Jan-23	Power Plan Development Plan	The objectives of the meeting were: dissemination of the Dieng-2 PLTP project development activity plan and information on the series of activities for preparing the AMDAL document.	Meaningful consultation	Sikunang Village Hall	6	52	PMU-PMC, Sikunang residents
31	03-Feb-23	Pad 30 Mobilization	Coordination meeting with Mr. Supri regarding mobilization of Auger at pad 30	Coordination	Pawuhan Sub-Village	0	5	PMU Dieng 2 and residents
32	06-Feb-23	Pond leak at Pad 29	Examine the source of pond leak and bring samples to the lab; follow up on findings regarding pond leak at pad 29	Coordination	Pad 29	0	6	PMU Dieng 2 and contractor
33	06-Feb-23	Impact pf well testing at Pad 9	Measurement of land affected by well testing at pad 9C a	Coordination	Farmland near Pad 9	0	4	PMU Dieng 2 and contractor
34	06-Feb-23	Perforated scrap pipes	Discussion with Karang Tengah BUMDes on acceptable price for scrap perforated pipes	Coordination	Temporary Office	1	3	PMU Dieng 2 and Karang Tengah's BUMDes
35	07-Feb-23	CSR Program Reconciliation - Batur	*Mechanism for channeling program funds *Partnership program *Submission of Village programs	Meaningful consultation	Dieng Unit Office	3	14	PMU, Batur Sub-district Government

No.	Date	Topic	Key Issues	Meeting Type/ Method	Venue	Count of Participants		Key Person Present (PMU/PMC/ Stakeholders)
						Female	Male	
36	08-Feb-23	Drilling Activities	Geological team and HSE drilling have conveyed Pad 29 drilling activities to the Mount Dieng monitoring post in light of the occurrence of several earthquakes It was conveyed that there was no significant effect of earthquakes occurred several times to Pad 29 and surrounding area	Coordination	Mount Dieng Karang Tengah Monitoring Post	0	5	PMU and Geological Team
37	08-Feb-23	Sikunang Village Chief's Tali Asih Program	1. Kejajar Sub-district Camat conveys support and openness for communication 2. The Village Head provides suggestions for a water pump program for an estimated 35 cultivators	Coordination	Kejajar Sub-District Office	0	6	PMU-PMC, Kejajar Sub-District Government
38	08-Feb-23	Sikunang Village Tali Asih Program Coordination	1. Submission of the tali asih program plan 2. The Village chief's suggestion for water pumps for 35 former cultivators	Coordination	Kejajar Sub-District Office	0	5	PMU-PMC, Head of Sikunang Village

No.	Date	Topic	Key Issues	Meeting Type/ Method	Venue	Count of Participants		Key Person Present (PMU/PMC/ Stakeholders)
						Female	Male	
39	8-9 Feb 2023	Emergency disaster preparedness	The purpose was to build public awareness of potential disasters in the environment around the Dieng Area, such as extreme weather, earthquakes, and landslides.	Training	Dieng Office	0	40	Karang Tengah residents, BPBD Banjarnegara, PMU Unit 2
40	09-Feb-23	activities at Pad 30	Follow-up regarding community empowerment brainstorming and evaluation regarding PT Supraco's activities at pad 30	Coordination	Wonosobo	1	8	PMU, Karang Tengah Village Government, Pawuhan residents
41	10-Feb-23	Payment to the Paritan Work Team at Pad 29	Make payment of wages for trenching work at Pad 9 location	Coordination	Temporary Office	0	6	PMU Dieng 2, workers at Pad 9
42	13-Feb-23	Handover of material aid to victims of house fire at Simpangan Sub-village	Material assistance: 1). Cement totaling 20 sacks 2). Plywood 6ml totaling 20 3). Kaso 50 pcs	Meaningful consultation	Simpangan Sub-village	0	3	PMU Dieng 2, Simpangan residents
43	14-Feb-23	External monitoring report (EMA: AMF)	Improvements to the substance of the report per PMU review	Coordination	Online	2	3	PMU-PMC, EMA
44	16-Feb-23	Landslide incident at pad 30	GDE and Supraco communicated regarding the landslide incident at pad 30	Coordination		0	6	GDE, contractor

No.	Date	Topic	Key Issues	Meeting Type/ Method	Venue	Count of Participants		Key Person Present (PMU/PMC/ Stakeholders)
						Female	Male	
45	17-Feb-23	Minutes of meeting	Signing of Minutes on handing-over used perforated casing Grame to Karang Tengah BUMDes	Coordination	Karang Tengah Village Office			PMU Dieng 2 and Karang Tengah BUMDes
46	22-Feb-23	Coordination with Batur Sub-District Head	Update on activities at pad 30 in Pawuhan Sub-village	Coordination	Batur Sub-District Office	1	3	PMU, Batur Sub-District Head
47	01-Mar-23	Sikunang Village clean water distribution program	Checking the distribution channels of clean water	Survey	Sikunang	0	5	PMU, Sikunang apparatus
48	14-Mar-23	Impact of Pad 9 well testing	FGD during ADB mission with community around Pad 9 related to the impact of well testing	FGD	House of community representative	9	8	PMU-PMC, ADB, Krajan community
49	14-Mar-23	Project impact and community program development	FGD during ADB mission with Pawuhan community related to project impact and community program development	FGD	Karang Tengah Village chief's house	11	14	PMU-PMC, ADB, Pawuhan residents
50	15-Mar-23	Livelihood of the women population	FGD during ADB Mission with women's group related to livelihood at Sikunang Village	FGD	Sikunang Village Hall	12	3	PMU-PMC, ADB, women group of Sikunang community

No.	Date	Topic	Key Issues	Meeting Type/ Method	Venue	Count of Participants		Key Person Present (PMU/PMC/ Stakeholders)
						Female	Male	
51	15-Mar-23	Plans for the power plant	FGD during ADB Mission with communities surrounding Pad 12 regarding the power plant	FGD	Office of the Sikunang Village Head	3	11	PMU-PMC, ADB, Sikunang residents
52	11-Mei-23	Mobilization	Meaningful Consultation of Mobilization Preparation from Pad 29 to Pad 30 for Pawuhan Community, Karang Tengah Village	Meaningful consultation	Temporary Office	5	47	PMU-PMC, contractor, Pawuhan Community
53	21-Jun-23	Spud in Pad 30	Meaningful consultation of spud in (drilling) Pad 30 for Pawuhan Community	Meaningful consultation	Pad 30	3	57	PMU-PMC, contractor, Pawuhan Community
54	23-Jun-23	Re-well testing at Pad 9C	Meaningful consultation with Krajan residents regarding re-well testing at Pad 9C	Meaningful consultation	Pad 9	3	49	PMU-PMC, contractor, Krajan Community
	Total					**116**	**544**	

Table 32. Construction Phase Affected People Consultation Patuha-2 Sub Project

No.	Date	Topic	Meeting Type / Method	Key Issues	Venue	Count of Participants		Key Person Present (PMU/PMC/ Stakeholders
						Female	Male	
1	04-Jan-23	Location verification of affected replacement forestland	Survey	Checking the location of compensation to match the existing block map at UPT Bapenda Bandung Regency accompanied by village officials	Sugihmukti Village	0	6	PMU Social Safeguard and Bappeda of Bandung Regency
2	12-Jan-23	BUMDEsma	Discussion	Discussion on BUMDesma Sugih Alam Lestari Improvement Plan	Yayasan Al-Huda Cikareo	0	6	PMU Social Safeguard and BUMDesma Sugoh Alam Lestari
3	16-Jan-23	IPPKH	Survey	Land Sector Map Measurement by Perhutani KRPH Ciwidey	Sugihmukti Village	1	18	PMU Patuha 2 and Perhuutani KRPH Ciwidey
4	07-Feb-23	Meeting with NGO, i.e. GMBI	Discussion	1. The GMBI party came to GDE to introduce the new chairman at the district level because the previous chairman had moved to the center. 2. GMBI asks to be involved in CSR implementation 3. GMBI wants to know about the CSR that has been carried out by GDE	Temporary Office			PMU Patuha 2 and GMBI

No.	Date	Topic	Meeting Type / Method	Key Issues	Venue	Count of Participants		Key Person Present (PMU/PMC/ Stakeholders
						Female	Male	
5	10-Feb-23	Handover of Sponsorship Compensation for Orphans	Meaningful consultation	Signing of Minutes and handing over gifts for Orphan Compensation to representatives of the Pacira Forum	Soreang Office	0	3	PMU, Pacira Forum
6	21-Feb-23	Discussion with F.P. Pacira, Grandmother Memet, and Rustandi Jurnal Soreang	Meaningful consultation	1. Update the situation 2. Interest Upload Planning 3. Project Socialization/Update Planning with NGOs/CSOs 4. Collaboration Offers from the Soreang Journal	Soreang Office			PMU and NGO
7	21-22 February 2023	Basic Safety Training	Training	Basic Safety Training Bumdesma Sugih Alam Lestari and partners	Temporary Office	0	15	PMU Patuha 2, Bumdesma Sugih Alam Lestari
8	01-Mar-23	Well testing	Meaningful consultation	Meaningful Consultation Pre well testing in Kp. Babakan Rancabolang: Well test plan notification, H2S Hazard Discussion, and H2S Hazard Handling Discussion	Kampung Babakan	29	25	PMU Patuha 2, Kampung Babakan Community
9	2 March 2023	Well testing	Meaningful consultation	Meaningful Consultation Pre well testing in Kp. Pasir Waas: Inform of well test plan, Discussion of H2S Hazards, Discussion of Handling H2S Hazards	Kampung Pasir Waas	13	17	PMU Patuha 2, Kampung Pasir Waas Community

No.	Date	Topic	Meeting Type / Method	Key Issues	Venue	Count of Participants		Key Person Present (PMU/PMC/ Stakeholders
						Female	Male	
10	20 March 2023	Situation of 27 landowners AHs	FGD	During the ADB Loan Review Mission, discussed about the land compensation and implementation of LRP	Sangkan Hurip	4	8	PMU, PMC, ADB, Sugihmukti Community
11	20 March 2023	UMKM/MSMEs	FGD	During the ADB Mission, FGD with women related to the progress of Saluyu's MSME activity and challenges	Sangkan Hurip	11	1	PMU, PMC, ADB, Panundaan Community
12	17-Mei-23	Community safety awareness	Meaningful consultation	Community safety awareness on potential hazards and disaster mitigation relative to volcanic earthquakes at Patuha mountain area.	Banjar Unit Rancabolang VIII office	21	36	Rancabolang community, most of whom work as tea plantation workers, PMU and PMC, Team from PVMBG (Center for Volcanology and Geological Hazard Mitigation)
13	25-Mei-23	LRP	Meaningful consultation	Meaningful consultation on rehabilitation support and LRP for 27 landowner at Sugihmukti Village	Sugihmukti Village Hall	8	24	PMU-PMC Social Safeguard, Sugihmukti Village Officers, landowner AHs
	TOTAL					**87**	**159**	

5 GRIEVANCES AND CORRECTIVE ACTION

5.1 Grievance Redress Mechanism

GDE has established a Standard Operation Procedure for its Grievance Redress Mechanism since 10 September 2020 with GDE's Decree No. 034.SK/PST.00-GDE/IX/2020. This SOP includes step-by-step instructions and specific time and workflows to handle stakeholder complaints effectively. The scope was divided into (i) Information, (ii) Consultation, and (iii) Mediation. A grievance log has been established. When relevant, the receipt and resolution of all grievances were reported here on a semi-annual basis in the Semi-Annual Environmental Monitoring Report when relevant.
For Dieng-2 Sub-Project (HALO DIENG 2), the communication media being used were:

a. Hotline : +62 812 – 10000 – 630
b. E-mail : halodieng2@geodipa.co.id
c. Complain Boxes : 4 boxes located at the Communication Centre (i.e. mosque in Pawuhan Sub-Village, the head of the village office, and mosque in Karangtengah Village)
d. Office : PT Geo Dipa Energi (Persero) Unit Dieng Jl. Raya Dieng-Batur, Banjarnegara

For Patuha-2 Sub-Project (HALO PATUHA 2), the communication media for grievances were as follows:

a. Hotline :+62 812 – 30000 – 630
b. E-mail : halopatuha2@geodipa.co.id
c. Office : PT Geo Dipa Energi (Persero) Unit Patuha, Jl. Rancabolang Km. 14, Desa Sugihmukti, Kec. Pasirjambu, Bandung

GDE has also established a Grievance Redress Committee referring to GDE's Decree No. 015.SK/PST.00-GDE/IV/2021 dated 15 April 2021. GDE conducted the first initial meeting of the Grievance Redress Committee in July-August 2021. GDE has intensified the Grievance Redress Mechanism disclosure/dissemination to stakeholders. Each local (village/sub-district) government office has a banner/leaflet/etc. related to GDE Grievance Redress Mechanism provided.

Table 33. Grievance Redress Committee

No	Role/Institution	Position within Team
COMMITTEE		
PT Geo Dipa Energi (Persero) – Project Head Office		
1	Hefi Hendri *Project General Manage*r	Head of Committee
2	Bintang L. Sasongko *HSE & Safeguard Division / Manager*	Member
	Reyno Rivelino Duta Muhammad *Government Relation & Social Safeguard Staff*	

No	Role/Institution	Position within Team
	Sari Ramadhani Putri *Environment Safeguard Assistant Manager*	
	Sannita Debora Ambarita *Health & Safety Staff*	
Representatives of sub-district level communication forum (*Forkompinca*)		
3	Head of Sub-District (*Kecamatan*)	Member
4	Head of Police Sector (Polsek)	Member
5	Head of Military Area Command (Koramil)	Member
TECHNICAL TEAM		
PT Geo Dipa Energi (Persero) – Project Site Office Patuha 2		
6a	Danang Maulana Project Manager Patuha 2	Head of Technical Team
7a	Aditya Rahman HSE & Safeguard Superintendent Patuha 2	Member
8a	Yudha Wahyu Pratama Social Safeguard & Public Relation Supervisor Patuha 2	Member
9a	Ananda Riana Putri Social Safeguard & Public Relation Staff Patuha 2	Member
PT Geo Dipa Energi (Persero) – Project Site Office Dieng 2		
6b	Muhammad Izuddin Project Manager Dieng 2	Head of Technical Team
7b	Sigit Dwi Pamungkas HSE & Safeguard Superintendent Dieng 2	Member
8b	Slamet Riyadi Social Safeguard & Public Relation Supervisor Dieng 2	Member
9b	Galan Alifin Novan Social Safeguard & Public Relation Staff Dieng 2	Member
Representatives of village government and community		
10	Head of Villages	Member
11	Community Leaders	Member
12	Women Representatives	Member
Others		
13	Wahyu Setyawan Minarto, Health Safety Environmental and Safeguard Specialist (Project Management Consultant)	Member
14	Contractor Representatives	Member

The GRM records indicate that even the mechanisms developed to facilitate stakeholder communication were effective. To add social mitigation readiness for well-testing at Pad 9, GDE established Central Communication which opened 24-hour a day during the well-testing as an additional GRM channel to receive complaints and grievances, particularly but not limited to the well-testing activity, from the community. GDE has also intensified the GRM channel disclosure/dissemination via leaflets. There were 4 (four) grievances/complaints recorded for Patuha 2 and 7 (seven) grievances received for Dieng 2 during this reporting period. Summary of grievance shown in Table 29 for Dieng 2. Following Table 30 summarises grievances received for Patuha 2 Sub Project during January – June 2023 period.

Table 34. List of Grievance(s) Received in January to June 2023 periods for Dieng-2 Sub-Project

No	Complaint / Query	Date Received	Impact Location	Complainant Name	Address/ Affiliation	Status of Complaint	Resolving Date	Resolving Category
1	A community members' irrigation pipe was affected by construction activity in Pad 30	9-May-23	Pawuhan, Karangtengah	Tunut	Pawuhan, Karangtengah	Resolved	31-May-2023	GDE Replaces the community member's irigation pipe
2	The house was impacted by the rig mobilization to Pad 30 activity.	6-June-2023	Pawuhan, Karangtengah	Rosyid	Pawuhan, Karangtengah	Ongoing	-	-
3	The house was impacted by the rig mobilization to Pad 30 activity.	7 -June-2023	Pawuhan, Karangtengah	Adi N	Pawuhan, Karangtengah	Ongoing	-	-
4	The house was impacted by the rig mobilization to Pad 30 activity.	7 -June-2023	Pawuhan, Karangtengah	Rinto	Pawuhan, Karangtengah	Ongoing	-	-
5	The house was impacted by the rig mobilization to Pad 30 activity.	12 -June-2023	Pawuhan, Karangtengah	Dulrohman	Pawuhan, Karangtengah	Ongoing	-	-
6	The house was impacted by the rig mobilization to Pad 30 activity.	15 -June-2023	Pawuhan, Karangtengah	Sa'roni	Pawuhan, Karangtengah	Ongoing	-	-

7	The house was impacted by the rig mobilization to Pad 30 activity.	15 -June-2023	Pawuhan, Karangtengah	Lastiana	Pawuhan, Karangtengah	Ongoing	-	-

There were two issues raised in the previous SEMRs which have not yet been resolved.

Table 35. Project Complaints or Issues – Not resolved from previous reports

No	Date of Grievance Submission	Name of Complainant	Description of Grievance Submitted	Location	Proposed Resolution	Status
1.	4 Jan 2022	Habib	The community around Pad 38 rejected the Power Plant construction plan near their residences. The community asked for socialization about the project.	Karangtengah	Dieng 2 conducted socialization and meaningful consultation with the community, FORKOPIMCA Batur, and FORKOPIMDA Banjarnegara	Ongoing
2.	8 June 2022	Syarif Hidayat	Complained that the steam from Dieng 1 activity damaged his roof and plants	Karangtengah	Dieng 2 forwarded this grievance to Dieng 1	Ongoing

Table 36. List of Grievance(s) Received in January to June 2023 periods for Patuha-2 Sub-Project

No	Complaint / Query	Date Received	Impact Location	Complainant Name	Address/ Affiliation	Status of Complaint	Resolving Date	Resolving Category
1	Questioning about allocation of parcel "Sembako Safari Ramadhan" for community and decided not to take it all as a form of protest	10-Apr-23	Sugihmukti	Maman	RW 06 Rancabolang	Resolved	18-Apr-23	Fulfilling the community requests by increasing the allocation of parcel, delivered on 18/4/23
2	Report from the villagers concerning GDE's Project activities causing micro	10-Apr-23	Sugihmukti	Agus	Kp. Babakan, RW 06 Rancabolang	Resolved	17-May-23	Conducting Community Safety Awareness related to seismicity with

No	Complaint / Query	Date Received	Impact Location	Complainant Name	Address/ Affiliation	Status of Complaint	Resolving Date	Resolving Category
	earthquake to their village							experts on 17/5/23
3	Report from a worker of contractor regarding unpaid salary	9-May-23	Sugihmukti	Asep Bambang	Kp. Kendeng, Rancabolang	Resolved	22-May-23	Conducting meeting with workers and contractor on 15/5/23 regarding unpaid salaries. Payment of salaries was made on 22/5/23
4	The drainage of access road was damaged by the movement of heavy vehicles and equipment	15-May-23	Panundaan	Ketua RW 28 dan 14	RW 28 dan RW 14	Resolved	23-May-23	The damaged drainage was repaired on 23/5/23

There were no issues raised in the previous SEMRs which have not yet been resolved.

Table 37. Project Complaints or Issues – Not resolved from previous reports

Details of Complaint	Detail of Person (Date, Name, Contact Details)	Action Needed and Date	The reason this was still not resolved
N.A.	N.A.	N.A.	N.A.

5.2 Corrective Actions

The following table gives information on any formal corrective action that has been issued to the contractor to improve environmental performance:

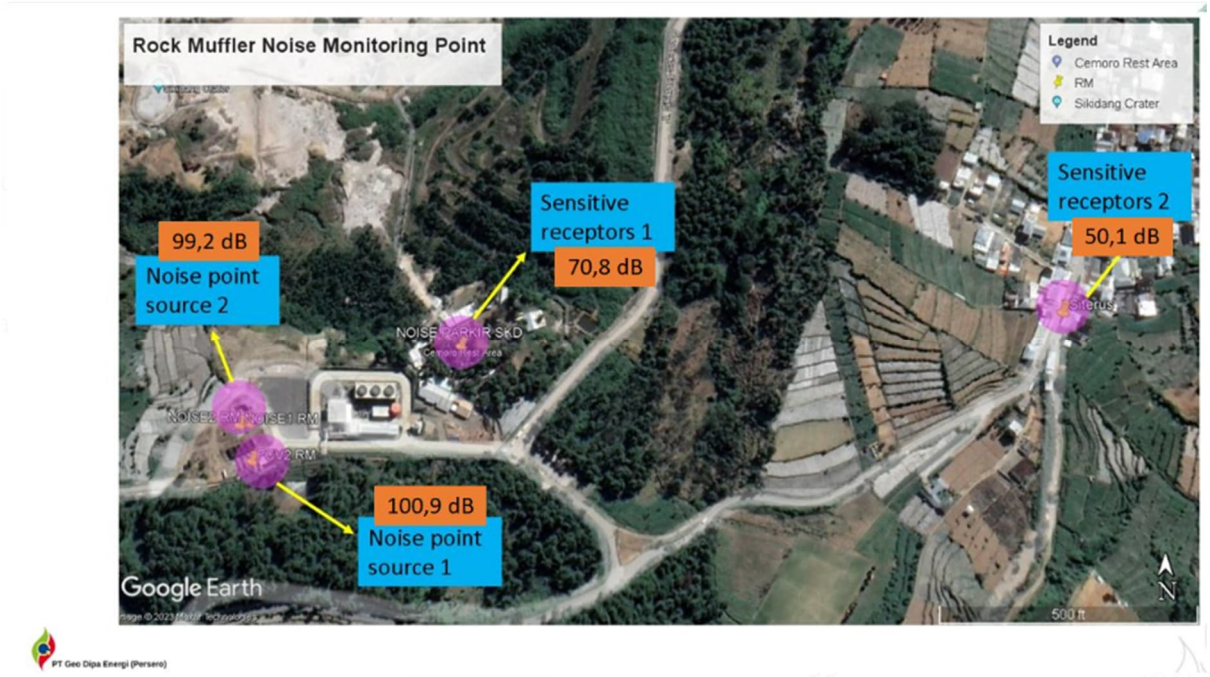
Table 38. Corrective Actions Issued

Reason for Corrective Action	Date Issued	Outcome	Comment / Follow Up
Used oil stored in the drum is not labelled and there is no	11 January 2023	JV ADA-APS to provide label for hazardous waste and container	Done 12 January 2023

appropriate secondary containment around the drum (JV ADA-APS Site Area Patuha)		shall be equipped with secondary containment.	
There was no waste segregation between organic waste and inorganic waste (JV ADA-APS Site Area Patuha)	11 January 2023	JV ADA-APS to conduct waste segregation and provide waste bin based on type of waste.	Done and continued
Emergency eyewash's water (above mud tank) was not flowing good and has no sign (JV ADA-APS Site Area Patuha)	11 January 2023	JV ADA-APS to re-check the emergency eyewash equipment	Done 12 January 2023
Drill cutting collected at Pad 33 and Bitingan Village and compacted as a brick for further utilization. Drill cutting also used as flooring at Pad 7 and dumping at Bitingan and Sileri Pond which is not recommended by CEMP (PT PRA site area Dieng)	21 February 2023	PT. PRA to fix drill cutting issue and must conduct training and educate the Subcontractor on drill cutting management in accordance with CEMP requirements	Done on March 1, 2023
Contractor personnel smoking not in the dedicated smoking area (PT PRA site area Dieng)	21 February 2023	PT. PRA to install no smoking area sign at several location and socialize to all personnel regarding smoking policy	Done on March 1, 2023
Secondary Containment near to fuel tank location found in appropriate condition (PT PRA site area Dieng)	21 February 2023	PT. PRA to fix secondary containment	Done on March 1, 2023
There was no sediment control in the drainage channel to the river (JV ADA-APS Site Area Patuha)	5 April 2023	JV ADA-APS to install sediment control.	Completed
Used oil stored in the drum at PPL was not equipped with appropriate secondary containment around the drum.	5 April 2023	JV ADA-APS to tidy up secondary containment at PPL 6	Done 6 April 2023

5.3 Corrective Action Based on Finding of ADB Mission

ADB Mission on March 2023 found that noise complaint has been received from villages near the Unit 1 rock muffler during power outages and plant trips. Therefore, ADB proposed to test noise level at closest noise receptor when rock muffler unit 1 venting steam after plant trips but prior to closing in production well. Following figure illustrated noise measurement during plant trips which was carried out on July 25, 2023, with a peak noise time range at 00.56 - 01.05.



5.4 Additional Information on Grievance regarding Leakage on Pad 29 and Micro Earthquake in Patuha

5.4.1 Leakage at Pad 29

The chronological leakage issue is described as follows:

- On January 9, the drilling team discovered a small tear in Pad 29's geomembrane and decided not to use the pond until it was repaired.
- The complainant raised a grievance about the suspected leaked pond on 11 January 2023 and asked for information.
- PMU repaired the leakage on 11 January 2023 and observed it for a few weeks.
- On 8 February 2023, PMU held a meaningful consultation related to the leaked pond, the action to repair the leakage, and the information about the project activity in Pad 29.
- The grievance was solved as the complainant accepted the information and the resolution that was conducted by PMU for his grievance.

5.4.2 Micro Earthquake in Patuha

There was a complaint from the villagers on 10 April 2023 concerning GDE's Project activities causing micro earthquake to their village. Complaint received when there is no drilling activity. The Volcanology and Geological Disaster Mitigation Centre (Pusat Vulkanologi dan Mitigasi Bencana Geologi/PVMBG) has explained that Mount Patuha is an area that has experienced

quite strong tectonic activity, marked by the formation of many faults and cracks. It is also an area that is prone to earthquakes.
Community Safety Awareness was carried out on May 2023, together with the PVMBG, the topic was:" Vulcanic Earthquake Potential of Patuha Mountain in Sugihmukti Atas Village".
The following table describes about earthquake classification and occurrence in Indonesia.

Table 39 Earthquake Classification

Classification	Magnitude
Microearthquakes	M ≤ 3
Small earthquake	3 ≤ M ≤ 5
Moderate earthquake	5 ≤ M ≤ 7
Macro quake	M ≥ 7

Source: PVMBG Ministry of Energy and Natural Resources, 2023

Table 40 Earthquake Statistic in Indonesia

Magnitude	Efect	Quantity
Less than 2	Not perceived by humans. only detected by earthquake devices	Many
2	Felt by certain people, the hanging object will swing	>1.000.000
3	Felt by people in the house. a stopped car will move	100.000
4	The hanging object is swinging. windows shake and may break	12.000
5	Felt by everyone, hanging items are falling	1400
6	There was a panic. the building suffered damage	160
7 - 8	There were cracks in the ground, only a few buildings were still standing	20

Source: PVMBG Ministry of Energy and Natural Resources, 2023

5.5 Biodiversity at surrounding Pad 12 and Proposed SAGS Route

GDE is committed to protecting natural capital and biodiversity to support sustainable economic growth and improve people's lives throughout the project area and surrounding communities. This includes management of protected areas, safeguarding watersheds, restoring habitats, and conserving biodiversity. Referring to the forest status, the entire surrounding area of Pad 12 and its proposed extension area is classified in protected forest. Therefore, the Government of Indonesia regulations[2] for utilization of this forest land for non-forestry purposes is applicable.

Biological assessment as part of above ADB's commitment, was carried out during baseline study for Addendum AMDAL as prepared by GDE (supported by Sucofindo) for the proposed Dieng Unit 2 Geothermal Power Plant Development at Pad 12. The geographical scope of this assessment including area of proposed Power Plant footprint (the surrounding area of Pad 12 and its proposed extension area) and area of proposed SAGS.

5.5.1 Flora

a. Observations on the Proposed Area for Dieng Unit 2 Power Plant Footprint at the surrounding area of Pad 12 and its proposed extension area

[2] Government of Indonesia Regulation No.23 of 2021 concerning Forest Management and Environment and Forestry Minister Regulation No.7 of 2021 concerning Forest Planning, Change of Forest Land Use and Change of Forest Function, also Forest Utilization

Based on the vegetation formation, in general the land use of the study area is divided into secondary natural forests managed by PT Perhutani, plantations (converted from forest and cultivated by local communities and shrubs).

The secondary natural forest vegetation is dominated by perennial tress including *Acacia decurens (*Cascia), *Cupressus sempervirens* (Fir wax)*, Casuarina* sp (Mountain fir), *Eucalyptus grandis (*commonly known as rose gum), *Pinus merkusii* (Pine). None of them is categorized into protected species due to their ecological status. *Eucalyptus grandis*, is smooth bark, rough at the base fibrous or a tall tree with flaky, grey to grey-brown. At maturity, it reaches 50 metres (160 feet) tall, though the largest specimens can exceed 80 metres (260 feet) tall. The introduction of this species in Indonesia has been occurred since the 18th century[3]. *Eucalyptus grandis* is one of the species selected for the development of the plantation forest in Indonesia. In order to obtain a superior plant for the continuity of the plantation forest program, various tree breeding techniques are often applied, one of which is through best provenance selection.

Referring to field observation, it was found that the ecosystem of this forest has been threated by cutting down trees for firewood and land forest conversion to be plantations for agricultural crop cultivation, especially potatoes, cabbage, carrots, loncang, and gendot peppers. The most cultivation on this plantation is carried out intensively using inappropriate terracing system and less concern to the existing land carrying capacity. Therefore, it might cause environmental quality degradation, especially increasing of potential erosion and landslides.

The existing plantation is mostly cultivated by seasonal plants including cabbage, carrots, loncang, and gendot peppers. In addition, the local cultivators also planted Carica (*Vasconcellea cundinamarcensis*) and Dutch eggplant (*Cyphomandra betacea*) on the plantation embankment. Carica and Dutch eggplant are raw material commonly used for candied fruits, chips, juice drinks which are traditonal gifts of Dieng. The shrubs and grasses are found in remaining study area of proposed Dieng Unit 2 Plant. Those vegetations wildly gorwth among the cultivated crops, under the canopy of forest trees and vacant land that left by the community. Those species are *Brugmansia* sp (Amethyst), *Melastoma malabathricum* (Senduduk), *Eupathorium odoratum* (Kirinyu), *Arundo donax* (Glonggong), *Panicum repens* (Lempuyang), and *Imperata cylindrica* (Reeds). The following figures show the condition of the entired surrounding area of Pad 12 and its proposed extension area.

[3] Mindawati, N. 2011. Kajian Kualitas Tapak Hutan Tanaman Industri Hibrid sebagai Bahan Baku Industri Pulp dalam Pengelolaan Hutan Lestari. Disertasi. Pascasarjana Institut Pertanian Bogor. Bogor.


Source: Field Observation (Sucofindo, 2023)

Figure 22 Flora of Study Area for Proposed Footprint of Dieng Unit 2 Power Plant at the Surrounding area of Pad 12 and Its Expansion Area

Detailed records of flora of study area could be seen in the following table.

Table 41 List of Flora on the Proposed Area for Dieng Unit 2 Power Plant Footprint

No	Local/Common Name	Scientific Name	Observation Location	Ecological Status	
				IUCN*	P.106**
1	Pine	*Pinus merkusii*	NS	Lc	-
2	Eucalyptus	*Eucalyptus grandis*	NS	Lc	-
3	Bamboo	*Bambusa* sp		-	-
4	Suren	*Toona sureni*		Lc	-
5	Acacia	*Acacia decurrens*	NS	Lc	-
6	Mountain Cheese	*Brugmansia* sp		Lc	-
7	Fir Wax	*Cupressus sempervirens*	NS	Lc	-
8	Lamtoro	*Leucaena leucocephala*		Lc	-
9	Kemlandingan	*Paraserianthes lophantha*		Lc	-
10	Carica	*Vasconcellea cundinamarcensis*	P	-	-
11	Mountain fir	*Casuarina* sp	NS	Lc	-
12	Pole Nails	*Cyathea contaminans*		Lc	-
13	Carrot	*Daucus carota*	P	Lc	-
14	Potato	*Solanum tuberosum*	P	Lc	-
15	Cabbage	*Brassica oleracea*	P	Lc	-
16	Pepper gendot	*Capsicum chinense*	P	-	-
17	Woe	*Allium fistulosum*	P	Lc	-
18	Dutch eggplant	*Cyphomandra betacea*	P	-	-
19	Nail	*Pteridium aquilinum*		Lc	-
20	Sitting	*Melastoma malabathricum*	S	Lc	-
21	Nail	*Polypodium vulgare*		-	-
22	Coffee	*Coffea* sp	P	-	-
23	Kirinyu	*Eupathorium odoratum*	S	Lc	-
24	Reeds	*Imperiata cylindrica*	S	-	-
25	Puzzle	*Cyperus* sp	S	-	-
26	Glonggong	*Arundo donax*	S	Lc	-

No	Local/Common Name	Scientific Name	Observation Location	Ecological Status	
				IUCN*	P.106**
27	Lempuyang	*Panicum repens*	S	Lc	-
28	Jukut jampang	*Eleusine indica*	S	Lc	-
29	*Grass*	*Axonopus compressus*	S	Lc	-

Source: Field Observation (Sucofindo, 2023)
Noted:
*) Ecological status refers to rules set up by International Union for Conservation of the Nature (IUCN): Lc (Least Concern)
**) Ecological status refers to Environment and Forestry Minister Regulation No P.106 of 2018

Based on above records, it assumed that the land use (based on vegetation formation) at the surrounding area of Pad 12 and its proposed extension area is mostly dominated by cultivated land that has been converted from forest to be plantation by local community for the last couple years ago. The visual observation during the baseline study advised that no indication of the important or key flora species will trigger Critical Habitat Assessment and specific mitigation measures in Biodiversity Action Plan (BAP).

The importance value index (IVI) of tree species was determined as the sum of relative frequency, relative density, and relative dominance. The IVI in ecology, is the measure of how dominant a species is in a given ecosystem. In addition, the biodiversity index is an ecological metric used to describe the amount of species diversity in a specific area. In this case, a Shannon-Wiener biodiversity index was used to describe the amount of species diversity in study area. The IVI and biodiversity index of study area are discussed below.

1. Secondary Natural Forest

   In overall, the semi quantitative observation identified 27 species living in this forest and biodiversity index value of 3.2 with a density of 1.180 individuals / m^2 or equivalent to 11.800 individuals/ha. The vegetation dominance value of 0.269 indicates that the vegetation population of this forest covers an area of 26.9% of the entire study area. (see Table 40). This general description advised that ecosystem of secondary natural forest is relatively stable based the biodiversity index. In theory, Shannon and Wienner divided the biodiversity index (H') into three categories including low (Hi<1), moderate (1<H'<3), and high (H'>3)[4]. Greater biodiversity in ecosystems, species, and individuals leads to greater stability. For example, species with high genetic diversity and many populations that are adapted to a wide variety of conditions are more likely to be able to weather disturbances, disease, and climate change[5].

[4] Shannon, C. E., & Wiener, W. (1963). The mathematical theory of communication.Urbana: University of Illinois Press
[5] https://www.biologicaldiversity.org/programs/biodiversity/elements_of_biodiversity/#:~:text=Greater%20biodiversity%20in%20ecosystems%2C%20species,%2C%20disease%2C%20and%20climate%20change.

The vegetation composition of secondary natural forest vegetation is dominated by perennial vegetation, *Acacia decurrens* (Acacia) indicated by the highest IVI (25.3) compared with other recorded species. Given *Acacia decurrens* originally growths in Australia and categorized into alien species in Indonesia, the presence of in this forest is little bit surprised. There is no existing bibliographical document (report, journal, etc.) which has explained the existing *Acacia decurrens* in this study area. It was known that Acacia is fast growing species that potentially invasive to the native species. Referring to the experience of Mount Merapi National Park, *Acacia decurrens* dominated the vegetations at mount slope of Merapi in particularly Kaliadem area after eruption in 2006. The dominancy of this species is significantly increased in 2010 and significantly changed the vegetation composition structure of this national park compared with the composition before eruption in 2006. Previously, the vegetation composition structure of this national park was consisted of various species including *Altingia excelsa* (Rasamala), *Schima wallichii* (puspa), *Casuarina sp* (casuarina) and Pinus *merkusii* (pine)[6].

The *Solanum tuberosum* (Potato) with IVI of 22.4 is the second dominant species. The presence of this species indicated that the natural secondary forest has converted to the cultivated land. There is no information of the historical forest conversion in this area.

2. Plantation/Cultivated Land

   11 species were identified during field observation in plantation or cultivated land. Those species are distributed in this area with a density of 0.615 individuals/m^2 or equivalent to 6.150 individuals/ha. Referring to vegetation data analysis (see Table 40), vegetation structure of plantation or cultivated land is dominated by the association *of Solanum tuberosum* (Potato) and *Brassica oleracea* (Wild cabbage). Potatoes and wild cabbage are the dominant plant compared with compared with other recorded species with IVI of 82,3 and 63.3 respectively. The vegetation dominance value of 0.6 indicates that cultivated crops covers an area of 56.6% of the study area. A vegetation biodiversity index of 2.1 indicates that the stability of the plantation ecosystem in the study area are in moderate category. It means the crops less adapted to a wide variety of conditions or more likely to be able to weather disturbances, disease, and climate change.

3. Shrubs

   The association of *Imperata cylindrica* (Alang-alang) and *Brugmansia* sp (Amethyst) dominated vegetation structure of study area which is consisted of 14 species. Alang-alang is the dominant vegetation with IVI 42 and Amethyst is the codominant vegetation with IVI 34.4. The vegetation density is 0.5 individuals/m^2 or equivalent to 5,330 individuals/ha. The vegetation dominance value of 0.165 indicates that the shrubs population covers an area of 16.5% of the entire study area.

[6] *Acacia decurrens* di Sebagian Kawasan Taman Nasional Gunung Merapi Yogyakarta (Sutomo, Jurnal Al Azhar Indonesia Seri Sains and Teknologi Vol.5 No.1, 2019)

Referring to biodiversity index value of 2.5, the stability level of this ecosystem in the study area is categorized to moderate level.

Table 42 Ecological Data Analysis of Flora on the Proposed Area for Dieng Unit 2 Power Plant Footprint

No	Scientific name	Kr	Fr	Dr	IVI	Pi.lnPi
Secondary Natural Forest						
1	*Mercussion pine*	0,013	0,500	0,010	7,682	0,094
2	*Eucalyptus grandis*	0,011	0,500	0,009	7,077	0,088
3	*Bambusa* sp	0,068	0,500	0,007	11,095	0,122
4	*Toona sureni*	0,020	0,625	0,010	9,037	0,106
5	***Acacia decurens***	0,085	0,750	0,037	**25,251**	0,208
6	*Brugmansia* sp	0,063	0,875	0,013	15,326	0,152
7	*Cupressus sempervirens*	0,080	0,625	0,020	17,867	0,168
8	*Leucaena leucocephala*	0,071	0,875	0,007	13,820	0,142
9	*Paraserianthes lophantha*	0,030	0,750	0,006	9,106	0,106
10	*Vasconcellea cundinamarcensis*	0,066	0,625	0,003	10,460	0,117
11	*Casuarina* sp	0,021	0,625	0,014	10,641	0,118
12	*Eupathorium odoratum*	0,044	0,625	0,013	12,298	0,131
13	*Daucus carota*	0,050	0,500	0,007	9,861	0,112
14	***Solanum tuberosum***	0,125	0,750	0,020	**22,400**	0,194
15	*Brassica oleracea*	0,100	0,625	0,017	18,313	0,171
16	*Cyphomandra betacea*	0,045	0,750	0,004	9,628	0,110
17	*Pteridium aquilinum*	0,056	0,875	0,010	13,548	0,140
18	*Melastoma malabathricum*	0,019	0,375	0,003	4,996	0,068
19	*Polypodium vulgare*	0,056	0,875	0,003	11,051	0,122
20	*Coffea* sp	0,015	0,250	0,003	3,709	0,054
21	*Cyathea contaminans*	0,014	0,750	0,003	6,730	0,085
22	*Imperiata cylindrica*	0,035	0,625	0,014	11,806	0,127
23	*Cyperus* sp	0,009	0,375	0,009	6,145	0,080
24	*Arundo donax*	0,019	0,375	0,007	6,494	0,083
25	*Panicum repens*	0,026	0,625	0,007	8,318	0,099
26	*Eleusine indica*	0,020	0,875	0,005	8,479	0,101
27	*Axonopus compressus*	0,020	0,875	0,006	8,978	0,105
Number of species		27				
Diversity Index (H')		3.204				
Density Index (K)		1.180				
Dominance Index (D)		0.269				
Plantation						
1	*Brugmansia* sp	0,063	0,750	0,013	23,062	0,197
2	*Vasconcellea cundinamarcensis*	0,066	0,625	0,017	22,511	0,194
3	*Daucus carota*	0,050	0,250	0,101	29,437	0,228
4	***Solanum tuberosum***	0,175	0,875	0,235	**82,266**	0,355
5	***Brassica oleracea***	0,131	0,875	0,168	**63,286**	0,328
6	*Cyphomandra betacea*	0,039	0,750	0,010	18,607	0,172
7	*Capsicum chinense*	0,015	0,375	0,003	8,295	0,099

No	Scientific name	Kr	Fr	Dr	IVI	Pi.lnPi
8	*Allium fistulosum*	0,035	0,625	0,002	14,819	0,149
9	*Cyperus* sp	0,009	0,250	0,002	5,288	0,071
10	*Eleusine indica*	0,018	0,875	0,005	15,957	0,156
11	*Axonopus compressus*	0,015	0,875	0,010	16,500	0,160
Number of species		11				
Diversity Index (H')		2.109				
Density Index (K)		0.615				
Dominance Index (D)		0.566				
Shrubs						
1	*Bambusa* sp	0,051	0,375	0,007	17,911	0,168
2	*Acacia decurens*	0,064	0,625	0,017	29,178	0,227
3	***Brugmansia* sp**	0,063	0,750	0,024	**34,423**	0,248
5	*Leucaena leucocephala*	0,058	0,750	0,007	23,716	0,201
6	*Paraserianthes lophantha*	0,031	0,375	0,007	14,159	0,144
8	*Eupathorium odoratum*	0,044	0,750	0,020	28,870	0,225
10	*Pteridium aquilinum*	0,049	0,875	0,007	23,076	0,197
11	*Melastoma malabathricum*	0,019	0,375	0,005	10,999	0,121
12	*Polypodium vulgare*	0,056	0,875	0,003	22,448	0,194
13	*Cyathea contaminans*	0,014	0,750	0,003	13,066	0,136
14	***Imperiata cylindrica***	0,041	0,875	0,040	**42,020**	0,275
Number of species		14				
Diversity Index (H')		2.546				
Density Index (K)		0.533				
Dominance Index (D)		0.165				

Source: Primary Data Analysis (Sucofindo,2023).

Noted: Kr (Relative Density), Fr (Relative Frequency), Dr (Relative Dominance), IVI (Important Value Index), and H' (Shannon-Wienner Diversity Index)

b. Observations on the Proposed Area for SAGS Footprint

Similar with land use of proposed Dieng Uni 2 Power Plant footprint, the proposed SAGS footprint is overlapping with secondary natural forest, plantation, and shrubs. Therefore, the vegetation species composition between those proposed footprints are not significantly different. Detailed records of vegetation species composition are provided in Table 41.

Figure 23 Vegetation conditions in the site study area of the proposed SAGS Footprint

The detailed records of vegetation composition in the study area are as follows:

Table 43 Composition of Vegetation Species on the Proposed Area for SAGS Footprint

No	Vegetation Type	Scientific Name	Ecological Status	
			IUCN	P.106
1	Flower	*Schima wallichii*	LC	-
2	Pine	*Mercussion pine*	LC	-
3	Eucalyptus	*Eucalyptus grandis*	LC	-
4	Bamboo	*Bambusa* sp	-	-
5	Suren	*Toona sureni*	LC	-
6	Acacia	*Acacia decurens*	LC	-
7	Mountain Cheese	*Brugmansia* sp	LC	-
8	Fir Wax	*Cupressus sempervirens*	LC	-
9	Lamtoro	*Leucaena leucocephala*	LC	-
10	Kemlandingan	*Paraserianthes lophantha*	LC	-
11	Karika	*Vasconcellea cundinamarcensis*	-	-
12	Mountain fir	*Casuarina* sp	LC	-
13	Pole Nails	*Cyathea contaminans*	LC	-
14	Carrot	*Daucus carota*	LC	-
15	Potato	*Solanum tuberosum*	LC	-
16	Cabbage	*Brassica oleracea*	LC	-
17	Pepper gendot	*Capsicum chinense*	-	-
18	Kara oncet	*Vicia faba*	-	-
19	Woe	*Allium fistulosum*	LC	-
20	Dutch eggplant	*Cyphomandra betacea*	-	-
21	Nail	*Pteridium aquilinum*	LC	-
22	Sitting	*Melastoma malabathricum*	LC	-
23	Nail	*Polypodium vulgare*	-	-
24	Coffee	*Coffea* sp	-	-
25	Kirinyu	*Eupathorium odoratum*	LC	-
26	Reeds	*Imperiata cylindrica*	-	-
27	Puzzle	*Cyperus* sp	-	-
28	Glonggong	*Arundo donax*	LC	-
29	Lempuyang	*Panicum repens*	LC	-
30	Jukut jampang	*Eleusine indica*	LC	-
31	*Grass*	*Axonopus compressus*	LC	-

Source: Primary data (Sucofindo,2023)

Noted:

- *) Ecological status refers to rules set up by International Union for Conservation of the Nature (IUCN): LC (Least Concern) EN (Endangered)

**) Ecological status refers to Environment and Forestry Minister Regulation No P.106 of 2018

Given the potential affected area of proposed SAGS footprint (the corridor width ranges between 10 and 12 m) is smaller than the area of proposed Dieng Unit 2 Power Plant, the impact of proposed SAGS development will be less compared with Dieng Unit 2 Power Plant development. In addition, the proposed SAGS footprint will be mostly sited beside the existing SAGS.

5.5.2 Fauna

Concerning to the time constraint, the wildlife observation focused on avian fauna. The bird observation using point counting method was conducted at the similar with flora observation. While the observation of other wildlife classes was conducted using qualitative method. The results of observation are discussed below.

a. Observations in Area PAD 12 the Proposed Area for Dieng Unit 2 Power Plant Footprint at the Surrounding area of Pad 12 and its proposed extension area

The field observations and community interviews identified 20 species of birds, 4 species of mammals, 2 species of reptiles, and 4 species of insects. Review on flora and fauna conservation status according to the Minister of Environment and Forestry No P.106 of 2018 and the IUCN Redlist, advised that no identified wildlife species is categorized into protected and endemic species. In addition, none of them is categorized in the migratory species. This species is one of the Asian Swallows belong to the Hirundinidae family. In the world, there are about 88 species, seven of which are residents and migrated to Indonesia. Those are Pacific Swallow (*Hirundo tahitica*) Barn Swallow (*Hirundo rustica*), Sand Martin (*Riparia riparia*), Red-rumped swallow (*Cecropis dauurica*), Fairy martin (*Petrochelidon ariel*), Tree martin (*Petrochelidon nigricans*), and House Martin (*Delichon dasypus*). The Asian swallows are insectivorous birds, so these species have important roles in controlling insects and pests. The Barn Swallow (*Hirundo rustica*) migrates from its breeding grounds in North America and Eurasia. To avoid extreme weather, this bird flies, forages and rests in other areas. The route is fairly far, starting from Central and South America, Southern Spain, Morocco, Egypt, Sub-Saharan Africa, the Middle East, India, Indochina, Malaysia, Australia, to Indonesia. In Indonesia, there are many records about Asian Swallows during migration, but still few have done research[7]. Based on the results of a collection of Asian Swallows observations from eBird, an online bird observation database site[8], this bird family has been observed in almost all of Indonesia.

[7] Eaton, JA., van Balen, B., Brickle, NW & Rheindt, FE. 2016. Birds of the Indonesian Archipelago. Greater Sundas and Wallacea.Lynx Editions. Barcelona.
[8] eBird. 2017. eBird: An online database of bird distribution and abundance [web application]. eBird, Cornell Lab of Ornithology, Ithaca, New York. Available: http://www.ebird.org. [Accessed: 15 November 2020]

Table 44 Records of Wildlife Species in the Proposed Area for Dieng Unit 2 Power Plant Footprint

No	Local Name	Scientific name	Information	Ecological Status	
				IUCN	P.106
Aves (Birds)					
1	Bondol peking	*Lonchura punctulata*	Found	LC	-
2	Burung hantu	*Ketupa ketupu*	Farmer Information	LC	-
3	Cekakak sungai	*Todiramphus chloris*	Found	LC	-
4	Cica Koreng Jawa	*Megalurus palustris*	Found	LC	-
5	Gereja	*Passer montanus*	Found	LC	-
6	Jalak Kerbau	*Acridotheres javanicus*	Farmer Information	VU	-
7	Kicuit hutan	*Motacilla cinerea*	Found	LC	-
8	Kipasan	*Rhipidura phoenicura*	Found	LC	-
9	Kutilang	*Pycnonotus aurigaster*	Found	LC	-
10	Layang-Layang	*Hirundo tahitica*	Found	LC	-
11	Madu sriganti	Nectarinia jugularis	Found	LC	-
12	Pentet Klabu	*Lanius schach*	Found	LC	-
13	Perkutut jawa	*Geopelia striata*	Found	LC	-
14	Sikatan Bubik	*Muscicapa latirostris*	Farmer Information	-	-
15	Sikatan Mugimaki	*Fidecula mugimaki*	Farmer Information	-	-
16	Tekukur biasa	*Streptopelia chinensis*	Found	LC	-
17	Tledekaan Gunung	*Cyornis* sp	Found		-
18	Trinil pantai	*Actitis hypoleucos*	Farmer Information	LC	-
19	Walet linchi	*Collocalia linchi*	Found	LC	-
20	Wiwik Klabu	*Cacomantis merulinus*	Found	LC	-
Mammal					
1	Boar	*Sus scrofa domesticus*	Farmer Information	LC	-
2	Javan treeshrew	*Tupaia javanica*	Farmer Information	LC	-
3	Forest cat	*Neofelis* sp	Farmer Information	LC	-
4	Rat	*Rattus* sp.	Farmer Information	-	
Reptile					
1	Klarap	*Draco volans*	Found	LC	-
2	Garden Lizard	*Eutropis multifasciata*	Found	LC	-
Insects					
1	Capung ciwet	*Pantala flavescens*	Found	LC	-
2	Capung kebo	*Orthetrum sabina*	Found	LC	-
3	Green locust	*Oxya serville*	Found	-	-
4	Butterfly	*Catopsilia Pomona*	Found	-	-

Source: Primary Data (Sucofindo, 2023)

INO: Geothermal Power Generation Project

Noted:

**) Ecological status refers to rules set up by International Union for Conservation of the Nature (IUCN): LC (Least Concern)*

***) Ecological status refers to Environment and Forestry Minister Regulation No P.106 of 2018*

Table 45 Ecological Analysis of Birds in the Proposed Area for Dieng Unit 2 Power Plant Footprint

No	Scientific Name	Types of Wildlife	Number of Individuals		
			BI	BII	BIII
1	*Lonchura punctulata*	Peking bondol	4	5	4
2	*Ketupa ketupu*	Owl	2	0	0
3	*Todiramphus chloris*	River kingfishers	2	0	0
4	*Megalurus palustris*	Javanese Scab Cica	6	8	4
5	*Passer montanus*	Church	0	4	5
6	*Acridotheres javanicus*	Buffalo Starling	4	0	0
7	*Motacilla cinerea*	Jungle tweet	0	6	0
8	*Rhipidura phoenicura*	Fan	2	0	1
9	*Pycnonotus aurigaster*	Finches	6	7	6
10	*Hirundo tahitica*	Kite	0	4	4
11	Nectarinia jugularis	Sriganti honey	4	0	2
12	*Lanius schach*	Pentet Klabu	6	4	6
13	*Geopelia striata*	Javanese curse	2	0	0
14	*Muscicapa latirostris*	Bubik Bond	2	0	0
15	*Fidecula mugimaki*	Sikatan Mugimaki	2	0	0
16	*Streptopelia chinensis*	Ordinary measuring	4	2	2
17	*Cyornis* sp	Tledekaan Mountain	2	0	0
18	*Actitis hypoleucos*	Trinil beach	0	1	0
19	*Collocalia linchi*	Linchi swallow	6	4	4
20	*Cacomantis merulinus*	Wiwik Klabu	2	0	1
Total Number of Individuals			56	45	39
Number of species			16	10	11
Diversity Index (H')			2,472	2,167	2,010
Type Evenness Index			0,892	0,941	0,838
Type Dominance Index			0,286	0,222	0,282

Source: Primary data (Sucofindo, 2023)

Information

BI : Secondary Natural Forest

BII : Plantation

BIII : Bush/Grounds

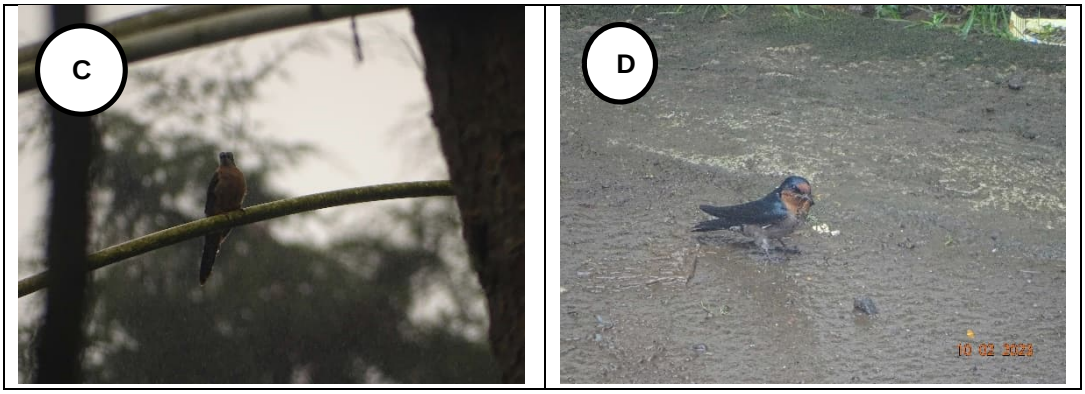


Figure 24 B**ird Species in the Study Area; A) Cica Javanese scab (*Megalurus palustris*), B) Pentet (*Lanius schach*), C) Wiwik klabu (*Cacomantis merulinus*), D) Asian kite (*Hirundo tahitica*).**

b. Observations on the Proposed Area for SAGS Footprint

The results of field observations and community interviews identified 21 species of birds, 4 species of mammals, 2 species of reptiles, and 4 species of insects are living in study area. Based on the conservation status of Protection and Endemic Status according to the Minister of Environment and Forestry No P.106 of 2018, no wildlife species were found that were included in the protected category and endemic species. They are categorized Least Concern (LC) category (25 species) and Vulnerable (Vu) category (1 species) according to the IUCN Red List. The species composition of wildlife in particularly bird in the proposed area for SAGS footprint is relatively similar with Dieng Unit 2 Power Plant footprint.

Table 46 Records of Wildlife Species in the Proposed Area for SAGS Footprint

No	Local Name	Scientific name	Remarks	Ecological Status	
				IUCN	P.106
Aves (Birds)					
1	Bondol peking	*Lonchura punctulata*	Observed	LC	-
2	Burung hantu	*Ketupa ketupu*	Interview	LC	-
3	Cekakak sungai	*Todiramphus chloris*	Observed	LC	-
4	Cica Koreng Jawa	*Megalurus palustris*	Observed	LC	-
5	Elang hitam	*Ictinaetus malayensis*	Observed	LC	-
6	Gereja	*Passer montanus*	Observed	LC	-
7	Jalak Kerbau	*Acridotheres javanicus*	Interview	VU	-
8	Kicuit hutan	*Motacilla cinerea*	Observed	LC	-
9	Kipasan	*Rhipidura phoenicura*	Observed	LC	-
10	Kutilang	*Pycnonotus aurigaster*	Observed	LC	-
11	Layang-Layang	*Hirundo tahitica*	Observed	LC	-
12	Madu sriganti	Nectarinia jugularis	Observed	LC	-
13	Pentet Klabu	*Lanius schach*	Observed	LC	-

No	Local Name	Scientific name	Remarks	Ecological Status	
				IUCN	P.106
14	Perkutut jawa	*Geopelia striata*	Observed	LC	-
15	Sikatan Bubik	*Muscicapa latirostris*	Interview	-	-
16	Sikatan Mugimaki	*Fidecula mugimaki*	Interview	-	-
17	Tekukur biasa	*Streptopelia chinensis*	Observed	LC	-
18	Tledekaan Gunung	*Cyornis* sp	Observed		-
19	Trinil pantai	*Actitis hypoleucos*	Farmer Information Interview	LC	-
20	Walet linchi	*Collocalia linchi*	Observed	LC	-
21	Wiwik Klabu	*Cacomantis merulinus*	Observed	LC	-
Mammal					
1	Boar	*Sus scrofa domesticus*	Interview	LC	-
2	Squirrel	Tupaia javanica	Interview	LC	-
3	Forest cat	*Neofelis* sp	Interview	LC	-
4	Rat	*Rattus* sp.	Interview	-	
Reptile					
1	Klarap	*Draco volans*	Observed	LC	-
2	Garden Lizard	*Eutropis multifasciata*	Observed	LC	-
Insects					
1	Wet dragonfly	*Pantala flavescens*	Observed	LC	-
2	Dragonfly kebo	*Orthetrum sabina*	Observed	LC	-
3	Green locust	*Oxya serville*	Observed	-	-
4	Butterfly	*Catopsilia Pomona*	Observed	-	-

Source: processed from Primary data (2023)

Information

Protection : Minister of Environment and Forestry No P.106 of 2018

Scarcity : IUCN Red List; DD (*Data Deficient*), LC (*Least Concern*), NT (*Near Threatened*), VU (Vulnerable), EN (Endangered), CR (Critically Endangered), and EX (Extinction).

Table 47 Ecological Analysis of Birds in the Proposed Area for SAGS Footprint

No	Scientific Name	Types of Wildlife	Number of Individuals		
			BI	BII	BIII
1	*Lonchura punctulata*	Peking bondol	4	6	6
2	*Ketupa ketupu*	Owl	2	0	0
3	*Todiramphus chloris*	River kingfishers	2	0	0
4	*Megalurus palustris*	Javanese Scab Cica	6	6	4
5	*Ictinaetus malayensis*	Black eagle	1	0	0
6	*Passer montanus*	Church	0	4	6
7	*Acridotheres javanicus*	Buffalo Starling	5	0	0
8	*Motacilla cinerea*	Jungle tweet	0	6	0
9	*Rhipidura phoenicura*	Fan	2	0	1
10	*Pycnonotus aurigaster*	Finches	6	6	6
11	*Hirundo tahitica*	Kite	0	4	4
12	Nectarinia jugularis	Sriganti honey	4	0	4

No	Scientific Name	Types of Wildlife	Number of Individuals		
			BI	BII	BIII
13	*Lanius schach*	Pentet Klabu	4	4	6
14	*Geopelia striata*	Javanese curse	2	0	0
15	*Muscicapa latirostris*	Bubik Bond	2	0	0
16	*Fidecula mugimaki*	Sikatan Mugimaki	2	0	0
17	*Streptopelia chinensis*	Ordinary measuring	4	2	2
18	*Cyornis* sp	Tledekaan Mountain	2	0	0
19	*Actitis hypoleucos*	Trinil beach	0	1	0
20	*Collocalia linchi*	Linchi swallow	6	4	4
21	*Cacomantis merulinus*	Wiwik Klabu	4	0	0
Total Number of Individuals			58	43	41
Number of species			17	10	11
Diversity Index (H')			2,781	2,132	2,028
Type Evenness Index			0,982	0,926	0,846
Type Dominance Index			0,293	0,233	0,268

Source: processed from Primary data (2023)

Information

BI : Secondary Natural Forest

BII : Plantation

BIII : Bush/Grounds

Figure 25 Bird Species in the Study area; A) Tekukur (*Streptopelia chinensis*), B) Pentet (*Lanius schach*), C) River kingfisher (*Todiramphus chloris*), D) Finches (*Pycnonotus aurigaster*),

c. Wildlife Environmental Quality Scale

Referring to the ecological analysis of birds, it is assumed that ecosystem of both proposed areas for Dieng Unit 2 Power Plant footprint and SAGS footprint is in good or stable condition based on biodiversity index (2.250 - <3,250) as calculated for this assessment (see Table 45).

Table 48 Determination of Diversity Index Criteria Condensed to Environmental Quality Scale

Fauna Quality	Environmental Quality Scale	
>3,250	5	Very good/very steady
2.250 - <3,250	4	Good/steady
1.575 - <2.2 50	3	Medium/moderately steady
1,000 - <1,575	2	Bad/less steady
<1,000	1	Very Bad/unsteady

Source: Shannon-Wiener in Fachrul (2007) modified.

6 CONCLUSION and RECOMMENDATION

6.1 Conclusion

In overall, the environmental performance of Dieng 2 Sub Project was considered in moderate level where GDE needs to improve several environmental mitigation measures through their supply chains (contractors and sub-contractors), since several non-compliance issues reported during January to June 2023 period. The areas need to be improved were included:

1) Waste management at drilling site and associated facility;
2) Noise control during well testing; and
3) Water supply for drilling works.

In the other side, the environmental performance of Patuha 2 Sub Project was considered in good level where GDE needs to improve environmental mitigation measure particularly waste management through their supply chains (contractors and subcontractors), even though no major non-compliance issues reported during January to June 2023 period.

6.2 Recommendations

Referring to the above conclusions, the following recommendations were made below.

Implementation of site-specific construction environmental management plans (CEMPs) must be monitored and regularly reported every month. Considering the current situation and condition in the site that dynamically changes, CEMP needs to be refined to accommodate the current state and lessons learned from current CEMP implementation.

It was also important for the contractors to implement combined occupational and community health and safety plans addressing community health issues during the construction phase. The Grievance Redress Mechanism (GRM) shall be further operationalized next semester with GRC dissemination, kick-off meetings, and GRC monitoring.

It was further recommendation to assess the potential impacts of drilling, well testing and powerplant development on noise and ambient air quality at nearby environmental sensitive receptors, such as the communities living close to the proposed plant locations (i.e. for Dieng-2). These predictive assessments provide more opportunities for impact mitigation success if conducted early in the design process, i.e. during initial plant layout conceptualization and planning and selection of plant technologies. This was expected during the Front-End-Engineering-Development (FEED) phase, rather than the Detailed Engineering Design (DED) only. However, predictive assessment findings from the FEED can be re-evaluated and refined during the DED by the EPC contractor.

Consultation and communication with all stakeholders shall be conducted regularly to communicate the impact (both positive and negative) and mitigation measures prepared to the stakeholders and obtain their recognition on D2P2 project development.

● APPENDICES

Appendix 1 PMU & PMC Joint Site Inspection to Dieng & Patuha Well Site
Appendix 2 HSE Performance of Contractor
Appendix 3 Environmental Quality Laboratory Testing Results

Appendix 1 PMU & PMC Joint Site Inspection to Dieng & Patuha Well Site

PT GEO DIPA ENERGI (PERSERO)

GEO DIPA ENERGI

BERITA ACARA
No. D2P2-BA-AEC-GDE-00018

AECOM

Date : 11 January 2023		**Subject :** Joint Site Inspection at PPL 2 on CEMP Implementation of Drilling Activity
Location : PPL 2		
Prepared by:	**Acknowledged by:**	**Acknowledged by:**
Name: Wahyu S. Minarto **PMC Representative**	**Name: Aditya Rahman** **PMU Representative**	**Name: Djemi Kapitan** **Contractor (JV ADA-APS)**

Today on Wednesday dated Eleven of January Two Thousand Twenty Third, PMU (represented by Aditya Rahman and Rista Jayanti) PMC (represented by Wahyu S. Minarto, Hasbullah Hasan and Asmorowati), JV ADA-APS (represented by Djemi Kapitan) did a joint site inspection of drilling activities at PPL 2

The Site Inspection began with HSE Induction by HSE Representatives of JV ADA-APS then explanation from Mr. Djemi Kapitan about current progress work and how JV ADA-APS managing the impacts and risks caused by the activities. Furthermore, site sighting is carried out in the JV ADA-APS site area at PPL 2. Detail of site inspection result is described in the table below:

No	Description	Findings	Corrective Action
1	General	When the site inspection is carried out drilling activity was conducted well completion testing. Well drilling is already completed, and the total depth is 210 mMD. In overall, the implementation of commitments as listed in CEMP was met the KPIs and no major incompliance finding	NA
2	CEMP Implementation- Waste Management	a. Hazardous waste resulted from activities is temporary stored at PPL 6 then transfer to PPL 6 before disposed to final disposal approved & certified by Government. b. Minor finding was notified that used oil stored in the drum is not labeled and there is no appropriate secondary containment around the drum. 	a. NA b. JV ADA-APS to provide label for hazardous waste and container shall be equipped with secondary containment

No	Description	Findings	Corrective Action
		c. Domestic waste generated are disposed in the bin provided by ETI. Minor finding was notified that there is no waste segregation between organic waste and inorganic waste d. Drilling waste was flowing to mud pond and the water reuse for mixing drilling mud e. Drill cutting collected at lay down area and compacted as a brick for further utilization	c. JV ADA-APS to conduct waste segregation d. NA e. NA
3	CEMP Implementation – Air Quality Management	• Dust generated during drilling is managed by spraying water in dusty areas • Emission test of all vehicles and heavy equipment has been completed and fulfill the standard. Emission test certificate is regularly renewed and the last test was conducted on 21 September 2022	NA
4	CEMP Implementation – Noise & Vibration Management	• Noise level was measured regularly to monitor noise impact toward worker and environment. • Worker has provided with earplug/muffs • There is complain so far from any parties regarding noise level and vibration.	NA
5	CEMP Implementation - Water Use for Drilling	• Daily use of water extracted from Cipaku River was recorder by Contractor. • Water bentonite based mud was reuse for drilling to reduce water requirement.	
6	CEMP - Occupational Health & Safety Risk Management	Daily tool box meeting, JSA, PTW and other HSE Program are implemented by JV ADA-APS a. Emergency eyewash's water (above mud tank) was not flowing good and has no sign 	NA a. To re-check the emergency eyewash equipment

No	Description	Findings	Corrective Action
		b. Emergency shower (above mud tank) not equipped with sign 	b. To complete with sign for emergency shower
		c. There is gap between railings that has potential drop object/ fall 	c. To close the gap
7	Gender Action Plan (GAP) monitoring - Worker Conditional	*Need data of the total worker (identify on gender and local-non local hire)*	
8	GAP monitoring - Training	*Need training data*	
9	GAP monitoring - Pad Facility	• There is no pedestrian path, or the sign of 'danger' is limited (only one sign) • The number of toilets is insufficient.	• Need more 'danger' sign • The number of public toilets is needed to be added
10	Grievance Redress Mechanism Committee (GRC)	The contractors or HSE personnel does not know that they are part of GRC member	Need PIC as a GRC member and actively participate to handle community complains related to project

List of attendance

GEO DIPA ENERGI

DAFTAR HADIR

Rapat : Inspeksi CEMP JV ADA APs (Rig Drilling)
Hari : Rabu
Tanggal : 11 Januari 2023
Tempat : R. Meeting Temporary Office PMU dan PPL 02

No	Nama	L/P	Jabatan/Instansi	Telepon	Email	Tanda Tangan
1	Aditya Rahman	L	HSE GDE	[illegible]		
2.	Rista Jayanti	P	Enviro Safeguard GDE	[illegible]	rista@geodipa.co.id	
3	Hasbulleh	L	Enviro - PMC Aecom	[illegible]		
4	Wahyu	L	HSE AECOM	[illegible]		
5	Armadon. R	P	Social gender Safeguard	[illegible]		
6	Christine . S	P	Social Safeguard			
7	Steve . C	L	—— // ——	081224505667		
8	Djemi Kapitan	L	HSE / JVADA APS	081384065252	djemi@ardrilling.com	

PT GEO DIPA ENERGI (PERSERO)

GEO DIPA ENERGI

BERITA ACARA
No. D2P2-BA-AEC-GDE-00018

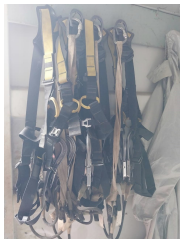
AECOM

Date : 11 January 2023		**Subject :** Joint Site Inspection at PPL 4 on CEMP Implementation of Well Testing
Location : PPL 4		
Prepared by:	**Acknowledged by:**	**Acknowledged by:**
Name: Wahyu S. Minarto **PMC Representative**	**Name: Aditya Rahman** **PMU**	**Name: Asep Wahyu** **Contractor (PT. Depriwangga)**

Today on Wednesday dated Eleven of January Two Thousand Twenty Third, PMU (represented by Aditya Rahman and Rista Jayanti) PMC (represented by Wahyu S. Minarto, Hasbullah Hasan, Christine Seta and Asmorowati), Depriwangga (represented by Asep Wahyu) did a joint site inspection at PT. Depriwangga site area at PPL 4

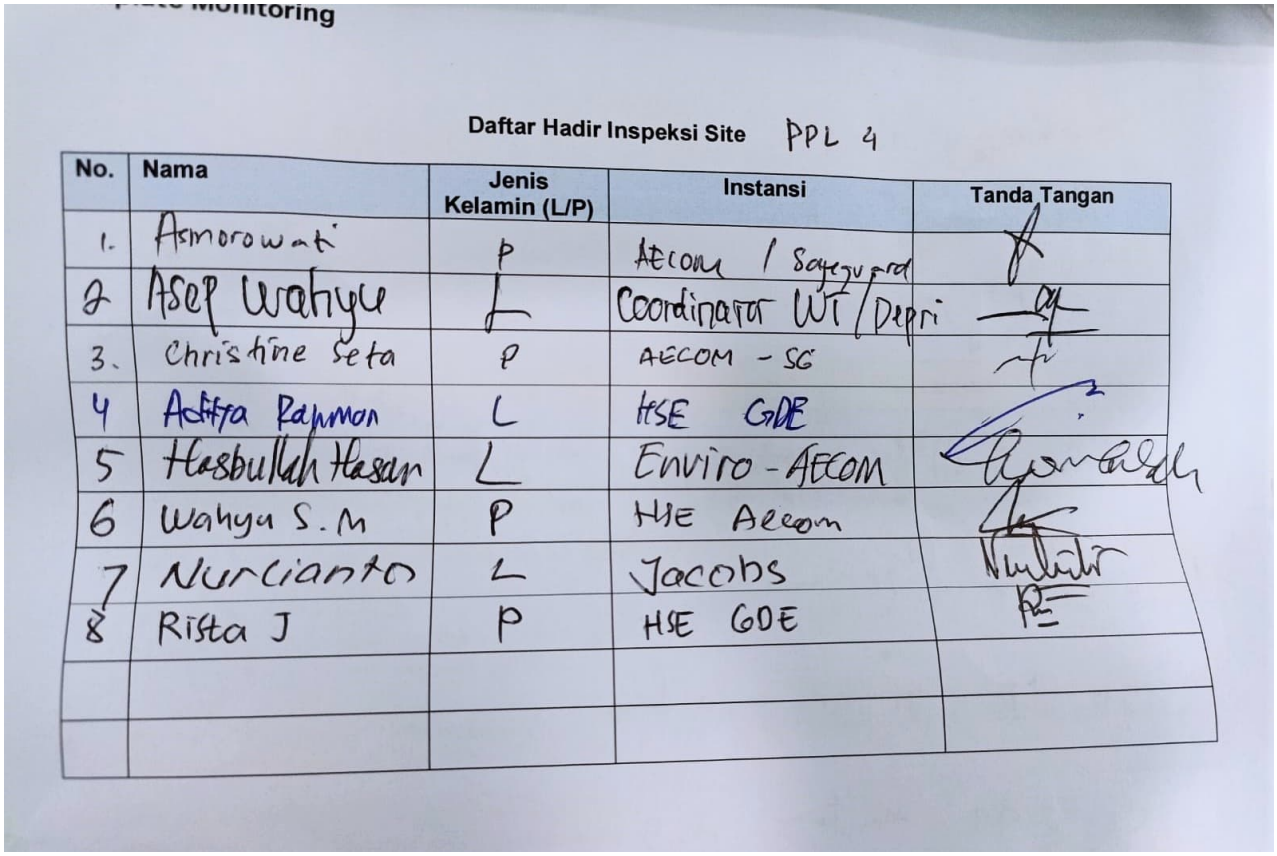
The Site Inspection began with an explanation from Mr. Asep about well testing current progress work and how Depriwangga managing the impacts and risks caused by the activities. Furthermore, site sighting is carried out in the PT. Depriwangga site area, and checking HSE documents such as H2S detector calibration certificate document. Detail of site inspection is described in the table below:

No	Description	Findings	Corrective Action
1	General	Depriwangga's scope of work is to perform well testing as requested by GDE to check well characteristic and capacity that has been drilled. When the site inspection is carried out well testing is on-going with FCV open 100%. During well testing noise is measured below the standard limit and H2S is 0 ppm	NA
2	CEMP Implementation- H2S Emission Management	In overall, the implementation of commitments as listed in CEMP was met the KPIs and only minor finding noticed during site inspection. During bleeding, H2S and NCG gas was flowing to NCG tank consict of NaOH to neutralize H2S. • Depriwangga has been installed 4 (four) H2S censors/detectors in surrounding well testing location. The censor connects to monitor in control room at PPL 4. • H2S concentration in surrounding well testing activity is check and measured every hour • As requested in CEMP H2S detector has to calibrated regularly, at the time Depriwangga could not show calibration certificate, it is keep at Head Office.	Depriwangga to submit calibration certificate to PMU
3	CEMP Implementation – Noise & Vibration Management	• Depriwangga regularly measure noise level in surrounding well testing location. Noise level is measured below standard	NA

No	Description	Findings	Corrective Action
		limit and no complain so far from any parties regarding noise level and vibration.	
4	CEMP Implementation – Brine Management	• Brine from well was flowing to water pond, water pond level is measured every hour and when reach the limit of pond capacity, then water pumped to well injection.	NA
5	CEMP Implementation – Waste Management	a. Waste bins is provided in site. b. Chemical and fuel container was equipped with secondary containment. c. Bund wall/secondary containment of diesel fuel container not properly installed.	a. Good finding b. Good finding c. To fix bund wall of diesel fuel container ASAP and drying oily water in the secondary containment.
6	CEMP – Occupational Health & Safety Risk Management	a. Daily toolbox meeting, JSA, PTW and other HSE Program are implemented. b. PPE – body harness found without inspection tag  c. PPE – Safety helmet found damaged, not standard (fake MSA)    d. Lifting gear – Webbing sling found damaged without damage tag 	a. Good finding b. Reinspect the body harness and complete with inspection tag c. Reinspect all helmet, replace damaged helmet with genuine d. Replace the damaged web sling and complete with inspection tag

No	Description	Findings	Corrective Action
		e. HSE Officer is not in place during site inspection f. Barricade tape around well head and pipe for well testing is using rope (improper barricade tape)	e. Depriwangga to assign back to back HSE Officer f. Replace rope with proper barricade tape
7	Gender Action Plan (GAP) monitoring - Worker Condition	• Total workers: - 2 coordinators (male, non-local) - 3 leaders (male, non-local) - 1 HSE (male, non-local) - 10 operators (male, local) - 6 drivers (male, local) – outside pad - 5 personnel for catering (4 male and 1 female, all are local workers) – outside pad • There are no medical personnel on site	• Need a medical staff or stand by HSE personnel or evidence that medical is provided by agreement with other
9	GAP monitoring - Training	• Training for workers	• To provide evidence to PMC: Training record (basic training, etc)
10	GAP monitoring - Pad Facility	• There is no pedestrian path, or the sign of 'danger' is limited (only one sign)  • For operator personnel who is stand by in the Pad, their shift are 12 hours and there is no proper place to take a rest	• Need more 'danger' sign • Need an 'emergency bed' to short taking a rest

Attendance List



Monitoring

Daftar Hadir Inspeksi Site PPL 4

No.	Nama	Jenis Kelamin (L/P)	Instansi	Tanda Tangan
1.	Asmorowati	P	Aecom / Sayegyard	
2	Asep Wahyu	L	Coordinator WT / Depri	
3.	Christine Seta	P	AECOM - SG	
4	Adhya Rahman	L	HSE GDE	
5	Hasbullah Hasan	L	Enviro - AECOM	
6	Wahyu S. M	P	HSE Aecom	
7	Nurcianto	L	Jacobs	
8	Rista J	P	HSE GDE	

PT GEO DIPA ENERGI (PERSERO)

GEO DIPA ENERGI

BERITA ACARA
No. D2P2-BA-AEC-GDE-00020

AECOM

Date : 21 February 2023		**Subject :** Joint Site Inspection at Well Pad 29 on CEMP Implementation of Drilling Activity
Location : Well Pad 29		
Prepared by:	**Acknowledged by:**	**Acknowledged by:**
Name: Hasbullah Hasan **PMC Representative**	**Name: Dian Nur Febrianto** **PMU Representative**	**Name: Edo** **Contractor (PT. PRA)**

Today on Tuesday dated twenty first of February Two Thousand Twenty Third, PMU (represented by Sigit Pamungkas and Dian Nur) PMC (represented by Hasbullah Hasan, Herdedi, Dini Sabaniah and Steve Christiantara), PT. PRA (represented by Edo) did a joint site inspection of drilling activities at Pad 29

The Site Inspection began with HSE Induction by HSE Representatives of PT. PRA then explanation from Mr. Edo about current progress work and how PT. PRA managing the impacts and risks caused by the activities. Furthermore, site sighting is carried out in the PT. PRA site area at Well Pad 29. Detail of site inspection result is described in the table below:

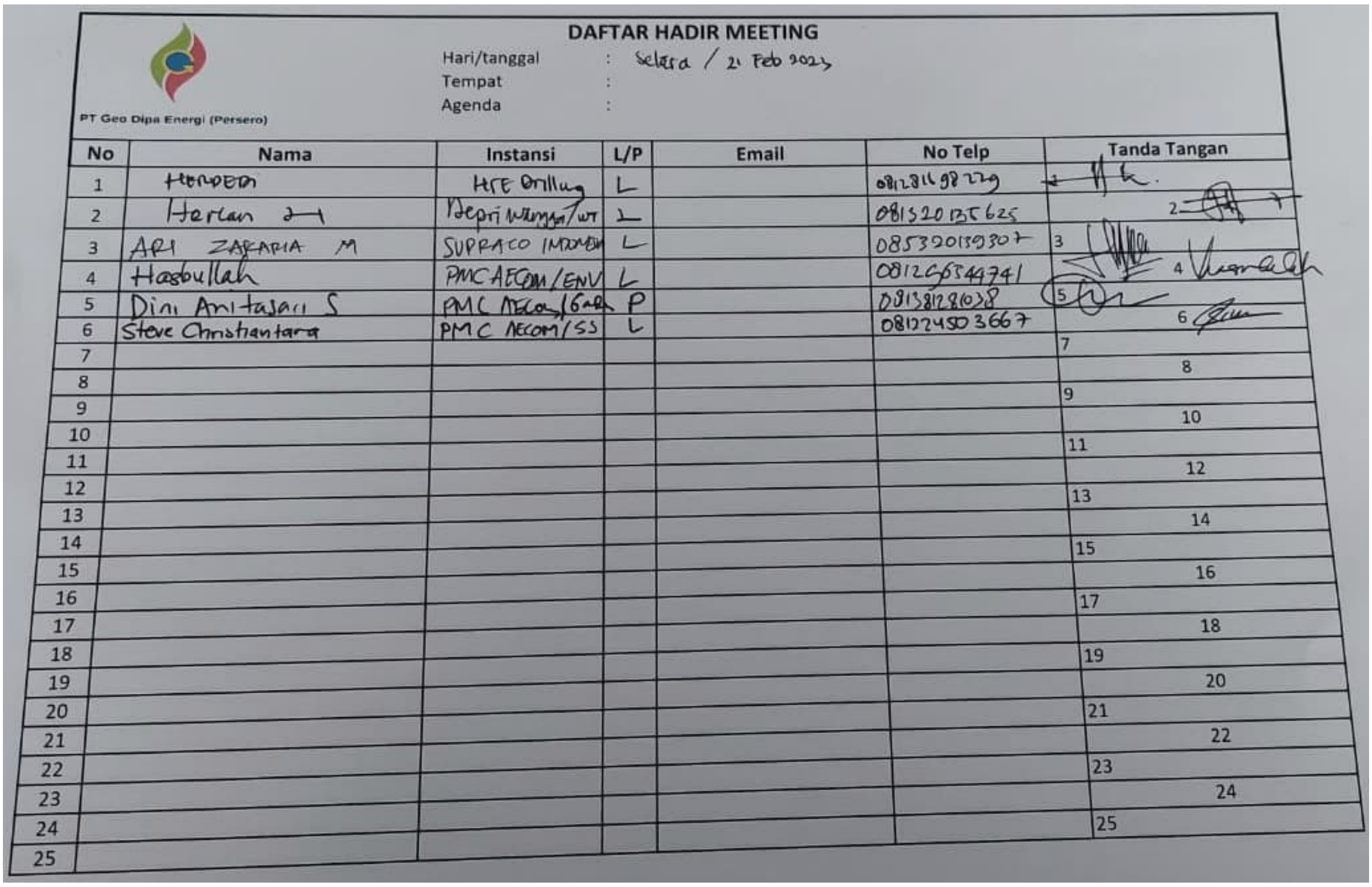
No	Description	Findings	Corrective Action
1	General	When the site inspection is carried out drilling activity was conducted string and drill bite pulling out. Well drilling is the second well and already reach depth of 1500 m. In overall, the implementation of commitments as listed in CEMP was partially met the KPIs and found some incompliance finding	NA
2	CEMP Implementation- Waste Management	a. Hazardous waste resulted from activities is temporary stored at Pad 29 then transfer to Pad 28 before disposed to final disposal approved & certified by Government. b. Minor finding was notified that during fuel transfer from fuel tanker there was spill and fuel drip contained in the bottle. 	a. NA b. PT. PRA to fix the problem of fuel transfer and provide spill kit and proper containment (due date March 1, 2023)

No	Description	Findings	Corrective Action
		c. Domestic waste generated are disposed in the bin provided by PT PPLI. Major finding was notified that there is no waste segregation between organic waste, inorganic waste and hazardous waste  d. Drilling waste was flowing to mud pond and the water reuse for mixing drilling mud e. Drill cutting collected at Pad 33 and Bitingan Village and compacted as a brick for further utilization. Drill cutting also used as flooring at Pad 7 and dumping at Bitingan and Sileri Pond which is not recommended by CEMP	c. PT. PRA to conduct waste segregation, provide waste bin based on type of waste and conduct socialization/training to Sub Contractor regarding waste segregation (due date March 1, 2023) d. NA e. PT. PRA to fix drill cutting issue and has to conduct training and educate the Subcontractor on drill cutting management in accordance with CEMP requirements (due date March 1, 2023)
3	CEMP Implementation – Air Quality Management	• Dust generated during drilling is managed by spraying water in dusty areas • Emission test of all vehicles and heavy equipment has been completed and fulfill the standard. Emission test certificate is regularly renewed and the last test was conducted on January 2023	NA
4	CEMP Implementation – Noise & Vibration Management	• Noise level was measured regularly to monitor noise impact toward worker and environment. • Worker has provided with earplug/muffs • There is no complain so far from any parties regarding noise level and vibration.	NA
5	CEMP Implementation - Water Use for Drilling	• Daily use of water extracted from Sidolok River was recorder by Contractor. • Water bentonite based mud was reuse for drilling to reduce water requirement.	NA
6	CEMP - Occupational Health & Safety Risk Management	• Daily tool box meeting, JSA, PTW and other HSE Program are implemented by PT. PRA. • In house training on HSE issue regularly conducted every week, participants were all personnel. • SCBA Training conducted three times a week participant were Rescue Team and all Rig Floor Crews	NA

No	Description	Findings	Corrective Action
		• Health Talk conducted every week attendance were all personnel Some minor finding on health & safety issues are as follows: a. Minor finding was notified during inspection Contractor personnel smoking not in the dedicated smoking area b. Secondary Containment at close to fuel tank location found in appropriate condition. c. In general house keeping in rig area look disorganized	a. PT. PRA to install no smoking area sign at several location and socialize to all personnel regarding smoking policy (due date March 1, 2023) b. PT. PRA to fix secondary containment (due date March 1, 2023) c. PT. PRA to conduct regular check of housekeeping condition (due date March 1, 2023)
7	Gender Action Plan (GAP) monitoring - Worker Conditional	• Total workers (per 20 Feb 2023 – night, day, on call)): - 2 leaders (male, non-local) - 20 operators (male, 1 local, 19 non-local) - 3 HSE (male, 3 non-local) - 12 drivers (male, 5 local, 7 non-local) - 15 helpers (male, all local) - 6 personals for catering (female, 2 in pad, 4 outside pad, local) - 5 GDE (male, DSV-NDSV-Drilling Logistic-HSE Supervisor-Geologist, non-local) - 1 HSE (male, 1 local, 19 non-local) - 10 operators (male, local) - 85: engineer, electric, mechanic (male, 24 local, 61 non-local) • The data people on board (POB) have not been disaggregated (male/female) • There is a medical person, including an ambulance car on site. An ambulance is	• To provide a disaggregated data for POB (due date March 1, 2023)
8	GAP monitoring - Training	• Training for workers, at least there are 5 kinds of short training have been conducted in the last 4 months: refresh SCBA, health talk, refresh training on stop works authority and refresh training H2S hazards awareness. • The data participants of training have not been disaggregated (male/female)	• To provide a disaggregated data for training participants (due date March 1, 2023)
9	GAP monitoring - Pad Facility	• There is toilet available 1 for female and 5 for male, but the water is not available and toilet for female was locked at that	• The water should be always available • Toilet should be

No	Description	Findings	Corrective Action
		time.	accessible at any time, especially during working hours.
10	Promotion of prevention of sexual harassment in the workplace	• There are posters ‘stop sexual harassment’ and ‘stop bullying’, however the posters posted inside the admin office and were not easily visible	• Posters should be pasted in places where workers can easily see and read them (due date March 1, 2023)

List of attendance



DAFTAR HADIR MEETING

PT Geo Dipa Energi (Persero)

Hari/tanggal : Selasa / 21 Feb 2023
Tempat :
Agenda :

No	Nama	Instansi	L/P	Email	No Telp	Tanda Tangan
1	Hendra	HTE Drilling	L		081281198229	1
2	Herlan 24	Depri Wayan/WT	L		081320135625	2
3	ARI ZAKARIA M	SUPRACO INDONESIA	L		085320139307	3
4	Hasbullah	PMC AECOM/ENV	L		081266344741	4
5	Dini Anitasari S	PMC AECOM/6AR	P		081381281038	5
6	Steve Christiantara	PMC AECOM/SS	L		081224503667	6
7						7
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PT GEO DIPA ENERGI (PERSERO)

GEO DIPA ENERGI

BERITA ACARA
No. D2P2-BA-AEC-GDE-00022

AECOM

Date : 5 April 2023		**Subject :** Joint Site Inspection at Well-Pad BB on CEMP Implementation of Drilling Activity
Location : Well-Pad BB, Rig Arjuna#88		
Prepared by:	**Acknowledged by:**	**Acknowledged by:**
Name: Wahyu S. Minarto **PMC Representative**	**Name: Aditya Rahman** **PMU Representative**	**Name: Sari Narulita Bahri** **Contractor (JV ADA-APS)**

On the day of Wednesday dated Fourth and Fifth of April Two Thousand Twenty-Three, PMU (represented by Rista Jayanti, Yudha Wahyu and Bambang Umbara), PMC (represented by Wahyu S. Minarto, Hasbullah Hasan, Novianto Hadi Suwito, Dini Sabaniah and Steve C), JV ADA-APS (represented by Sari Narulita Bahri and Sugiharto) did a joint site inspection of Contractor Environmental Management Plan (CEMP) implementation during drilling activities at Pad BB.

The Site Inspection began with HSE Induction by Sugiharto, HSE Representatives of JV ADA-APS, then Drajat, Company Man explained about current progress work and how JV ADA-APS was managing the impacts and risks caused by the activities. Site sighting was carried out inside the JV ADA-APS site area at Pad BB. For inspection of Biodiversity Action Plan (BAP) implementation, the site sighting was also conducted outside the Pad BB in particularly access road to Pad BB. Detail of site inspection result was described in the table below:

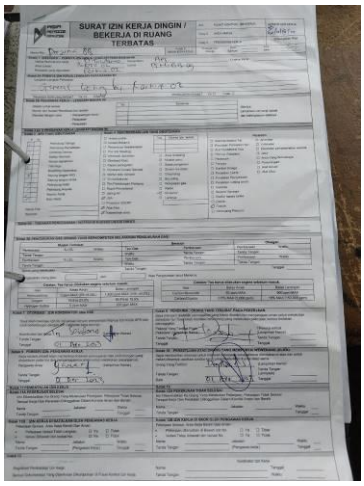
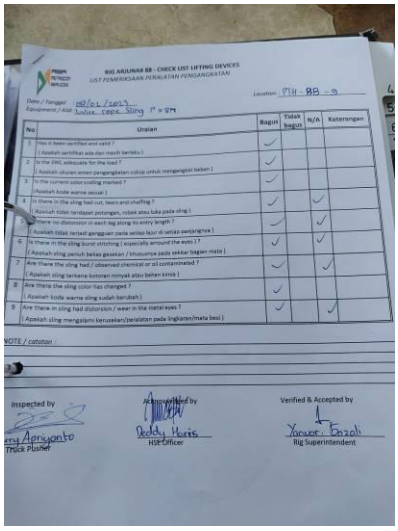
No	Description	Findings	Corrective Action
1	General	When the site inspection was carried out drilling activity was conducted well drilling (sidetrack). Well drilling was already reached depth 1692 meter In overall, the implementation of commitments as listed in CEMP was met the KPIs and no major incompliance finding	NA
2	CEMP Implementation- Waste Management	• Hazardous waste resulted from activities was temporary stored in the well-pad then transfer to PPL 6 before disposed to final disposal approved & certified by Government. • Minor finding was notified that used oil stored in the drum at PPL seem not equipped with appropriate secondary containment around the drum. • Domestic waste generated were temporary disposed in the bins provided by ETI. • Drilling waste was flowing to mud pond and the water reused for mixing drilling mud • Drill cutting collected at lay down area (outside well-pad BB) and compacted as	NA JV ADA-APS to tidy up secondary containment at PPL 6 NA NA NA

No	Description	Findings	Corrective Action
		bricks for further utilization	
3	CEMP Implementation – Air Quality Management	• Dust generated during drilling was managed by spraying water in dusty areas • Emission test of all vehicles and heavy equipment has been completed and fulfill the standard. Emission test certificate was regularly renewed, and the last test was conducted on 21 September 2022 • Air quality sampling conducted every month by third party contractor	NA
4	CEMP Implementation – Noise & Vibration Management	• Noise level was measured regularly to monitor noise impact toward worker and environment. • Worker has provided with earplug/muffs • There was no complain so far from any parties regarding noise level and vibration.	NA
5	CEMP Implementation - Water Use for Drilling	• Daily use of water extracted from Cipaku River was recorder by Contractor. • Water bentonite-based mud was reuse for drilling to reduce water requirement.	
6	CEMP Implementation - Water Quality Management	• Domestic liquid wastewater from the septic tank flows into the drainage canal and was absorbed into the ground • Drainage channel had been made around the well pad, there was no sediment control in the drainage channel to the river • Drill cutting collected in well pad and transferred to storage at Lay Down area for further treatment • Water mud from drilling activity store at water pond, and regularly pumping to PPL 4 and PPL 2 to avoid overflow to water stream.	NA Recommendation for JV ADA-APS to install sediment control NA NA
7	CEMP Implementation - H2S Management	• Seven H2S detectors was installed in surrounding well pad and was monitored from control room • Portable H2S detector provided for assigned personnel • SCBA was provided in case any emergency event	NA
8	CEMP Implementation Erosion and landslide	There was no erosion and landslide found in well pad. Early warning system (EWS) was provided.	NA
9	CEMP Implementation - Occupational Health & Safety Risk Management	Key findings: • Safety Induction, safety meetings records were available and in place • MCU record indicates all personnel had valid MCU • Overall housekeeping was good • Most of the APAR was inspected	

No	Description	Findings	Corrective Action
		• Railing for fall protection was sufficient • Operator certificate was valid. However, 2 operators will be expired (July & August 2023) Need improvement: a) Alat Pemadam Api Besar (APAB) near fuel tank area was not protected from weather b) No record of simulation using APAB c) No record of training of using APAB d) Some bund walls need to be enhanced e) No sign for emergency shower & eyewash f) Emergency shower was hard to be identified g) Emergency buoy at pond only found 1 h) Most of Permit to Work has not been closed i) Web sling did not follow color coding protocol	a) Install roof/ shelter b) Conduct simulation drill using APAB c) Conduct training d) Repair bundwall e) To add proper safety sign f) Paint with bright color (yellow) g) To add at least 1 more buoy h) To be completed i) Comply with color coding protocol
	Biodiversity Action Plan (BAP) Implementation – Biodiversity Protection	• Biodiversity induction was reportedly included during HSE Induction as conducted in regular basis (once in three months); • SOP for wildlife/animal rescue including the transport cage was provided on site; and • Referring to the interview and evidence on site, campaign or education of biodiversity conservation and protection has never been conducted. • No accident or incident involving wildlife/animal was recorded; and • Javan Surilis were reportedly showed quite often at access roadsides in particularly at the location where the canopy bridge was sited (STA 0+310).	• Records of biodiversity induction needed to be incorporated in the next CEMP Implementation Monthly Report • Evidence of campaign or education of biodiversity conservation and protection needs to be incorporated in the next CEMP Implementation Monthly Report
10	Gender Action Plan (GAP) monitoring - Worker Condition	• Total workers: - Total worker, local and non-local: 248 Male, 18 female - Non-local worker: 2 female, 155 male - Local worker: 93 male, 16 female (administration, catering, housekeeping)	• N/A • Send data to team
11	GAP monitoring - Training	• Regular training for worker: - Basic Training for worker - Permit to work - Job safety analysis	• To provide sex-disaggregate data • To provide sex-disaggregate data

No	Description	Findings	Corrective Action
		- H2S • Meaningful consultation already conducted before mobilization and spud in activities.	for meaningful activities •
12	GAP monitoring - Pad Facility	• Medical personnel stand by on site (1 doctor, 2 medical staff) • Proper pedestrian path provided, including inspection line and sign of 'danger' • Place to stay overnight and take a rest were provided • Proper toilet provided (5 toilet for men, 2 toilets for women, there was toilet in each minicamp) • Praying room was available (musholla, 1 for male and 1 for female) • T-Card was already on Pad facility • PPE provided to all workers • Poster on sexual harassment prevention was in place	• N/A • To provide sex-disaggregate data in T-Card. • PPE record and distribution

Picture

	
Animal Transport Cage and Empty Space of Biodiversity Conservation Campaign	Inconsistency of Permit to Work, no date and for the complete PTW no sign from company man to close
	
Inconsistency of wire sling inspection, N/A was ticked along with Bagus	No shelter in APAB
	
Emergency eyewash lack of Signage to indicate the position	Condition of bund wall at Fuel Tank area need to be repaired

	
Emergency showe was not clearly visible	Bund walls need repair
	
Drainage channel to river	Improper B3 storage

	
Anti harassment banner at base camp	Anti harassment poster at rig porta office
	
Proper and safe walkway provided	Adequate toilet facilities with gender segregation
	
Contaminated drainage water	Praying room (musholla) provided

Appendix 2 HSE Performance of Contractor

PT. PLUMPANG RAYA ANUGRAH
Drilling & Workover Rig Services

QHSE & OPERATION RIG PERFORMANCE MONTHLY REPORT

PT.PLUMPANG RAYA ANUGRAH

Rig & Facility Name: PRA#09

Doc. No. : FOR-CP-QHSE-05.01 Rev.00

		Target	Remarks	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23	YTD 2023
	Man Hours			62184	51627	61200	59772	57108	52728							344619
	KM Drive			5247	6091	6029	5566	5595	5369							33897
	Incident Injury Free (IIF) Days			31	59	90	120	151	182	212	243	273	304	334	365	
I	LAGGING INDICATOR															
	Fatality Case	0		0	0	0	0	0	0							0
	LTI Case	0		0	0	0	0	0	0							0
	RWD Case	0		0	0	0	0	0	0							0
	MT Case	0		0	0	0	0	0	0							0
	TRI Case	0		0	0	0	0	0	0							0
	TRIR	0.00		0	0	0	0	0	0							0.00
	No. of Day Loss	0		0	0	0	0	0	0							0
	Severity Rate	0.00		0	0	0	0	0	0							0.00
	Motor Vehicle Crash Case (MVCC)	0		0	0	0	0	0	0							0
	MVC Rate	0.00		0	0	0	0	0	0							0.00
	OIL SPILL (≥ 1 bbls / 159 Liters)	0		0	0	0	0	0	0							0
	ETA-Property Damage	0		0	0	0	0	0	0							0
	FAC	0		0	0	0	0	0	0							0
	NEAR-MISS	10		0	0	0	0	0	0							0
	Fire Incident	0		0	0	0	0	0	0							0
	Sexual harassment case	0		0	0	0	0	0	0							0
	Environmental Incidents	0		0	0	0	0	0	0							0
	Security disturbance	0		0	0	0	0	0	0							0
	Number of grivances received from local Community	0		0	0	0	0	0	0							0
	Occupational Diseases (PAK)	0		0	0	0	0	0	0							0

PT. PLUMPANG RAYA ANUGRAH
Drilling & Workover Rig Services

QHSE & OPERATION RIG PERFORMANCE MONTHLY REPORT

PT. PLUMPANG RAYA ANUGRAH

Rig & Facility Name: PRA#09

Doc. No. : FOR-CP-QHSE-05.01 Rev.00

		Target	Remarks	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23	YTD 2023
II	LEADING INDICATOR															
1	Hazard Observation Card															
	Participant 90% and Status Closing Finding 98%	100%	Min 1200 Card / Month	2793	2163	2417	2292	2274	1605							**13544**
2	Management Walkthrough															
	Sr. Management Visit (Director & GM)	2	Every 6 Month	0	0	0	0	0	0							**0**
	Management Visit (Manager)	12	Every Month	1	1	1	1	1	1							**6**
3	Drill															
	Fire	2	Refer to Rig HSE Program	1	1	1	1	1	1							**6**
	BOP & Well Control	2	Refer to Rig HSE Program	0	1	1	1	0	1							**4**
	H2S Release	1	Refer to Rig HSE Program	2	2	1	1	1	1							**8**
	MEDIVAC	1	Refer to Rig HSE Program	1	1	1	1	1	1							**6**
	Oil Spill	1	Refer to Rig HSE Program	0	0	0	0	0	0							**0**
4	Audit, Inspection & Monitoring															
	QHSE Audit Internal	1	Refer to Rig HSE Program	0	0	0	0	0	0							**0**
	QHSE Audit External	1	Refer to Rig HSE Program	0	0	0	0	0	0							**0**
	Camp & Hygiene Inspection	12	Every Month	1	1	1	1	1	1							**6**
	Lifting, Rigging & Slinging	2	Every 6 Month per Rig	0	0	0	0	0	1							**1**
	Internal Drop Object Inspection	12	Every Month per Rig	1	1	1	1	1	1							**6**
	Light & Heavy Vehicle Inspection	1	1 times/vehicle by mechanics/month	1	1	1	1	1	1							**6**
	Noise Mapping	2	Every 6 Month	0	0	0	1	0	1							**2**
	Illumination Measure	2	Every 6 Month	0	0	0	0	0	0							**0**
	Dangerous Waste (B3) Disposal to third party	100%	Every 3 Month	100%	100%	100%	100%	100%	100%							**50.00%**
	Domestic Waste Disposal to TPA	100%	Every Weeks	100%	100%	100%	100%	100%	100%							**50.00%**
	Medical Check Up	100%	Pre-employment & Every 1 Year	100%	100%	100%	100%	100%	100%							**50.00%**
5	No. of JSA, PTW & JMM															
	JSA	100%	For every job require	100%	100%	100%	100%	100%	100%							**50.00%**
	PTW	100%	If any job needed PTW	100%	100%	100%	100%	100%	100%							**50.00%**
	Journey Management Moving / JMP	100%	If any job needed JMM	100%	100%	100%	100%	100%	100%							**50.00%**
6	QHSE Meeting															
	Tailgate/Toolbox/Pre-Shift Meeting	100%	Every 2x / day	100%	100%	100%	100%	100%	100%							**50.00%**
	Pre Job Meeting	100%	Before job	100%	100%	100%	100%	100%	100%							**50.00%**
	Stand Down Meeting	100%	If any Incident share	100%	100%	100%	100%	100%	100%							**50.00%**
7	QHSE Campaign															
	Banner/sticker	4	Every 3 Month	2	1	1	0	0	0	0	0	0	0	1	0	**5**
8	QHSE Training, Induction & Orientation															
	QHSE Orientation	100%	If any new personnel	100%	100%	100%	100%	100%	100%							**50.00%**
	Basic Safety Training	1	In House Training	1	1	1	1	1	1							**6**
	Lifting, Rigging & Slinging	2	In House Training	1	1	1	1	1	1							**6**
	DDC	100%	In House Training	0	0	0	1	1	0							**16.67%**
9	Reward & Punishment															
	Reward	100%	Every Weeks	100%	100%	100%	100%	100%	100%							**50.00%**
	Punishment	100%	If any violation	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
10	Customer Satisfaction															
	Customer Satisfaction Survey	**100%**	Every year or end of contract	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**

	Target	LAGGING INDICATOR 2023												YTD
		Jan	Feb	Mar	Apr	Mei	Jun	Jul	Agu	Sep	Okt	Nov	Des	
		ARJUNA#88	ARJUNA#88	ARJUNA#88	ARJUNA#88	ARJUNA#88	ARJUNA#88	ARJUNA#88	ARJUNA#88	ARJUNA#88	ARJUNA#88	ARJUNA#88	ARJUNA#88	
Man Hours JV ADA-APS & Sercom	**(Hours Worked)**	73,044	68,568	72,648	69,576	73,055	73,109							430,000
Cum Man Hours	**(Hours Worked)**	1,124,244	1,192,812	1,265,460	1,335,036	1,408,091	1,481,200							1,481,200
KM Driven	**(Km)**	5,047	3,537	4,197	5,030	4,959	5,456							969,566
Safe operation	**(Days)**	31	28	31	30	31	30							638
LAGGING INDICATOR	**Target**													
Fatality	**0**	0	0	0	0	0	0							0
LTI (Lost Time Injury) / DAFWC (Day Away From Work Case)	**0**	0	0	0	0	0	0							0
RWDC (Restricted WorkDay Case)	**0**	0	0	0	0	0	0							0
MTC (Medical Treatment case)	**0**	0	0	0	0	0	0							0
MVC (Motor Vehicle Crash)	**0**	0	0	0	0	0	0							0
Recordable Spill	**0**	0	0	0	0	0	0							0
Property Damage	**0**	0	1	0	0	0	0							1
FAC (First Aid Case)	**0**	0	0	0	0	0	0							0
Nearmiss Report	**Min 3 or as client regulation**	1	0	1	0	0	0							2
Fire Incident	**0**	0	0	0	0	0	0							0
EFFICIENCY, QUALITY & RELIABILITY	**Target**													
Rig Reliability	**98%**	96	95	95	95	95	95							9516.7%
Rig Availability	**98%**	90	92	91	92	92	92							9150.0%
Utilization Rate	**90%**	90	90	90	90	90	90							9000.0%
Unpaid	**Less than 3 Hrs**	0	0	0	0	0	0							0

369288.00
301212.00
68076.00

APS Monthly QHSE Program Report - 2023

Laporan Bulanan QHSE Program	Target	Keterangan	TAHUN 2023												Ytd Achievement
			1	2	3	4	5	6	7	8	9	10	11	12	
1. Pertemuan QHSE/ Komunikasi															
Tailgate/Toolbox/Pre-shift Meeting	1440	2x per hari	62	56	62	60	31	60							331
Pre Job Meeting	2160	Minimal 3x sehari	11	16	10	16	18	8							79
Stand Down Meeting	100%	Jika ada isu/ incident	4	9	2	0	0	0							15
Pertemuan QHSE Bulanan	24	Setiap bulan minggu ke 3 atau 4	0	0	0	0	0	0							0
Sosialisasi Pencapaian Kinerja QHSE	24	Setiap bulan minggu ke 3 atau 4	2	2	2	4	4	4							18
Sosialisasi Register Temuan/ isu	24	Setiap bulan minggu ke 3 atau 4	2	2	2	4	4	4							18
Sosialisasi APS General Procedures/ SPS/ JSA	24	Setiap bulan minggu ke 3 atau 4	476	411	459	437	463	469							2715
Sosialisasi Kebijakan PT GDE & PT APS	8	Setiap 3 Bulan	0	0	0	0	0	0							0
Induksi QHSE	100%	Saat Induksi pekerja/ tamu	77	78	125	58	80	56							474
Komunikasi Peraturan dan Perundang-undangan pada pekerja	100%	Saat Induksi pekerja/ tamu	1	1	1	58	80	56							197
Pertemuan Sr. Management dan pekerja	8	Setiap 3 Bulan	6	8	3	0	1	0							18
2. Pelatihan QHSE															
Orientasi QHSE	100%	Pekerja baru, kontrak baru dan tahunan (Sesuai Matrik Pelatihan)	0	0	0	0	0	0							0
Basic Safety Training	100%	Pekerja baru, kontrak baru dan tahunan (Sesuai Matrik Pelatihan)	0	0	0	0	0	0							0
Awareness	100%	Refresh Onsite Training	7	12	25	9	20	19							350
3. Inspeksi dan pelaporan QHSE															
Inspeksi QHSE Bulanan	100%	Sebelum Bekerja	420	481	423	4	4	4							1336
Inspeksi Housekeeping	96	Mingguan	4	4	4	4	4	4							24
Fire Extinguisher Inspection	24	Bulanan	4	4	4	4	4	4							24
Pre Trip Inspection	90%	Harian per kendaraan	93	87	90	93	94	9							466
PPE Inspection	96	Mingguan per kru	4	4	4	4	4	4							24
Safety Equipment & Special PPE Inspection	24	Bulanan	1	1	1	4	4	4							15
Rig & Equipment Inspection	96	Mingguan	4	4	4	4	4	4							24
QHSE Monthly Report	24	Bulanan	1	1	1	1	1	1							6
4. Kesehatan dan Hygiene															
Noise Measurement	1	Tahunan	0	0	1	0	1	0							2
Illumination Measurement	1	Tahunan	0	0	0	0	0	0							0
Medical Check Up	100%	Pekerja baru, kontrak baru dan tahunan	100%	100%	100%	100%	100%	100%							6
Hygiene inspection	4	Mingguan	4	4	4	4	4	4							24
5. Emergency Drill															
Fire	6	Setiap 4 bulan	1	0	1	1	3	1							7
BOP/ Well Control	6	Setiap 4 bulan	0	0	0	0	0	0							0
H2S Release	6	Setiap 4 bulan	3	1	0	1	0	1							6
Medivac	6	Setiap 4 bulan	1	1	1	1	0	2							6
Oil Spill	6	Setiap 4 bulan	0	0	0	0	0	0							0

6. Hazard Observation Card/ BBS/ PEKA																
Paricipant 95% and Status Closing Finding 98%	95%	Minimum 7 Card / month / Employee	4850	5590	4866	5757	6285	6672								34020
7. Management Walkthru (MWT)																
Sr. Management Visit (President Director, General Manager, Operation Manager & QHSE Manager)	8	Setiap sumur	6	8	3	1	18	0								36
8. Kampanye QHSE																
Banner/ Poster/ Leaflet	4	Setiap 6 bulan	0	0	0	0	0	0								0
9. Reward & Punishment																
Reward	6	Setiap 4 bulan	1	1	1	4	4	4								15
Punishment	-	Jika ada pelanggaran	0	0	0	0	0	0								0
10. Investigasi dan laporan Accident/ Incident																
Accident/ Incident	0	Sesuai kejadian	0	0	0	0	0	0								0
Nearmiss	0	Sesuai kejadian	1	0	1	0	0	0								2
11. Performa QHSE oleh Internal & Client																
QHSE Audit by Client	4	Setiap 6 bulan	0	0	0											0
Internal Audit	2	Tahunan	0	0	0											0
Management Review	2	Tahunan	0	0	0											0
Pengukuran Lingkungan (by third party)	4	Setiap 3 bulan	0	0	1											1

Appendix 3 Summary of Environmental Monitoring Reports and Laboratory Testing Results

A. Dieng 2 Sub Project

This summary of environmental monitoring report is referred to the Environmental Permit of Dieng Unit 2 Geothermal Power Plant Development Project prepared by PT Sucofindo Indonesia.

The scope of environmental monitoring includes:

1. Ambient air quality monitoring;
2. Noise monitoring;
3. Surface water quality monitoring;
4. Clean water/groundwater quality monitoring;
5. Domestic wastewater monitoring;
6. Produced water quality monitoring;
7. Solid waste monitoring;
8. Erosion and landslide monitoring;
9. Traffic and road safety monitoring; and
10. Aquatic biota monitoring.

This monitoring is undertaken in quarterly and semesterly basis. The distribution of monitoring is showed in the following figures and the results of monitoring are provided in the following sections.

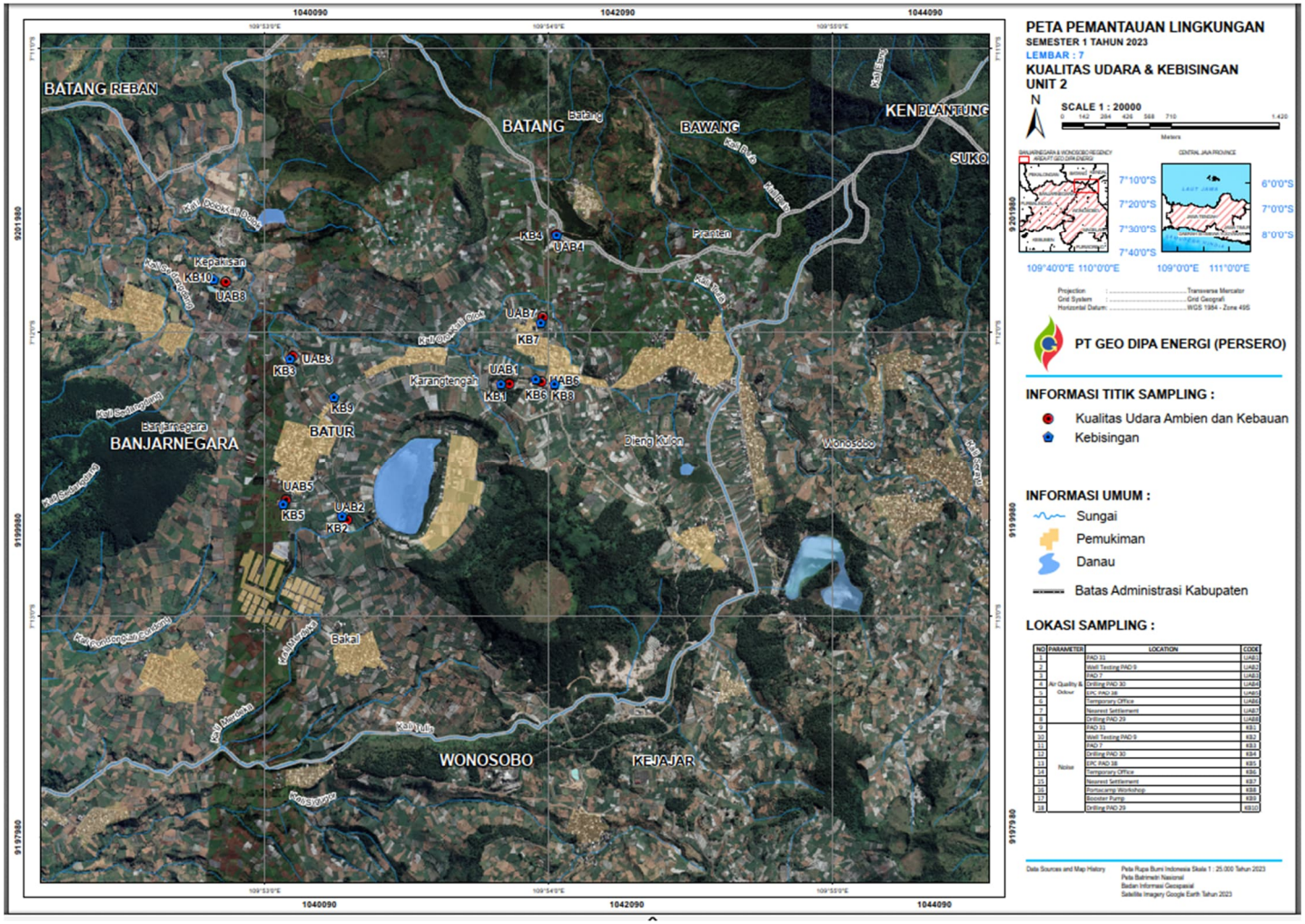


Figure 1 Sampling Location of Air Quality, Noise and Vibration

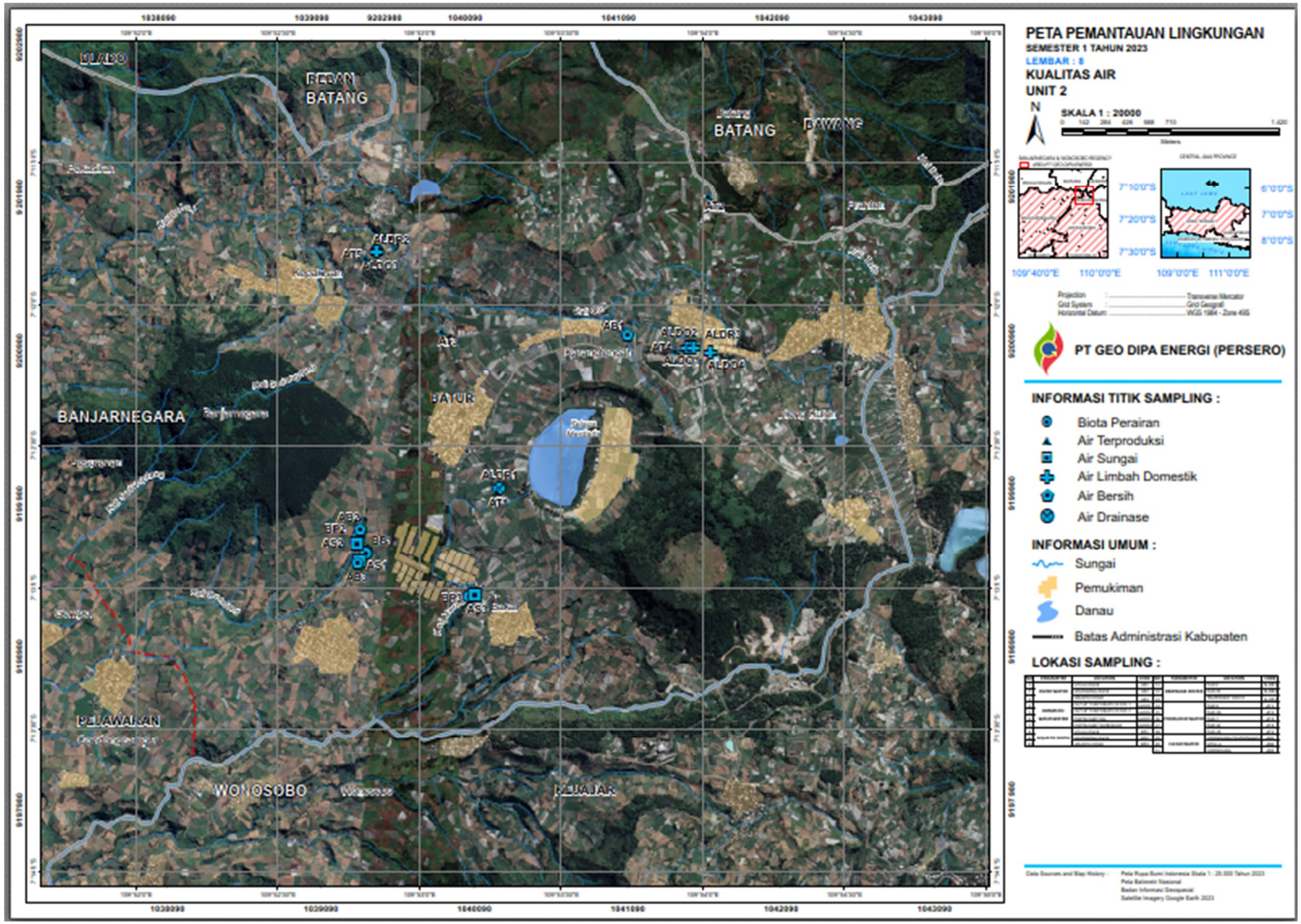


Figure 2 Sampling Location of Water Quality

PT Geo Dipa Energi (Persero)

AIR SUNGAI

1. Ambient Air Quality

Ambien Air Quality Quarterly Monitoring Description

Period	Quarterly
Standard	Republic of Indonesia Government Regulation Number 22 of 2021 Appendix VII
Method	Air sampling to measure dust content using a dust filter and suction pump. The air pump used for dust is of the High Volume Air Sampler (HVAS) type, then the dust particles are analyzed using a gravimetric apparatus.
Monitoring Location	AQ-1 PAD 7 AQ-2 PAD 9 AQ-3 PAD 30 AQ-4 PAD 31 AQ-5 PAD 29 AQ-6 Nearest Settlement AQ-7 EPC PAD 38 AQ-8 Temporary Office

Table 1 Results of Ambient Air Quality Analysis for the First Quarter of 2023

Parameter	Unit	Results								Quality standards	WHO Guidelines	Method
		AQ-1	AQ-2	AQ-3	AQ-4	AQ-5	AQ-6	AQ-7	AQ-8			
Sulfur Dioxide (SO2)	µg/Nm3	< 26	< 26	< 26	< 26	< 26	-	-	-	**150**	20	SNI 19-7119.7-2017
Carbon Monoxide (CO)	µg/Nm3	< 1146	< 1146	< 1146	< 1146	< 1146	-	-	-	**10,000**	-	PO/AKL/46
Nitrogen Dioxide (NO2)	µg/Nm3	12,5	15,4	17,3	14,5	12,6	-	-	-	**200**	200	SNI 19-7119.2-2017

Parameter	Unit	Results								Quality standards	WHO Guidelines	Method
		AQ-1	AQ-2	AQ-3	AQ-4	AQ-5	AQ-6	AQ-7	AQ-8			
Oxidants (O3)	µg/Nm3	10,2	12,3	8,5	10,6	11,3	-	-	-	**150**	100	SNI 19-7119.8-2017
Hydrocarbons (HC)	µg/Nm3	< 20	< 20	< 20	< 20	< 20	-	-	-	**160**	-	TIME 3rd Ed. 198 P (Sect. II Part 101)
Particles (PM 10)	µg/Nm3	56,5	20,3	18,1	20,1	18,3	-	-	-	**75**	50	SNI 19-7119.15-2016
Particles (PM 2.5)	µg/Nm3	17,3	17,2	15,2	17,8	10,1	-	-	-	**55**	25	SNI 19-7119.14-2016
Suspended Particles (TSP)	µg/Nm3	56,5	54,5	61,2	60,3	30,2	-	-	-	**230**	-	SNI 19-7119.3-2017
Lead (Pb)	µg/Nm3	< 0,040	< 0,040	< 0,040	< 0,040	< 0,040	-	-	-	**2**	-	SNI 19-7119.4-2017
Ammonia (NH3)	ppm	0,058	0,060	0,058	0,057	0,057	-	-	-	**2**	-	SNI 19-7119.1-2005
Hydrogen Sulfide (H2S)	ppm	< 0,008	< 0,008	< 0,008	< 0,008	< 0,008	-	-	-	**0.02**	-	SNI 19-4844-1998

Source: Laboratory Analysis Result PT. Sucofindo 2023

Table 2 Results of Ambient Air Quality Analysis for the Second Quarter of 2023

Parameter	Unit	Results								Quality standards	WHO Guidelines	Method
		AQ-1	AQ-2	AQ-3	AQ-4	AQ-5	AQ-6	AQ-7	AQ-8			
Sulfur Dioxide (SO2)	µg/Nm3	< 26	< 26	< 26	< 26	-	< 26	< 26	< 26	**150**	20	SNI 19-7119.7-2017

Parameter	Unit	Results								Quality standards	WHO Guidelines	Method
		AQ-1	AQ-2	AQ-3	AQ-4	AQ-5	AQ-6	AQ-7	AQ-8			
Carbon Monoxide (CO)	µg/Nm3	< 1146	< 1146	< 1146	< 1146	-	< 1146	< 1146	< 1146	**10,000**	-	PO/AKL/46
Nitrogen Dioxide (NO2)	µg/Nm3	14,0	13,4	20,7	12,6	-	14,3	< 10	10,2	**200**	200	SNI 19-7119.2-2017
Oxidants (O3)	µg/Nm3	13,2	11,9	12,8	12,6	-	13,2	13,0	12,7	**150**	100	SNI 19-7119.8-2017
Hydrocarbons (HC)	µg/Nm3	< 20	< 20	< 20	< 20	-	< 20	< 20	< 20	**160**	-	TIME 3rd Ed. 198 P (Sect. II Part 101)
Particles (PM 10)	µg/Nm3	**76,7**	68,9	32,3	72,3	-	40,2	63,3	66,1	**75**	50	SNI 19-7119.15-2016
Particles (PM 2.5)	µg/Nm3	37,0	32,3	19,8	35,4	-	21,1	30,1	32,3	**55**	25	SNI 19-7119.14-2016
Suspended Particles (TSP)	µg/Nm3	19,4	19,4	78,7	18,1	-	85,7	15,1	15,8	**230**	-	SNI 19-7119.3-2017
Black Lead (Pb)	µg/Nm3	< 0,040	< 0,040	< 0,040	< 0,040	-	< 0,040	< 0,040	< 0,040	**2**	-	SNI 19-7119.4-2017

Parameter	Unit	Results								Quality standards	WHO Guidelines	Method
		AQ-1	AQ-2	AQ-3	AQ-4	AQ-5	AQ-6	AQ-7	AQ-8			
Ammonia (NH3)	ppm	-	-	< 0,045	-	-	< 0,045	-	-	**2**	-	SNI 19-7119.1-2005
Hydrogen Sulfide (H2S)	ppm	< 0,008	< 0,008	< 0,008	< 0,008	-	< 0,008	-	-	**0.02**	-	SNI 19-4844-1998

Source: Laboratory Analysis Result PT. Sucofindo 2023

Exceed the limit

Based on the results of ambient air quality measurements in the first quarter and second quarter of 2023 referring to Government Regulation of the Republic of Indonesia Number 22 of 2021 Appendix VII and the WHO Ambient Air Quality Guidelines, it is known that one of the test parameters (particularly for parameters PM10 and PM2.5) exceeds the standard quality, namely at Pad 7 during the second quarter with a PM10 yield of 76.7 µg/Nm3.

Ambien Air Quality Semesterly Monitoring Description

Period	Semester 2, 2022		
Threshold Limit	- Government Regulation of the Republic of Indonesia Number 22 of 2021 Appendix VII - Ministry of Environment Decree No. Kep.50/MENLH/11/1996 (Odor)		
Monitoring Location	1	AQ-1	Ngandam Village
	2	AQ-2	Pawuhan Village
	3	AQ-3	Karangsari (Dieng Kulon) Village
	4	AQ-4	Karang Tengah Village
	5	AQ-5	Kepakisan Village
	6	AQ-6	Simpangan Village
	7	AQ-7	Sikunang Village
	8	AQ-8	Production Office
	9	AQ-9	Power Plant

Table 3 Ambient Air Quality Monitoring Results for the First Semester of 2023

Parameter	Unit	Result									Threshold Limit	Method
		AQ-1	AQ-2	AQ-3	AQ-4	AQ-5	AQ-6	AQ-7	AQ-8	AQ-9		
Sulfur Dioxide (SO2)	µg/Nm^3	< 26	< 26	< 26	< 26	< 26	< 26	< 26	< 26	< 26	**150**	SNI 19-7119.7-2017
Carbon Monoxide (CO)	µg/Nm^3	< 1146	< 1146	< 1146	< 1146	< 1146	< 1146	< 1146	< 1146	< 1146	**10.000**	PO/AKL/46
Nitrogen Dioxide (NO2)	µg/Nm^3	17,6	17,6	18,1	10,7	< 10	10,3	18,1	10,8	11,1	**200**	SNI 19-7119.2-2017
Oksidan (O3)	µg/Nm^3	13,0	13,0	12,6	12,4	12,2	12,5	11,8	12,6	12,9	**150**	SNI 19-7119.8-2017
Hidrocarbon (HC)	µg/Nm^3	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	**160**	MASA 3rd Ed. 198 P (Sect. II Part 101)
Particle (PM 10)	µg/Nm^3	58,1	58,1	43,8	30,1	31,2	27,8	40,2	36,7	30,7	**75**	SNI 19-7119.15-2016
Particle (PM 2.5)	µg/Nm^3	30,4	30,4	23,1	19,2	18,7	16,1	22,7	20,2	17,1	**55**	SNI 19-7119.14-2016
Total Suspended Particulate (TSP)	µg/Nm^3	106,3	106,3	89,6	68,7	66,7	63,7	85,7	76,6	65,6	**230**	SNI 19-7119.3-2017
Lead (Pb)	µg/Nm^3	< 0,040	< 0,040	< 0,040	< 0,040	< 0,040	< 0,040	< 0,040	< 0,040	< 0,040	**2**	SNI 19-7119.4-2017
Ammonia (NH_3)	ppm	< 0,045	< 0,045	< 0,045	< 0,045	< 0,045	< 0,045	< 0,045	< 0,045	< 0,045	**2**	SNI 19-7119.1-2005
Hydrogen Sulfide (H_2S)	ppm	< 0,008	< 0,008	< 0,008	< 0,008	< 0,008	< 0,008	< 0,008	< 0,008	0,009	**0,02**	SNI 19-4844-1998

Source: Laboratory Analysis Result PT. Sucofindo 2023

Based on the ambient air quality measurements conducted during the first semester of 2023, and in accordance with the environmental quality standards outlined in the Government Regulation of the Republic of Indonesia Number 22 of 2021 Appendix VII, all test parameters, with particular attention to PM10 and PM2.5, were found to be well within the prescribed limits. Importantly, none of the monitoring locations exceeded the standards set.

2. Noise

2a. Noise Measurement Description (Project Area)

Period	Quarterly
Standard	Decree of the Minister of Environment No. 48 of 1996
Method	24-hour noise measurement consisting of daytime and nighttime noise measurements. Noise level measurement can be done using a sound level meter. This tool usually measures the sound pressure level dB(A) for 10 (ten) minutes for each measurement. Readings are made every 5 (five) seconds. Noise level measurement method refers to SNI 7231:2009.
Monitoring Location	1 PAD 7 2 PAD 9 3 PAD 30 4 PAD 31 5 PAD 29 6 PAD 38 7 Temporary Office 8 Nearest Settlement 9 Portacamp Workshop 10 Booster Pump 11 Water Pump Station

Table 4 Results of Noise Measurement for the First Semester of 2023

No.	Location	Unit	Quarter I			Quarter II			Threshold Value	IFC Guidelines		Methods
			Ls	Lm	Lsm	Ls	Lm	Lsm		Day Time	Evening Time	
1	PAD 7	dBA	52.6	40.2	51.2	53.4	**45.2**	52.6	70	55	45	SNI 8427:2017
2	PAD 9	dBA	53	35.5	51.4	**56.5**	**47.5**	55	70	55	45	SNI 8427:2017
3	PAD 30	dBA	52.5	37.5	51	**57.2**	**55**	58.3	70	55	45	SNI 8427:2017
4	PAD 31	dBA	52.6	35.5	53	51.5	38.2	50	70	55	45	SNI 8427:2017
5	PAD 29	dBA	56.4	49.3	55.8	53.4	**57.1**	58.4	70	55	45	SNI 8427:2017
6	PAD 38	dBA	-	-	-	48.8	36.5	47.5	70	55	45	SNI 8427:2017
7	Temporary Office	dBA	-	-	-	52.3	37.5	50.8	65	55	45	SNI 8427:2017

No.	Location	Unit	Quarter I			Quarter II			Threshold Value	IFC Guidelines		Methods
			Ls	Lm	Lsm	Ls	Lm	Lsm		Day Time	Evening Time	
8	Nearest Settlement	dBA	-	-	-	52.5	45	51.8	55	55	45	SNI 8427:2017
9	Portacamp Workshop	dBA	-	-	-	53.4	43.2	52.1	55	55	45	SNI 8427:2017
10	Booster Pump	dBA	51.5	36.5	50	**62**	**66**	51	70	55	45	SNI 8427:2017
11	Water Pump Station	dBA	-	-	-	53.4	57.1	58.4	70	55	45	SNI 8427:2017

Source: Sucofindo Laboratory, 2023

Information

- *Ls : Measurement at an interval of 06.00 – 22.00*
- *Lm : Measurement at an interval of 22.00 – 06.00*
- *Lsm : Measurement during 24 hour activity*
-

	Exceed the limit

Based on the noise level measurements conducted during the first and second quarters of 2023, all recorded results were found to be within the noise level threshold value specified in accordance with the Decree of the Minister of Environment No. 48 of 1996, except for specific locations and time periods.

At the Pad 9 well test location, the Pad 30 drilling location, and the booster pump during the 'day time' or 'Ls' measurement, the noise levels exceeded the IFC Guidelines standard. Similarly, at the Pad 7 location, the Pad 9 well test, the Pad 30 drilling location, the pad 29, and the booster pump during the "evening time" or 'Lm' measurement, the noise levels exceeded the IFC Guideline standard.

The elevated noise levels observed at these locations and times are attributed to the extensive activity of workers and equipment, particularly in the project area. To ensure compliance with noise standards and mitigate potential adverse effects on the surrounding environment and communities, appropriate noise control measures should be implemented during these periods of heightened activity.

2b. Noise Measurement Description (Villages Area)

Noise level measurements for Semester I 2023 were carried out at 9 measurement points surrounding residential areas and office activity locations (Office and Power Plant Dieng Unit 1).

Period	1st Semester 2023		
Threshold Limit	Decree of the Minister of the Environment No. 48 Year 1996		
Monitoring Location	1	AQ-1	Ngandam Village
	2	AQ-2	Pawuhan Village
	3	AQ-3	Karangsari (Dieng Kulon) Village
	4	AQ-4	Karang Tengah Village
	5	AQ-5	Kepakisan Village
	6	AQ-6	Simpangan Village
	7	AQ-7	Sikunang Village
	8	AQ-8	Production Office
	9	AQ-9	Power Plant

The results of detailed noise level measurements can be seen in the following table

Table 6 Noise Measurement for First Semester 2023

No	Location	units	Q I			Q II			Threshold Value	IFC Guidelines		Methods
			Ls	Lm	Lsm	Ls	Lm	Lsm		Day Time	Evening Time	
1	Kepakisan	dBA	51,3	39,6	50	54.8	40.8	53.3	55	55	45	PO/AKL/60
2	Simpangan Village	dBA	48,7	36,5	47,3	**55.6**	40.5	54	55	55	45	PO/AKL/60
3	Karang Tengah Village	dBA	52,3	43,5	51,4	51.7	39.6	50.3	55	55	45	PO/AKL/60
4	Pawuhan	dBA	53,4	40,6	52	**55.4**	**45.2**	54.2	55	55	45	PO/AKL/60
5	Karangsari	dBA	48,4	38,4	47,3	**55.8**	41.7	54.3	55	55	45	PO/AKL/60
6	Ngandam	dBA	48,5	38,5	47,4	49.7	38.9	48.5	55	55	45	PO/AKL/60
7	Sikunang village	dBA	48	40,5	47,3	**55.8**	42.1	54.3	55	55	45	PO/AKL/60
8	Unit 1 Dieng Office	dBA	49	36.3	48	52.8	48.7	53.1	70	70	70	PO/AKL/60
9	Power Plant Dieng Unit 1	dBA	49	36.3	48	59.1	58.8	61.3	70	70	70	PO/AKL/60

Source: Laboratory Analysis Result PT. Sucofindo 2023

Exceed the limit

According to Kep. MENLH Kep.48/MENLH/11/1996 concerning noise level standards, the results of 24-hour noise level measurements (Lsm) for the first semester of 2023 show that all monitoring locations have noise levels that are still below the threshold value.

3. Surface Water Quality

River Water Quality

Surface water quality monitoring during the ongoing Dieng Unit 2 Geothermal Power Plant Development was carried out at three locations including Sidandang River, Situlu River and Siranthi River. The summary of this monitoring scope is seen below.

Period	Semesterly and quarterly
Standard	Appendix VI. Government Regulation of the Republic of Indonesia Number 22 of 2021 concerning Implementation of Environmental Protection and Management.
Sampling and Analysis Method	• Analysis of Surface Water/River Laboratory around the project site refers to Appendix VI. Government Regulation of the Republic of Indonesia Number 22 of 2021 concerning Implementation of Environmental Protection and Management). • Analysis of water samples was carried out in the laboratory using standard methods (Standard Methods — for the Examination of Water and Wastewater — Issue 19, APHA, 1995).
Monitoring Location	1. Sidandang River 2. Situlu River 3. Siranthi River 4. Tulis River 5. Putih (Sikunang) River 6. Sidolok River

The results of monitoring are showed in the following tables.

Table 7 Water Quality of Situlu, Sidandang and Siranthi River during the First Quarter of 2023

Parameter	Unit	Result			Threshold Limit	Lab Testing Method
		Situlu	Sidandang	Siranthi		
Physics						
Temperature	°C	18	19	20	Normal ± 3	2550 B
Dissolved solid	mg/L	164	206	**1116**	1000	2540 C
Suspended solid	mg/L	3	3	14	50	2540 D
Organic Chemistry						
pH at Lab	-	7,6	7,7	7,9	6 – 9	4500-H^+-B
BOD 5 days 20 °C *	mg/L	1,08	0,899	**4,02**	3	5210 B
COD - $K_2Cr_2O_7$	mg/L	5,15	4,28	18,1	25	PO/LK/05 (Titrimetric)
Dissolved Oxygen at Lab	mg/L	7,2	**7,1**	**6,8**	4	4500-O-G
Total Phosphate as P	mg/L	0,2	**0,9**	0,11	0.2	4500-P-D
Nitrate as N	mg/L	**12**	**13**	6,91	10	4500-NO_3-E
Ammonia as NH3	mg/L	< 0,036	< 0,036	0,19	-	4500-NH_3-F
Dissolved Arsenic	mg/L	< 0,002	< 0,002	< 0,002	1	3114 C
Cobalt	mg/L	< 0,002	< 0,002	< 0,002	0.2	3120 B, 3030 E
Barium	mg/L	< 0,010	< 0,010	< 0,010	-	3120 B, 3030 E
Boron	mg/L	< 0,220	< 0,220	< 0,220	1	3120 B, 3030 E
Selenium	mg/L	< 0,002	< 0,002	< 0,002	0.05	3114 C
Cadmium	mg/L	< 0,0001	< 0,0001	< 0,0001	0.01	3120 B, 3030 E
Chromium Hexavalent	mg/L	< 0,016	< 0,016	< 0,016	0.05	3500-Cr-B
Copper	mg/L	< 0,015	< 0,015	< 0,015	0.02	3120 B, 3030 E
Iron	mg/L	< 0,030	< 0,030	< 0,030	-	3120 B, 3030 E
Lead	mg/L	< 0,002	< 0,002	< 0,002	0.03	3120 B, 3030 E
Mangan	mg/L	< 0,030	< 0,030	0,4	-	3120 B, 3030 E

Parameter	Unit	Result			Threshold Limit	Lab Testing Method
		Situlu	Sidandang	Siranthi		
Mercury	mg/L	< 0,0005	< 0,0005	< 0,0005	0.002	3112-B
Zinc	mg/L	< 0,035	< 0,035	< 0,035	0.05	3120 B, 3030 E
Chloride	mg/L	20,5	43,6	12,0	-	4500-Cl^-D
Cyanide	mg/L	< 0,040	< 0,040	< 0,040	0.02	4500-CN-E
Flouride	mg/L	0,38	0,23	0,36	1.5	4500-F-D
Nitrite as N	mg/L	0,004	0,003	**0,89**	0.06	4500-NO_2^-B
Sulfate	mg/L	3,31	5,77	39,1	-	SNI 06-6989.20:2009
Free Chlorin at Lab	mg/L	< 0,050	< 0,050	< 0,050	0.03	4500-Cl^-G
Sulphur - H_2S	mg/L	< 0,020	< 0,020	< 0,020	0.002	SNI 06-6989.70:2009
Microbiology						
Faecal Coliform	per 100 mL	58	63	60	1000	9222 D
Total Coliform	per 100 mL	140	70	910	5000	9222 B
Organic Chemistry						
Oil & Grease	mg/L	< 2,5	< 2,5	< 2,5	1000	5520 C
Surfactant Anionic as MBAS	mg/L	0,021	0,024	0,024	0,2	5540 C
Phenolic compound	mg/L	< 0,02	< 0,02	< 0,02	1	5530 C

Source: Laboratory Analysis Result PT. Sucofindo 2023

Note:

	Exceed the limit

Table 8 Water Quality of Situlu, Sidandang and Siranthi River during the Second Quarter of 2023

Parameter	Unit	Result			Threshold Limit	Method
		Situlu	Sidandang	Siranthi		
Physics						
Temperature	°C	19	19	27	Normal ± 3	2550 B
Dissolved solid	mg/L	200	155	190	1000	2540 C
Suspended solid	mg/L	5	4	18	50	2540 D
Organic Chemistry						
pH at Lab	-	7,4	7,9	7,0	6 – 9	4500-H^+-B
BOD 5 days 20 °C *	mg/L	0,932	1,05	1,92	3	5210 B
COD - $K_2Cr_2O_7$	mg/L	4,44	4,98	9,13	25	PO/LK/05 (Titrimetric)
Dissolved Oxygen at Lab	mg/L	5,6	**6,2**	5,5	4	4500-O-G
Total Phosphate as P	mg/L	0,2	0,2	**0,5**	0.2	4500-P-D
Nitrate as N	mg/L	**11**	**12**	5,75	10	4500-NO_3-E
Ammonia as NH3	mg/L	8,55	0,09	0,97	-	4500-NH_3-F
Dissolved Arsenic	mg/L	< 0,002	< 0,002	< 0,002	1	3114 C
Cobalt	mg/L	< 0,002	< 0,002	< 0,002	0.2	3120 B, 3030 E
Barium	mg/L	< 0,010	< 0,010	< 0,010	-	3120 B, 3030 E
Boron	mg/L	< 0,220	< 0,220	< 0,220	1	3120 B, 3030 E
Selenium	mg/L	< 0,002	< 0,002	< 0,002	0.05	3114 C
Cadmium	mg/L	< 0,0001	< 0,0001	< 0,0001	0.01	3120 B, 3030 E
Chromium Hexavalent	mg/L	< 0,016	< 0,016	< 0,016	0.05	3500-Cr-B
Copper	mg/L	< 0,015	< 0,015	< 0,015	0.02	3120 B, 3030 E
Iron	mg/L	< 0,030	< 0,030	< 0,030	-	3120 B, 3030 E
Lead	mg/L	< 0,002	< 0,002	< 0,002	0.03	3120 B, 3030 E
Mangan	mg/L	< 0,030	< 0,030	< 0,030	-	3120 B, 3030 E
Mercury	mg/L	< 0,0005	< 0,0005	< 0,0005	0.002	3112-B

Parameter	Unit	Result			Threshold Limit	Method
		Situlu	Sidandang	Siranthi		
Zinc	mg/L	< 0,035	< 0,035	< 0,035	0.05	3120 B, 3030 E
Chloride	mg/L	40,6	17,0	30,1	-	4500-Cl^-D
Cyanide	mg/L	< 0,040	< 0,040	< 0,040	0.02	4500-CN-E
Flouride	mg/L	< 0,080	< 0,080	0,37	1.5	4500-F-D
Nitrite as N	mg/L	< 0,003	0,004	**0,68**	0.06	4500-NO_2^-B
Sulfate	mg/L	8,82	5,54	0,37	-	SNI 06-6989.20:2009
Free Chlorin at Lab	mg/L	< 0,050	< 0,050	< 0,050	0.03	4500-Cl^-G
Sulphur - H_2S	mg/L	< 0,020	< 0,020	< 0,020	0.002	SNI 06-6989.70:2009
Microbiology						
Faecal Coliform	per 100 mL	110	110	1600	1000	9222 D
Total Coliform	per 100 mL	210	210	1600	5000	9222 B
Organic Chemistry						
Oil & Grease	mg/L	< 2,5	< 2,5	< 2,5	1000	5520 C
Surfactant Anionic as MBAS	mg/L	< 0,030	0,033	0,034	0,2	5540 C
Phenolic compound	mg/L	< 0,02	< 0,02	< 0,014	1	5530 C

Source: Laboratory Analysis Result PT. Sucofindo 2023

Note:

	Exceed the limit

The above tables showed that phosphate and nitrate concentration were always exceeding water quality standard. The utilization of fertilizers by the local farmers might affected water quality in the rivers.

Similar with the previous quarter monitoring results, the phosphate and nitrate concentration in the rivers exceed the threshold value. Additionally, the nitrite parameter has also exceeded the threshold value at Siranthi River, which was assumed to be due to the influence of pesticides used by local farmers.

In addition to the three-river mentioned above GDE was also conducted monitoring at the surrounding rivers of Unit 1 Operation activity including:

- Tulis River;
- Putih (Sikunang) River; and
- Sidolog River.

The following tables show the result of river water quality monitoring at those rivers.
Based on the laboratory analysis results and monitoring of the Tulis River's water quality during the first and second quarters of 2023, overall, the Upstream and downstream of the Tulis River showed relatively good water quality.
However, some parameters exceeded the quality standards at certain monitoring points. In Quarter I at the upstream Kali Tulis point, the Chemical Oxygen Requirement (BOD) was measured at 4.45 mg/L, exceeding the quality standard. Additionally, Nitrate and Total Phosphate parameters did not meet the quality standards, with values of 12 mg/L and 0.33 mg/L, respectively. Furthermore, the Fecal Coliform parameter showed a value above the quality standard with 1600 MPN/100ml. In Quarter II at the same upstream Kali Tulis point, only the Nitrate parameter exceeded the quality standard, with a value of 11 mg/L.
Moving downstream, the Downstream of the Tulis River exhibited parameters that did not meet the Class II river water quality standard in Quarter I, including the color parameter at 139 Pt-Co Units, BOD with a value of 3.4 mg/L, Ammonia at 0.35 mg/L, Total Phosphate exceeding 0.27 mg/L, and Zinc (Zn) at 0.3 mg/L. Similarly, in Quarter II, parameters that did not meet the quality standards included BOD with a value of 3.07 mg/L, Nitrite at 0.19 mg/L, and Ammonia at 0.21 mg/L.
These deviations from the quality standards may be attributed to the presence of a residential area and the dominance of community agricultural land surrounding the sampling locations. The possibility of seepage from residential waste and the use of chemical and organic fertilizers on agricultural land, including organic manure, are factors contributing to the elevated Fecal Coliform value at the upstream Kali Tulis point during the first quarter of 2023.

Overall, while the water quality of the Tulis River is relatively good in general, specific parameters at certain locations during different quarters show the potential impact of human activities and agricultural practices on the river's water quality.

Tulis River

The results of laboratory analysis of surface water quality parameters for the third quarter of 2022 located at the upstream monitoring point of the Tulis River can be seen in the following table.

Table 9 Water Quality of Tulis River Upstream during the Quarter I of 2023

Parameter	Unit	Result	Threshold Limit	METODE
PHYSICS				
Temperature	^{0}C	18	Dev 3	SNI 06-6989.23-2005
Total Dissolved Solids (TDS)	mg/L	119	1000	SNI 6989.27:2019
Total Suspended Solids (TSS)	mg/L	18	50	SNI 6989.3:2019
Color	Pt-Co Unit	4,6	50	SNI 6989.80:2011
CHEMISTRY				
Acidity (pH)	-	7,9	6 - 9	SNI 6989.11:2019
Biochemical Oxygen Demand (BOD)	mg/L	**4,45**	3	SNI 6989.72:2009
Chemical Oxygen Demand (COD)	mg/L	21,2	25	SNI 6989.2:2019
Dissolved Oxygen (DO)	mg/L	5,0	Min. 4	4500 O G #)
Sulphate (SO_4^2)	mg/L	11,9	300	SNI 6989.20:2019
Chloride (Cl^-)	mg/L	10,5	300	SNI 6989.19:2009
Nitrate (NO_3-N)	mg/L	**12**	10	SNI 6989.79:2011
Nitrite (NO_2-N)	mg/L	0,51	0,06	SNI 06-6989.9-2004
Ammonia (as N)	mg/L	< 0,036	0,2	SNI 06-6989.30-2005
Total Nitrogen	mg/L	14	15	4500-O G#)
Total Phosphate (as P)	mg/L	**0,33**	0,2	SNI 06-6989.31-2005
Fluoride (F)	mg/L	0,46	1,5	SNI.06-6989.29 -2005
Sulfur as H_2S	mg/L	< 0,020	0,002	SNI 6989.70:2009
Cyanide (CN)	mg/L	< 0,040	0,02	SNI 6989.77:2011
Chlorine Free	mg/L	< 0,050	0,03	4500 -Cl G#)
Dissolved Barium (Ba)	mg/L	< 0,010	(-)	SNI 06-6989.39-2005
Dissolved Boron (B)	mg/L	< 0,220	1,0	SNI 06-2481-1991
Dissolved Mercury (Hg)	mg/L	< 0,0005	0,002	SNI 6989.78:2019
Dissolved Arsenic (As)	mg/L	< 0,002	0,05	SNI 6989.81:2018
Dissolved Selenium (Se)	mg/L	< 0,002	0,05	SNI 6989.83:2018
Dissolved Iron (Fe)	mg/L	< 0,030	(-)	SNI 6989.84:2019
Dissolved Cadmium (Cd)	mg/L	< 0,0001	0,01	SNI 06-6989.38-2005
Dissolved Cobalt (Co)	mg/L	< 0,002	0,2	SNI 6989.68:2009
Dissolved Manganese (Mn)	mg/L	< 0,030	(-)	SNI 6989.84:2019
Dissolved Nickel (Ni)	mg/L	< 0,050	0,05	SNI 6989.18:2009
Dissolved Zinc (Zn)	mg/L	< 0,035	0,05	SNI 6989.84:2019
Dissolved Copper (Cu)	mg/L	< 0,015	0,02	SNI 6989.84:2019
Dissolved Lead (Pb)	mg/L	< 0,002	0,03	SNI 6989.46:2009
Hexavalent chromium (Cr^{6+})	mg/L	< 0,016	0,05	SNI 6989.71:2009
Oils &; Grease	mg/L	< 2,5	1	SNI 6989.10:2011
Total Detergent	mg/L	0,022	0,2	SNI 06-6989.51-2005
Phenol	mg/L	< 0,02	0,005	SNI 06-6989.21-2004
MICROBIOLOGY				
Fecal Coliform	MPN/100 ml	**1600**	1000	9222 D#)
Total Coliform	MPN/100 ml	1600	5000	9221 B#)
ADDITIONAL				
Garbage	Nihil	Nihil	Nihil	Visual
Debit	L/detik	4480	-	SNI 8066-2005

Source: Laboratory Analysis Result PT. Sucofindo 2023

Note:

	Exceed the limit

The results of laboratory analysis of surface water quality parameters for the first quarter of 2022 located at the downstream monitoring point of Tulis River can be seen in the following table.

Table 10 Water Quality of Tulis River Downstream during the Quarter I of 2023

Parameter	Unit	Result	Threshold Limit	METODE
PHYSICS				
Temperature	^{0}C	18	Dev 3	SNI 06-6989.23-2005
Total Dissolved Solids (TDS)	mg/L	115	1000	SNI 6989.27:2019
Total Suspended Solids (TSS)	mg/L	16	50	SNI 6989.3:2019
Color	Pt-Co Unit	**139**	50	SNI 6989.80:2011
CHEMISTRY				
Acidity (pH)	-	7,9	6 - 9	SNI 6989.11:2019
Biochemical Oxygen Demand (BOD)	mg/L	**3,40**	3	SNI 6989.72:2009
Chemical Oxygen Demand (COD)	mg/L	16,2	25	SNI 6989.2:2019
Dissolved Oxygen (DO)	mg/L	5,2	Min. 4	4500 O G #)
Sulphate (SO_4^{2})	mg/L	39,0	300	SNI 6989.20:2019
Chloride (Cl^-)	mg/L	31,6	300	SNI 6989.19:2009
Nitrate (NO_3-N)	mg/L	6,62	10	SNI 6989.79:2011
Nitrite (NO_2-N)	mg/L	0,28	0,06	SNI 06-6989.9-2004
Ammonia (as N)	mg/L	**0,35**	0,2	SNI 06-6989.30-2005
Total Nitrogen	mg/L	8,26	15	4500-O G#)
Total Phosphate (as P)	mg/L	**0,27**	0,2	SNI 06-6989.31-2005
Fluoride (F)	mg/L	0,45	1,5	SNI.06-6989.29 -2005
Sulfur as H_2S	mg/L	< 0,020	0,002	SNI 6989.70:2009
Cyanide (CN)	mg/L	< 0,040	0,02	SNI 6989.77:2011
Chlorine Free	mg/L	< 0,050	0,03	4500 -Cl G#)
Dissolved Barium (Ba)	mg/L	< 0,010	(-)	SNI 06-6989.39-2005
Dissolved Boron (B)	mg/L	< 0,220	1,0	SNI 06-2481-1991
Dissolved Mercury (Hg)	mg/L	< 0,0005	0,002	SNI 6989.78:2019
Dissolved Arsenic (As)	mg/L	< 0,002	0,05	SNI 6989.81:2018
Dissolved Selenium (Se)	mg/L	< 0,002	0,05	SNI 6989.83:2018
Dissolved Iron (Fe)	mg/L	0,03	(-)	SNI 6989.84:2019
Dissolved Cadmium (Cd)	mg/L	< 0,0001	0,01	SNI 06-6989.38-2005
Dissolved Cobalt (Co)	mg/L	< 0,002	0,2	SNI 6989.68:2009
Dissolved Manganese (Mn)	mg/L	0,09	(-)	SNI 6989.84:2019
Dissolved Nickel (Ni)	mg/L	< 0,050	0,05	SNI 6989.18:2009
Dissolved Zinc (Zn)	mg/L	**0,3**	0,05	SNI 6989.84:2019
Dissolved Copper (Cu)	mg/L	< 0,015	0,02	SNI 6989.84:2019
Dissolved Lead (Pb)	mg/L	< 0,002	0,03	SNI 6989.46:2009
Hexavalent chromium (Cr^{6+})	mg/L	< 0,016	0,05	SNI 6989.71:2009
Oils &; Grease	mg/L	< 2,5	1	SNI 6989.10:2011
Total Detergent	mg/L	0,022	0,2	SNI 06-6989.51-2005
Phenol	mg/L	< 0,02	0,005	SNI 06-6989.21-2004
MICROBIOLOGY				
Fecal Coliform	MPN/100 ml	110	1000	9222 D#)

Parameter	Unit	Result	Threshold Limit	METODE
Total Coliform	MPN/100 ml	920	5000	9221 B#)
ADDITIONAL				
Garbage	Nihil	Nihil	Nihil	Visual
Debit	L/detik	12600	-	SNI 8066-2005

Source: Laboratory Analysis Result PT. Sucofindo 2023

Note:

Exceed the limit

The results of laboratory analysis of surface water quality parameters for the second quarter of 2023 located at the upstream monitoring point of Tulis River can be seen in the following table.

Table 11 Water Quality of Tulis River Upstream during the Quarter II of 2023

Parameter	Unit	Result	Threshold Limit	METODE
PHYSICS				
Temperature	^{0}C	19	Dev 3	SNI 06-6989.23-2005
Total Dissolved Solids (TDS)	mg/L	165	1000	SNI 6989.27:2019
Total Suspended Solids (TSS)	mg/L	4	50	SNI 6989.3:2019
Color	Pt-Co Unit	8,9	50	SNI 6989.80:2011
CHEMISTRY				
Acidity (pH)	-	7,6	6 - 9	SNI 6989.11:2019
Biochemical Oxygen Demand (BOD)	mg/L	2,12	3	SNI 6989.72:2009
Chemical Oxygen Demand (COD)	mg/L	10,1	25	SNI 6989.2:2019
Dissolved Oxygen (DO)	mg/L	6,8	Min. 4	4500 O G #)
Sulphate (SO_4^{2})	mg/L	7,79	300	SNI 6989.20:2019
Chloride (Cl^-)	mg/L	23,5	300	SNI 6989.19:2009
Nitrate (NO_3-N)	mg/L	**11**	10	SNI 6989.79:2011
Nitrite (NO_2-N)	mg/L	0,037	0,06	SNI 06-6989.9-2004
Ammonia (as N)	mg/L	0,086	0,2	SNI 06-6989.30-2005
Total Nitrogen	mg/L	12,6	15	4500-O G#)
Total Phosphate (as P)	mg/L	0,2	0,2	SNI 06-6989.31-2005
Fluoride (F)	mg/L	< 0,080	1,5	SNI.06-6989.29 -2005
Sulfur as H_2S	mg/L	< 0,020	0,002	SNI 6989.70:2009
Cyanide (CN)	mg/L	< 0,040	0,02	SNI 6989.77:2011
Chlorine Free	mg/L	< 0,050	0,03	4500 -Cl G#)
Dissolved Barium (Ba)	mg/L	< 0,010	(-)	SNI 06-6989.39-2005
Dissolved Boron (B)	mg/L	< 0,220	1,0	SNI 06-2481-1991
Dissolved Mercury (Hg)	mg/L	< 0,0005	0,002	SNI 6989.78:2019
Dissolved Arsenic (As)	mg/L	< 0,002	0,05	SNI 6989.81:2018
Dissolved Selenium (Se)	mg/L	< 0,002	0,05	SNI 6989.83:2018
Dissolved Iron (Fe)	mg/L	< 0,030	(-)	SNI 6989.84:2019
Dissolved Cadmium (Cd)	mg/L	< 0,0001	0,01	SNI 06-6989.38-2005
Dissolved Cobalt (Co)	mg/L	< 0,002	0,2	SNI 6989.68:2009
Dissolved Manganese (Mn)	mg/L	< 0,030	(-)	SNI 6989.84:2019
Dissolved Nickel (Ni)	mg/L	< 0,050	0,05	SNI 6989.18:2009
Dissolved Zinc (Zn)	mg/L	< 0,035	0,05	SNI 6989.84:2019

Parameter	Unit	Result	Threshold Limit	METODE
Dissolved Copper (Cu)	mg/L	< 0,015	0,02	SNI 6989.84:2019
Dissolved Lead (Pb)	mg/L	< 0,002	0,03	SNI 6989.46:2009
Hexavalent chromium (Cr^{6+})	mg/L	< 0,016	0,05	SNI 6989.71:2009
Oils &; Grease	mg/L	< 2,5	1	SNI 6989.10:2011
Total Detergent	mg/L	0,030	0,2	SNI 06-6989.51-2005
Phenol	mg/L	< 0,02	0,005	SNI 06-6989.21-2004
MICROBIOLOGY				
Fecal Coliform	MPN/100 ml	84	1000	9222 D#)
Total Coliform	MPN/100 ml	210	5000	9221 B#)
ADDITIONAL				
Garbage	Nihil		Nihil	Visual
Debit	L/detik	121	-	SNI 8066-2005

Source : Results of Laboratory Analysis of PT Sucofindo, 2023

The results of laboratory analysis of surface water quality parameters for the second quarter of 2023 located at the downstream monitoring point of Sungai Tulis can be seen in the following table:

Table 12 Water Quality of Tulis River Downstream during the Quarter II of 2023

Parameter	Unit	Result	Threshold Limit	METODE
PHYSICS				
Temperature	^{0}C	19	Dev 3	SNI 06-6989.23-2005
Total Dissolved Solids (TDS)	mg/L	129	1000	SNI 6989.27:2019
Total Suspended Solids (TSS)	mg/L	5	50	SNI 6989.3:2019
Color	Pt-Co Unit	14,2	50	SNI 6989.80:2011
CHEMISTRY				
Acidity (pH)	-	7,8	6 - 9	SNI 6989.11:2019
Biochemical Oxygen Demand (BOD)	mg/L	**3,07**	3	SNI 6989.72:2009
Chemical Oxygen Demand (COD)	mg/L	14,6	25	SNI 6989.2:2019
Dissolved Oxygen (DO)	mg/L	5,4	Min. 4	4500 O G #)
Sulphate (SO_4^2)	mg/L	45,5	300	SNI 6989.20:2019
Chloride (Cl^-)	mg/L	11,5	300	SNI 6989.19:2009
Nitrate (NO_3-N)	mg/L	7,23	10	SNI 6989.79:2011
Nitrite (NO_2-N)	mg/L	**0,19**	0,06	SNI 06-6989.9-2004
Ammonia (as N)	mg/L	**0,21**	0,2	SNI 06-6989.30-2005
Total Nitrogen	mg/L	8,64	15	4500-O G#)
Total Phosphate (as P)	mg/L	0,16	0,2	SNI 06-6989.31-2005
Fluoride (F)	mg/L	< 0,080	1,5	SNI.06-6989.29 -2005
Sulfur as H_2S	mg/L	< 0,020	0,002	SNI 6989.70:2009
Cyanide (CN)	mg/L	< 0,040	0,02	SNI 6989.77:2011
Chlorine Free	mg/L	< 0,050	0,03	4500 -Cl G#)
Dissolved Barium (Ba)	mg/L	< 0,010	(-)	SNI 06-6989.39-2005
Dissolved Boron (B)	mg/L	< 0,220	1,0	SNI 06-2481-1991
Dissolved Mercury (Hg)	mg/L	< 0,0005	0,002	SNI 6989.78:2019
Dissolved Arsenic (As)	mg/L	< 0,002	0,05	SNI 6989.81:2018
Dissolved Selenium (Se)	mg/L	< 0,002	0,05	SNI 6989.83:2018

Parameter	Unit	Result	Threshold Limit	METODE
Dissolved Iron (Fe)	mg/L	< 0,030	(-)	SNI 6989.84:2019
Dissolved Cadmium (Cd)	mg/L	< 0,0001	0,01	SNI 06-6989.38-2005
Dissolved Cobalt (Co)	mg/L	< 0,002	0,2	SNI 6989.68:2009
Dissolved Manganese (Mn)	mg/L	0,4	(-)	SNI 6989.84:2019
Dissolved Nickel (Ni)	mg/L	< 0,050	0,05	SNI 6989.18:2009
Dissolved Zinc (Zn)	mg/L	< 0,035	0,05	SNI 6989.84:2019
Dissolved Copper (Cu)	mg/L	< 0,015	0,02	SNI 6989.84:2019
Dissolved Lead (Pb)	mg/L	< 0,002	0,03	SNI 6989.46:2009
Hexavalent chromium (Cr^{6+})	mg/L	< 0,016	0,05	SNI 6989.71:2009
Oils &; Grease	mg/L	< 2,5	1	SNI 6989.10:2011
Total Detergent	mg/L	0,026	0,2	SNI 06-6989.51-2005
Phenol	mg/L	< 0,02	0,005	SNI 06-6989.21-2004
MICROBIOLOGY				
Fecal Coliform	MPN/100 ml	110	1000	9222 D#)
Total Coliform	MPN/100 ml	110	5000	9221 B#)
ADDITIONAL				
Garbage	Nihil	Nihil	Nihil	Visual
Debit	L/detik	192	-	SNI 8066-2005

Source : Results of Laboratory Analysis of PT Sucofindo, 2023

Exceed the limit

Putih River (Sikunang)

The results of laboratory analysis of surface water quality parameters for the first quarter of 2023 located at the upstream monitoring point of the Putih River (Sikunang) can be seen in the following table.

Table 13 Water Quality of Putih River (Sikunang) Upstream during Quarter I of 2023

Parameter	Unit	Result	Threshold Limit	METODE
PHYSICS				
Temperature	^{0}C	18	Dev 3	SNI 06-6989.23-2005
Total Dissolved Solids (TDS)	mg/L	153	1000	SNI 6989.27:2019
Total Suspended Solids (TSS)	mg/L	3	50	SNI 6989.3:2019
Color	Pt-Co Unit	0,7	50	SNI 6989.80:2011
CHEMISTRY				
Acidity (pH)	-	7,3	6 - 9	SNI 6989.11:2019
Biochemical Oxygen Demand (BOD)	mg/L	0,869	3	SNI 6989.72:2009
Chemical Oxygen Demand (COD)	mg/L	4,14	25	SNI 6989.2:2019
Dissolved Oxygen (DO)	mg/L	7,8	Min. 4	4500 O G #)
Sulphate (SO_4^{2})	mg/L	21,6	300	SNI 6989.20:2019
Chloride (Cl^-)	mg/L	29,1	300	SNI 6989.19:2009
Nitrate (NO_3-N)	mg/L	**12**	10	SNI 6989.79:2011
Nitrite (NO_2-N)	mg/L	0,04	0,06	SNI 06-6989.9-2004
Ammonia (as N)	mg/L	0,05	0,2	SNI 06-6989.30-2005
Total Nitrogen	mg/L	13,8	15	4500-O G#)
Total Phosphate (as P)	mg/L	0,1	0,2	SNI 06-6989.31-2005
Fluoride (F)	mg/L	0,48	1,5	SNI.06-6989.29 -2005
Sulfur as H_2S	mg/L	< 0,020	0,002	SNI 6989.70:2009
Cyanide (CN)	mg/L	< 0,040	0,02	SNI 6989.77:2011
Chlorine Free	mg/L	< 0,050	0,03	4500 -Cl G#)
Dissolved Barium (Ba)	mg/L	< 0,010	(-)	SNI 06-6989.39-2005
Dissolved Boron (B)	mg/L	< 0,220	1,0	SNI 06-2481-1991
Dissolved Mercury (Hg)	mg/L	< 0,0005	0,002	SNI 6989.78:2019
Dissolved Arsenic (As)	mg/L	< 0,002	0,05	SNI 6989.81:2018
Dissolved Selenium (Se)	mg/L	< 0,002	0,05	SNI 6989.83:2018
Dissolved Iron (Fe)	mg/L	< 0,030	(-)	SNI 6989.84:2019
Dissolved Cadmium (Cd)	mg/L	< 0,0001	0,01	SNI 06-6989.38-2005
Dissolved Cobalt (Co)	mg/L	< 0,002	0,2	SNI 6989.68:2009
Dissolved Manganese (Mn)	mg/L	< 0,030	(-)	SNI 6989.84:2019
Dissolved Nickel (Ni)	mg/L	< 0,050	0,05	SNI 6989.18:2009
Dissolved Zinc (Zn)	mg/L	< 0,035	0,05	SNI 6989.84:2019
Dissolved Copper (Cu)	mg/L	< 0,015	0,02	SNI 6989.84:2019
Dissolved Lead (Pb)	mg/L	< 0,002	0,03	SNI 6989.46:2009
Hexavalent chromium (Cr^{6+})	mg/L	< 0,016	0,05	SNI 6989.71:2009
Oils &; Grease	mg/L	< 2,5	1	SNI 6989.10:2011
Total Detergent	mg/L	0,020	0,2	SNI 06-6989.51-2005
Phenol	mg/L	< 0,02	0,005	SNI 06-6989.21-2004

Parameter	Unit	Result	Threshold Limit	METODE
MICROBIOLOGY				
Fecal Coliform	MPN/100 ml	220	1000	9222 D#)
Total Coliform	MPN/100 ml	240	5000	9221 B#)
ADDITIONAL				
Garbage	Nihil	Nihil	Nihil	Visual
Debit	L/detik	8100	-	SNI 8066-2005

Source : Results of Laboratory Analysis of PT Sucofindo, 2023

Exceed the limit

The results of laboratory analysis of surface water quality parameters for the first quarter of 2023 located at the downstream monitoring point of the Putih River (Sikunang) can be seen in the following table.

Table 14 Water Quality of Putih River (Sikunang) Downstream Quarter I of 2023

Parameter	Unit	Result	Threshold Limit	METODE
PHYSICS				
Temperature	^{0}C	19	Dev 3	SNI 06-6989.23-2005
Total Dissolved Solids (TDS)	mg/L	208	1000	SNI 6989.27:2019
Total Suspended Solids (TSS)	mg/L	4	50	SNI 6989.3:2019
Color	Pt-Co Unit	< 2,5	50	SNI 6989.80:2011
CHEMISTRY				
Acidity (pH)	-	7,3	6 - 9	SNI 6989.11:2019
Biochemical Oxygen Demand (BOD)	mg/L	1,32	3	SNI 6989.72:2009
Chemical Oxygen Demand (COD)	mg/L	6,27	25	SNI 6989.2:2019
Dissolved Oxygen (DO)	mg/L	7,2	Min. 4	4500 O G #)
Sulphate (SO_4^{2})	mg/L	38,5	300	SNI 6989.20:2019
Chloride (Cl^-)	mg/L	5,06	300	SNI 6989.19:2009
Nitrate (NO_3-N)	mg/L	**12**	10	SNI 6989.79:2011
Nitrite (NO_2-N)	mg/L	0,022	0,06	SNI 06-6989.9-2004
Ammonia (as N)	mg/L	< 0,036	0,2	SNI 06-6989.30-2005
Total Nitrogen	mg/L	13	15	4500-O G#)
Total Phosphate (as P)	mg/L	**0,22**	0,2	SNI 06-6989.31-2005
Fluoride (F)	mg/L	0,47	1,5	SNI.06-6989.29 -2005
Sulfur as H_2S	mg/L	< 0,020	0,002	SNI 6989.70:2009
Cyanide (CN)	mg/L	< 0,040	0,02	SNI 6989.77:2011
Chlorine Free	mg/L	< 0,050	0,03	4500 -Cl G#)
Dissolved Barium (Ba)	mg/L	< 0,010	(-)	SNI 06-6989.39-2005
Dissolved Boron (B)	mg/L	< 0,220	1,0	SNI 06-2481-1991
Dissolved Mercury (Hg)	mg/L	< 0,0005	0,002	SNI 6989.78:2019
Dissolved Arsenic (As)	mg/L	< 0,002	0,05	SNI 6989.81:2018
Dissolved Selenium (Se)	mg/L	< 0,002	0,05	SNI 6989.83:2018
Dissolved Iron (Fe)	mg/L	< 0,030	(-)	SNI 6989.84:2019
Dissolved Cadmium (Cd)	mg/L	< 0,0001	0,01	SNI 06-6989.38-2005
Dissolved Cobalt (Co)	mg/L	< 0,002	0,2	SNI 6989.68:2009
Dissolved Manganese (Mn)	mg/L	< 0,030	(-)	SNI 6989.84:2019
Dissolved Nickel (Ni)	mg/L	< 0,050	0,05	SNI 6989.18:2009

Parameter	Unit	Result	Threshold Limit	METODE
Dissolved Zinc (Zn)	mg/L	< 0,035	0,05	SNI 6989.84:2019
Dissolved Copper (Cu)	mg/L	< 0,015	0,02	SNI 6989.84:2019
Dissolved Lead (Pb)	mg/L	< 0,002	0,03	SNI 6989.46:2009
Hexavalent chromium (Cr^{6+})	mg/L	< 0,016	0,05	SNI 6989.71:2009
Oils &; Grease	mg/L	< 2,5	1	SNI 6989.10:2011
Total Detergent	mg/L	0,021	0,2	SNI 06-6989.51-2005
Phenol	mg/L	< 0,02	0,005	SNI 06-6989.21-2004
MICROBIOLOGY				
Fecal Coliform	MPN/100 ml	1100	1000	9222 D#)
Total Coliform	MPN/100 ml	1600	5000	9221 B#)
ADDITIONAL				
Garbage	Nihil	Nihil	Nihil	Visual
Debit	L/detik	7200	-	SNI 8066-2005

Source : Results of Laboratory Analysis of PT Sucofindo, 2023

Exceed the limit

The results of laboratory analysis of surface water quality parameters for the second quarter of 2023 located at the upstream monitoring point of the Putih River (Sikunang) can be seen in the following table.

Table 15 Water Quality of the Putih River (Sikunang) Upstream during the Quarter II of 2023

Parameter	Unit	Result	Threshold Limit	METODE
PHYSICS				
Temperature	^{0}C	18	Dev 3	SNI 06-6989.23-2005
Total Dissolved Solids (TDS)	mg/L	146	1000	SNI 6989.27:2019
Total Suspended Solids (TSS)	mg/L	5	50	SNI 6989.3:2019
Color	Pt-Co Unit	5,3	50	SNI 6989.80:2011
CHEMISTRY				
Acidity (pH)	-	7,6	6 - 9	SNI 6989.11:2019
Biochemical Oxygen Demand (BOD)	mg/L	1,07	3	SNI 6989.72:2009
Chemical Oxygen Demand (COD)	mg/L	5,11	25	SNI 6989.2:2019
Dissolved Oxygen (DO)	mg/L	6,4	Min. 4	4500 O G #)
Sulphate (SO_4^2)	mg/L	26,6	300	SNI 6989.20:2019
Chloride (Cl^-)	mg/L	29,1	300	SNI 6989.19:2009
Nitrate (NO_3-N)	mg/L	**13**	10	SNI 6989.79:2011
Nitrite (NO_2-N)	mg/L	**0,095**	0,06	SNI 06-6989.9-2004
Ammonia (as N)	mg/L	0,18	0,2	SNI 06-6989.30-2005
Total Nitrogen	mg/L	13,3	15	4500-O G#)
Total Phosphate (as P)	mg/L	0,1	0,2	SNI 06-6989.31-2005
Fluoride (F)	mg/L	< 0,080	1,5	SNI.06-6989.29 -2005
Sulfur as H_2S	mg/L	< 0,020	0,002	SNI 6989.70:2009

Parameter	Unit	Result	Threshold Limit	METODE
Cyanide (CN)	mg/L	< 0,040	0,02	SNI 6989.77:2011
Chlorine Free	mg/L	< 0,050	0,03	4500 -Cl G#)
Dissolved Barium (Ba)	mg/L	< 0,010	(-)	SNI 06-6989.39-2005
Dissolved Boron (B)	mg/L	< 0,228	1,0	SNI 06-2481-1991
Dissolved Mercury (Hg)	mg/L	< 0,0005	0,002	SNI 6989.78:2019
Dissolved Arsenic (As)	mg/L	< 0,002	0,05	SNI 6989.81:2018
Dissolved Selenium (Se)	mg/L	< 0,002	0,05	SNI 6989.83:2018
Dissolved Iron (Fe)	mg/L	< 0,030	(-)	SNI 6989.84:2019
Dissolved Cadmium (Cd)	mg/L	< 0,0001	0,01	SNI 06-6989.38-2005
Dissolved Cobalt (Co)	mg/L	< 0,002	0,2	SNI 6989.68:2009
Dissolved Manganese (Mn)	mg/L	< 0,030	(-)	SNI 6989.84:2019
Dissolved Nickel (Ni)	mg/L	< 0,050	0,05	SNI 6989.18:2009
Dissolved Zinc (Zn)	mg/L	< 0,035	0,05	SNI 6989.84:2019
Dissolved Copper (Cu)	mg/L	< 0,015	0,02	SNI 6989.84:2019
Dissolved Lead (Pb)	mg/L	< 0,002	0,03	SNI 6989.46:2009
Hexavalent chromium (Cr^{6+})	mg/L	< 0,016	0,05	SNI 6989.71:2009
Oils &; Grease	mg/L	< 2,5	1	SNI 6989.10:2011
Total Detergent	mg/L	0,039	0,2	SNI 06-6989.51-2005
Phenol	mg/L	< 0,02	0,005	SNI 06-6989.21-2004
MICROBIOLOGY				
Fecal Coliform	MPN/100 ml	280	1000	9222 D#)
Total Coliform	MPN/100 ml	1100	5000	9221 B#)
ADDITIONAL				
Garbage	Nihil	331	Nihil	Visual
Debit	L/detik	331	-	SNI 8066-2005

Source : Results of Laboratory Analysis of PT Sucofindo, 2022

Exceed the limit

The results of laboratory analysis of surface water quality parameters for the second quarter of 2023 located at the downstream monitoring point of the Putih River (Sikunang) can be seen in the following table.

Table 16 Water Quality of of the Putih River (Sikunang) Downstream during the Quarter II of 2023

Parameter	Unit	Result	Threshold Limit	METODE
PHYSICS				
Temperature	^{0}C	19	Dev 3	SNI 06-6989.23-2005
Total Dissolved Solids (TDS)	mg/L	209	1000	SNI 6989.27:2019
Total Suspended Solids (TSS)	mg/L	5	50	SNI 6989.3:2019
Color	Pt-Co Unit	8,7	50	SNI 6989.80:2011
CHEMISTRY				
Acidity (pH)	-	7,3	6 - 9	SNI 6989.11:2019
Biochemical Oxygen Demand (BOD)	mg/L	1,03	3	SNI 6989.72:2009
Chemical Oxygen Demand (COD)	mg/L	4,92	25	SNI 6989.2:2019

Parameter	Unit	Result	Threshold Limit	METODE
Dissolved Oxygen (DO)	mg/L	7,3	Min. 4	4500 O G #)
Sulphate (SO_4^{2})	mg/L	39,7	300	SNI 6989.20:2019
Chloride (Cl^-)	mg/L	51,1	300	SNI 6989.19:2009
Nitrate (NO_3-N)	mg/L	**11**	10	SNI 6989.79:2011
Nitrite (NO_2-N)	mg/L	0,071	0,06	SNI 06-6989.9-2004
Ammonia (as N)	mg/L	0,016	0,2	SNI 06-6989.30-2005
Total Nitrogen	mg/L	11,4	15	4500-O G#)
Total Phosphate (as P)	mg/L	0,2	0,2	SNI 06-6989.31-2005
Fluoride (F)	mg/L	< 0,080	1,5	SNI.06-6989.29 -2005
Sulfur as H_2S	mg/L	< 0,020	0,002	SNI 6989.70:2009
Cyanide (CN)	mg/L	< 0,040	0,02	SNI 6989.77:2011
Chlorine Free	mg/L	< 0,050	0,03	4500 -Cl G#)
Dissolved Barium (Ba)	mg/L	< 0,010	(-)	SNI 06-6989.39-2005
Dissolved Boron (B)	mg/L	< 0,228	1,0	SNI 06-2481-1991
Dissolved Mercury (Hg)	mg/L	< 0,0005	0,002	SNI 6989.78:2019
Dissolved Arsenic (As)	mg/L	< 0,002	0,05	SNI 6989.81:2018
Dissolved Selenium (Se)	mg/L	< 0,002	0,05	SNI 6989.83:2018
Dissolved Iron (Fe)	mg/L	< 0,030	(-)	SNI 6989.84:2019
Dissolved Cadmium (Cd)	mg/L	< 0,0001	0,01	SNI 06-6989.38-2005
Dissolved Cobalt (Co)	mg/L	< 0,002	0,2	SNI 6989.68:2009
Dissolved Manganese (Mn)	mg/L	< 0,030	(-)	SNI 6989.84:2019
Dissolved Nickel (Ni)	mg/L	< 0,050	0,05	SNI 6989.18:2009
Dissolved Zinc (Zn)	mg/L	< 0,035	0,05	SNI 6989.84:2019
Dissolved Copper (Cu)	mg/L	< 0,015	0,02	SNI 6989.84:2019
Dissolved Lead (Pb)	mg/L	< 0,002	0,03	SNI 6989.46:2009
Hexavalent chromium (Cr^{6+})	mg/L	< 0,016	0,05	SNI 6989.71:2009
Oils &; Grease	mg/L	< 2,5	1	SNI 6989.10:2011
Total Detergent	mg/L	0,044	0,2	SNI 06-6989.51-2005
Phenol	mg/L	< 0,02	0,005	SNI 06-6989.21-2004
MICROBIOLOGY				
Fecal Coliform	MPN/100 ml	1600	1000	9222 D#)
Total Coliform	MPN/100 ml	1600	5000	9221 B#)
ADDITIONAL				
Garbage	Nihil	Nihil	Nihil	Visual
Debit	L/detik	364	-	SNI 8066-2005

Source : Results of Laboratory Analysis of PT Sucofindo, 2023

Exceed the limit

From the laboratory analysis results above, the water quality of Sungai Putih can be summarized for Qo quarterly periods in 2023 as follows:

Quarter I of 2023: During the first quarter of 2023, the water quality of upstream Sungai Putih (Sikunang) showed relatively good results, except for the Nitrate parameter, which recorded a level of 12 mg/L. At the downstream monitoring point, the Nitrate and Total Phosphate parameters exceeded the quality standard with values of 12 mg/L and 0.22 mg/L, respectively. These elevated values are likely attributed to residues from fertilizer use in the agricultural lands surrounding the sampling location.
Quarter II of 2023: In the second quarter of 2023, both the upstream and downstream parts of the Putih River (Sikunang) exhibited relatively good water quality results. The parameters for Physics, Organic Chemistry, and Microbiology met the quality standards. However, the Nitrate (NO3-N)

parameter slightly exceeded the Class II river water quality standard with a value of 13 mg/L at the Upper White River (Sikunang) monitoring point, and the Nitrate (NO3-N) parameter was 11 mg/L at the Downstream of Sungai Putih (Sikunang) monitoring point. The presence of residential and homestay areas near the sampling locations, along with agricultural lands dominated by community farming, may contribute to potential seepage of residential waste and fertilizer residues into the river.
Overall, the water quality in both quarterly periods is relatively good, except for the specific parameters mentioned above, which indicate potential pollution sources related to agricultural activities and residential waste.

Sidolog River

The results of laboratory analysis of surface water quality parameters for the first quarter of 2023 located at the upstream monitoring point of the Sidolog River can be seen in the following table.

Table 17 Water Quality of Sidolog River Upstream during the Quarter I of 2023

Parameter	Unit	Result	Threshold Limit	METODE
PHYSICS				
Temperature	^{0}C	19	Dev 3	SNI 06-6989.23-2005
Total Dissolved Solids (TDS)	mg/L	186	1000	SNI 6989.27:2019
Total Suspended Solids (TSS)	mg/L	4	50	SNI 6989.3:2019
Color	Pt-Co Unit	5,4	50	SNI 6989.80:2011
CHEMISTRY				
Acidity (pH)	-	8,2	6 - 9	SNI 6989.11:2019
Biochemical Oxygen Demand (BOD)	mg/L	2,12	3	SNI 6989.72:2009
Chemical Oxygen Demand (COD)	mg/L	10,1	25	SNI 6989.2:2019
Dissolved Oxygen (DO)	mg/L	5,6	Min. 4	4500 O G #)
Sulphate (SO_4^{2})	mg/L	6,11	300	SNI 6989.20:2019
Chloride (Cl^-)	mg/L	31,6	300	SNI 6989.19:2009
Nitrate (NO_3-N)	mg/L	**12**	10	SNI 6989.79:2011
Nitrite (NO_2-N)	mg/L	0,038	0,06	SNI 06-6989.9-2004
Ammonia (as N)	mg/L	< 0,036	0,2	SNI 06-6989.30-2005
Total Nitrogen	mg/L	13	15	4500-O G#)
Total Phosphate (as P)	mg/L	0,19	0,2	SNI 06-6989.31-2005
Fluoride (F)	mg/L	0,34	1,5	SNI.06-6989.29 -2005
Sulfur as H_2S	mg/L	< 0,020	0,002	SNI 6989.70:2009
Cyanide (CN)	mg/L	< 0,040	0,02	SNI 6989.77:2011
Chlorine Free	mg/L	< 0,050	0,03	4500 -Cl G#)
Dissolved Barium (Ba)	mg/L	< 0,010	(-)	SNI 06-6989.39-2005
Dissolved Boron (B)	mg/L	< 0,220	1,0	SNI 06-2481-1991
Dissolved Mercury (Hg)	mg/L	< 0,0005	0,002	SNI 6989.78:2019
Dissolved Arsenic (As)	mg/L	< 0,002	0,05	SNI 6989.81:2018
Dissolved Selenium (Se)	mg/L	< 0,002	0,05	SNI 6989.83:2018
Dissolved Iron (Fe)	mg/L	< 0,030	(-)	SNI 6989.84:2019
Dissolved Cadmium (Cd)	mg/L	< 0,0001	0,01	SNI 06-6989.38-2005
Dissolved Cobalt (Co)	mg/L	< 0,002	0,2	SNI 6989.68:2009

Parameter	Unit	Result	Threshold Limit	METODE
Dissolved Manganese (Mn)	mg/L	< 0,030	(-)	SNI 6989.84:2019
Dissolved Nickel (Ni)	mg/L	< 0,050	0,05	SNI 6989.18:2009
Dissolved Zinc (Zn)	mg/L	< 0,035	0,05	SNI 6989.84:2019
Dissolved Copper (Cu)	mg/L	< 0,015	0,02	SNI 6989.84:2019
Dissolved Lead (Pb)	mg/L	< 0,002	0,03	SNI 6989.46:2009
Hexavalent chromium (Cr^{6+})	mg/L	< 0,016	0,05	SNI 6989.71:2009
Oils &; Grease	mg/L	< 2,5	1	SNI 6989.10:2011
Total Detergent	mg/L	0,021	0,2	SNI 06-6989.51-2005
Phenol	mg/L	< 0,02	0,005	SNI 06-6989.21-2004
MICROBIOLOGY				
Fecal Coliform	MPN/100 ml	70	1000	9222 D#)
Total Coliform	MPN/100 ml	1100	5000	9221 B#)
ADDITIONAL				
Garbage	Nihil	Nihil	Nihil	Visual
Debit	L/detik	2400	-	SNI 8066-2005

Source : Results of Laboratory Analysis of PT Sucofindo, 2023

Exceed the limit

The results of laboratory analysis of surface water quality parameters for the first quarter of 2023 located at the downstream monitoring point of the Sidolog River can be seen in the following table

Table 18 Water Quality of Sidolog River during the Quarter I of 2023

Parameter	Unit	Result	Threshold Limit	METODE
PHYSICS				
Temperature	^{0}C	19	Dev 3	SNI 06-6989.23-2005
Total Dissolved Solids (TDS)	mg/L	234	1000	SNI 6989.27:2019
Total Suspended Solids (TSS)	mg/L	21	50	SNI 6989.3:2019
Color	Pt-Co Unit	8,3	50	SNI 6989.80:2011
CHEMISTRY				
Acidity (pH)	-	7,7	6 - 9	SNI 6989.11:2019
Biochemical Oxygen Demand (BOD)	mg/L	**3,76**	3	SNI 6989.72:2009
Chemical Oxygen Demand (COD)	mg/L	17,9	25	SNI 6989.2:2019
Dissolved Oxygen (DO)	mg/L	5,6	Min. 4	4500 O G #)
Sulphate (SO_4^{2})	mg/L	19,2	300	SNI 6989.20:2019
Chloride (Cl^-)	mg/L	68,6	300	SNI 6989.19:2009
Nitrate (NO_3-N)	mg/L	**12**	10	SNI 6989.79:2011
Nitrite (NO_2-N)	mg/L	**0,11**	0,06	SNI 06-6989.9-2004
Ammonia (as N)	mg/L	< 0,036	0,2	SNI 06-6989.30-2005
Total Nitrogen	mg/L	13	15	4500-O G#)
Total Phosphate (as P)	mg/L	**0,31**	0,2	SNI 06-6989.31-2005
Fluoride (F)	mg/L	0,49	1,5	SNI.06-6989.29 -2005
Sulfur as H_2S	mg/L	< 0,020	0,002	SNI 6989.70:2009
Cyanide (CN)	mg/L	< 0,040	0,02	SNI 6989.77:2011
Chlorine Free	mg/L	< 0,050	0,03	4500 -Cl G#)

Parameter	Unit	Result	Threshold Limit	METODE
Dissolved Barium (Ba)	mg/L	< 0,010	(-)	SNI 06-6989.39-2005
Dissolved Boron (B)	mg/L	< 0,220	1,0	SNI 06-2481-1991
Dissolved Mercury (Hg)	mg/L	< 0,0005	0,002	SNI 6989.78:2019
Dissolved Arsenic (As)	mg/L	< 0,002	0,05	SNI 6989.81:2018
Dissolved Selenium (Se)	mg/L	< 0,002	0,05	SNI 6989.83:2018
Dissolved Iron (Fe)	mg/L	< 0,030	(-)	SNI 6989.84:2019
Dissolved Cadmium (Cd)	mg/L	< 0,0001	0,01	SNI 06-6989.38-2005
Dissolved Cobalt (Co)	mg/L	< 0,002	0,2	SNI 6989.68:2009
Dissolved Manganese (Mn)	mg/L	< 0,030	(-)	SNI 6989.84:2019
Dissolved Nickel (Ni)	mg/L	< 0,050	0,05	SNI 6989.18:2009
Dissolved Zinc (Zn)	mg/L	< 0,035	0,05	SNI 6989.84:2019
Dissolved Copper (Cu)	mg/L	< 0,015	0,02	SNI 6989.84:2019
Dissolved Lead (Pb)	mg/L	< 0,002	0,03	SNI 6989.46:2009
Hexavalent chromium (Cr^{6+})	mg/L	< 0,016	0,05	SNI 6989.71:2009
Oils &; Grease	mg/L	< 2,5	1	SNI 6989.10:2011
Total Detergent	mg/L	0,020	0,2	SNI 06-6989.51-2005
Phenol	mg/L	< 0,02	0,005	SNI 06-6989.21-2004
MICROBIOLOGY				
Fecal Coliform	MPN/100 ml	**1600**	1000	9222 D#)
Total Coliform	MPN/100 ml	1600	5000	9221 B#)
ADDITIONAL				
Garbage	Nihil	Nihil	Nihil	Visual
Debit	L/detik	21000	-	SNI 8066-2005

Source : Results of Laboratory Analysis of PT Sucofindo, 2023

Exceed the limit

The results of laboratory analysis of surface water quality parameters for the second quarter of 2023 located at the upstream monitoring point of the Sidolog River can be seen in the following table.

Table 19 Water Quality of Sidolog River Upstream during the Quarter II of 2023

Parameter	Unit	Result	Threshold Limit	METODE
PHYSICS				
Temperature	^{0}C	20	Dev 3	SNI 06-6989.23-2005
Total Dissolved Solids (TDS)	mg/L	194	1000	SNI 6989.27:2019
Total Suspended Solids (TSS)	mg/L	4	50	SNI 6989.3:2019
Color	Pt-Co Unit	4,3	50	SNI 6989.80:2011
CHEMISTRY				
Acidity (pH)	-	7,6	6 - 9	SNI 6989.11:2019
Biochemical Oxygen Demand (BOD)	mg/L	**5,54**	3	SNI 6989.72:2009
Chemical Oxygen Demand (COD)	mg/L	4,46	25	SNI 6989.2:2019
Dissolved Oxygen (DO)	mg/L	7,3	Min. 4	4500 O G #)
Sulphate (SO_4^2)	mg/L	8,48	300	SNI 6989.20:2019
Chloride (Cl^-)	mg/L	29,6	300	SNI 6989.19:2009
Nitrate (NO_3-N)	mg/L	10	10	SNI 6989.79:2011

Parameter	Unit	Result	Threshold Limit	METODE
Nitrite (NO_2-N)	mg/L	0,029	0,06	SNI 06-6989.9-2004
Ammonia (as N)	mg/L	0,18	0,2	SNI 06-6989.30-2005
Total Nitrogen	mg/L	10,720	15	4500-O G#)
Total Phosphate (as P)	mg/L	0,19	0,2	SNI 06-6989.31-2005
Fluoride (F)	mg/L	< 0,080	1,5	SNI.06-6989.29 -2005
Sulfur as H_2S	mg/L	< 0,020	0,002	SNI 6989.70:2009
Cyanide (CN)	mg/L	< 0,040	0,02	SNI 6989.77:2011
Chlorine Free	mg/L	< 0,050	0,03	4500 -Cl G#)
Dissolved Barium (Ba)	mg/L	< 0,010	(-)	SNI 06-6989.39-2005
Dissolved Boron (B)	mg/L	< 0,228	1,0	SNI 06-2481-1991
Dissolved Mercury (Hg)	mg/L	< 0,0005	0,002	SNI 6989.78:2019
Dissolved Arsenic (As)	mg/L	< 0,002	0,05	SNI 6989.81:2018
Dissolved Selenium (Se)	mg/L	< 0,002	0,05	SNI 6989.83:2018
Dissolved Iron (Fe)	mg/L	< 0,030	(-)	SNI 6989.84:2019
Dissolved Cadmium (Cd)	mg/L	< 0,0001	0,01	SNI 06-6989.38-2005
Dissolved Cobalt (Co)	mg/L	< 0,002	0,2	SNI 6989.68:2009
Dissolved Manganese (Mn)	mg/L	< 0,030	(-)	SNI 6989.84:2019
Dissolved Nickel (Ni)	mg/L	< 0,050	0,05	SNI 6989.18:2009
Dissolved Zinc (Zn)	mg/L	< 0,035	0,05	SNI 6989.84:2019
Dissolved Copper (Cu)	mg/L	< 0,015	0,02	SNI 6989.84:2019
Dissolved Lead (Pb)	mg/L	< 0,002	0,03	SNI 6989.46:2009
Hexavalent chromium (Cr^{6+})	mg/L	< 0,016	0,05	SNI 6989.71:2009
Oils &; Grease	mg/L	< 2,5	1	SNI 6989.10:2011
Total Detergent	mg/L	0,040	0,2	SNI 06-6989.51-2005
Phenol	mg/L	< 0,02	0,005	SNI 06-6989.21-2004
MICROBIOLOGY				
Fecal Coliform	MPN/100 ml	84	1000	9222 D#)
Total Coliform	MPN/100 ml	110	5000	9221 B#)
ADDITIONAL				
Garbage	Nihil	Nihil	Nihil	Visual
Debit	L/detik	287	-	SNI 8066-2005

Source : Results of Laboratory Analysis of PT Sucofindo, 2023

	Exceed the limit

The results of laboratory analysis of surface water quality parameters for the second quarter of 2023 located at the downstream monitoring point of the Sidolog River can be seen in the following table.

Table 20 Water Quality of Sidolog River Downstream during the Quarter II of 2023

Parameter	Unit	Result	Threshold Limit	METODE
PHYSICS				
Temperature	^{0}C	20	Dev 3	SNI 06-6989.23-2005
Total Dissolved Solids (TDS)	mg/L	164	1000	SNI 6989.27:2019
Total Suspended Solids (TSS)	mg/L	4	50	SNI 6989.3:2019
Color	Pt-Co Unit	9,3	50	SNI 6989.80:2011
CHEMISTRY				

Parameter	Unit	Result	Threshold Limit	METODE
Acidity (pH)	-	7,8	6 - 9	SNI 6989.11:2019
Biochemical Oxygen Demand (BOD)	mg/L	2,02	3	SNI 6989.72:2009
Chemical Oxygen Demand (COD)	mg/L	9,62	25	SNI 6989.2:2019
Dissolved Oxygen (DO)	mg/L	6,8	Min. 4	4500 O G #)
Sulphate (SO_4^2)	mg/L	7,51	300	SNI 6989.20:2019
Chloride (Cl^-)	mg/L	24,0	300	SNI 6989.19:2009
Nitrate (NO_3-N)	mg/L	**12**	10	SNI 6989.79:2011
Nitrite (NO_2-N)	mg/L	0,040	0,06	SNI 06-6989.9-2004
Ammonia (as N)	mg/L	0,046	0,2	SNI 06-6989.30-2005
Total Nitrogen	mg/L	12,7	15	4500-O G#)
Total Phosphate (as P)	mg/L	0,16	0,2	SNI 06-6989.31-2005
Fluoride (F)	mg/L	< 0,080	1,5	SNI.06-6989.29 -2005
Sulfur as H_2S	mg/L	< 0,020	0,002	SNI 6989.70:2009
Cyanide (CN)	mg/L	< 0,040	0,02	SNI 6989.77:2011
Chlorine Free	mg/L	< 0,050	0,03	4500 -Cl G#)
Dissolved Barium (Ba)	mg/L	< 0,010	(-)	SNI 06-6989.39-2005
Dissolved Boron (B)	mg/L	< 0,228	1,0	SNI 06-2481-1991
Dissolved Mercury (Hg)	mg/L	< 0,0005	0,002	SNI 6989.78:2019
Dissolved Arsenic (As)	mg/L	< 0,002	0,05	SNI 6989.81:2018
Dissolved Selenium (Se)	mg/L	< 0,002	0,05	SNI 6989.83:2018
Dissolved Iron (Fe)	mg/L	< 0,030	(-)	SNI 6989.84:2019
Dissolved Cadmium (Cd)	mg/L	< 0,0001	0,01	SNI 06-6989.38-2005
Dissolved Cobalt (Co)	mg/L	< 0,002	0,2	SNI 6989.68:2009
Dissolved Manganese (Mn)	mg/L	< 0,030	(-)	SNI 6989.84:2019
Dissolved Nickel (Ni)	mg/L	< 0,050	0,05	SNI 6989.18:2009
Dissolved Zinc (Zn)	mg/L	< 0,035	0,05	SNI 6989.84:2019
Dissolved Copper (Cu)	mg/L	< 0,015	0,02	SNI 6989.84:2019
Dissolved Lead (Pb)	mg/L	< 0,002	0,03	SNI 6989.46:2009
Hexavalent chromium (Cr^{6+})	mg/L	< 0,016	0,05	SNI 6989.71:2009
Oils &; Grease	mg/L	< 2,5	1	SNI 6989.10:2011
Total Detergent	mg/L	0,022	0,2	SNI 06-6989.51-2005
Phenol	mg/L	< 0,02	0,005	SNI 06-6989.21-2004
MICROBIOLOGY				
Fecal Coliform	MPN/100 ml	110	1000	9222 D#)
Total Coliform	MPN/100 ml	210	5000	9221 B#)
ADDITIONAL				
Garbage	Nihil	Nihil	Nihil	Visual
Debit	L/detik	358	-	SNI 8066-2005

Source : Results of Laboratory Analysis of PT Sucofindo, 2023

Exceed the limit

Based on the laboratory analysis results, the water quality of the Sidolog River during the first and second quarters of 2023 is discussed below.

Quarter I of 2023: In the first quarter of 2023, the monitoring results showed that the water quality of Sidolog River at both monitoring locations, the upstream and downstream stream; is relatively good. At

the upstream section, all concentrations of the physical parameters met the quality standard, while the concentrations of inorganic chemical parameter in particularly Nitrate (12 mg/L); was exceeding the river water quality standard Class II . However, the concentration of organic chemical parameters and microbiological parameters met the river water quality standards Class II.

In the downstream section, the monitoring results showed that concentration of physical and organic chemical parameters met the quality standards. However, concentration of several inorganic chemical parameters were exceeding the river water quality standards Class II. Those parameters are including the BOD parameter (3.76 mg/L), Nitrate (12 mg/L), Nitrite (0.11 mg/L), and Total Phosphate (0.31 mg/L). Additionally, the microbial parameter showed a concentration above the river water quality Class II standard when the concentration of Fecal Coliform was 1600 MPN/100ml. The presence of residues from fertilizer use on agricultural land was identified as a potential causal factor of exceeding inorganic chemical parameters concentration. It is worth noting that the vicinity of the sampling location is a mixed area of residential and homestay area, with dominant community agricultural land, further contributing to possible seepage from residential waste and the use of chemical and organic fertilizers on agricultural land.

Quarter II of 2023: In the second quarter of 2023, the water quality of the Sidolog River continued to show relatively good results in both the upstream and downstream parts of the river. In the upstream section, the Physics parameters met the quality standards. However, some Inorganic Chemistry parameters exceeded the Class II river water quality standards, particularly the BOD parameter at 5.54 mg/L. Nevertheless, the Organic Chemical Parameters and Microbiological parameters met the Class II river water quality standards.

In the downstream section, the water quality parameters for Physics, Organic Chemistry, and Microbiology met the Class II river water quality standards. However, the BOD value exceeded the quality standard, and it was attributed to seepage of residues from the use of chemical fertilizers on agricultural land.

Overall, the water quality of the Sidolog River showed relatively positive results during both quarterly periods, but there were specific instances of parameters exceeding the quality standards, primarily associated with agricultural activities and residential waste seepage.

Drainage Water Monitoring

In quarter I of 2023, the measurements of drainage water quality at three monitoring locations indicated that all test parameters were within the environmental quality standards in accordance with the Regional Regulation of Central Java Province Number 5 of 2012. This regulation pertains to the amendment of Regional Percentages of Central Java Province Number 4, 2004, which specifically addresses the Wastewater Quality Standards for Geothermal Exploration and Production businesses and/or activities.

Monitoring of drainage water quality in the Dieng Unit 2 area for Semester I 2023 was carried out in Quarter I and Quarter II at three location points with monitoring results can be seen in the following table:

Period	Quarterly
Standard	Regional Regulation of Central Java Province Number 5 year 2012 concerning Amendments to Regional Regulations of Central Java Province No.4 of 2004 concerning changes to Wastewater Quality Standards for Geothermal Exploration and Production Businesses and/or Activities
Method	Testing of drainage water parameters was carried out for oil and grease parameters according to SNI 6989.10:2011, Total Organic Carbon according to 5310 C*, and pH according to SNI 6989.11:2019
Monitoring Location	1 Drilling Pad 29 2 Temporary Office 3 PAD 9

Table 27 Water Quality of Drainage Water during the First Quarter of 2023

Parameter	units	Analysis results			Environmental Quality Standards	Method
		Pad 29	Temporary Office	Pad 9		
Oils & Fats	mg/L	< 2,5	< 2,5	< 2,5	15	SNI 6989.10:2011
Total Organic Carbon	mg/L	2,4	0,84	1,2	110	SNI 06-6989.30-2005
pH	-	8,8	7,9	6,8	-	SNI 06-6989.11-2019

Source: Laboratory Analysis Result PT. Sucofindo 2023

Table 28 Water Quality of Drainage Water during the Second Quarter of 2023

Parameter	units	Analysis results			Environmental Quality standards	Method
		Pad 29	Temporary Office	Pad 9		
Oils & Fats	mg/L	< 2,5	-	-	15	SNI 6989.10:2011
Total Organic Carbon	mg/L	1,34	-	-	110	SNI 06-6989.30-2005
pH	-	8,1	-	-	-	SNI 06-6989.11-2019

Source: Laboratory Analysis Result PT. Sucofindo 2023

4. Clean Water/Groundwater

Clean water quality testing is carried out to determine the quality of clean water used during activities in the Dieng Unit 2 PLTP area. By monitoring domestic wastewater regularly, it will be able to ensure that the clean water used is safe to use and does not cause health problems. Locations for measuring the quality of clean water for the first semester of 2023 were carried out in 3 locations. The locations of clean water quality sampling points are in the Sidendang (Simpangan), Situlu, and Sidendang springs.

Period	Quarterly
Standard	Regulation of the Minister of Health of the Republic of Indonesia Number 32 of 2017, Appendix I A. Concerning Environmental Health Quality Standards and Water Health Requirements for Sanitation Hygiene purposes
Method	Standard methods for the examination of water and waste water 23 rd Edition 2017 APHA-AWWA-WEF
Monitoring Location	1 Sidendang (Simpangan) 2 Situlu 3 Sidendang

Table 33. **Water Quality of** Sidendang (Simpangan) during the First Quarter of 2023

No.	Parameter	Unit	Results	Quality Standard	Method
1.	**MANDATORY PARAMETERS**				
	A. PHYSICS :				
1.	Turbidity	NTU	0,22	25	SNI 06-6989.25-2005
2.	Color	Pt-Co	< 2,5	50	SNI 6989.80:2011
3.	Total Dissolved Solids (TDS)	mg/L	405	1000	SNI 6989.27:2019
4.	Temperatur	^{0}C	28	Air Temperature ± 3	SNI 06-6989.23-2005
5.	Flavor	-	Tasteless	Tasteless	SNI 3554:2015 part 3.2.1
6.	Odor	-	Odorless	Odorless	SNI 3554:2015 part 3.2.2
	B. MICROBIOLOGY :				
1.	Total Coliform	Amount/100 ml	46	50	9222 B#)
2.	E. coli	Amount/100 ml	0	0	9222 G#)
	C. CHEMISTRY				
1.	pH	-	**6,3**	6,5 - 8,5	SNI 6989.11:2019
2.	Iron (Fe)	mg/L	< 0,030	1	SNI 6989.84:2019
3.	Florida (F)	mg/L	< 0,080	1,5	SNI 06-6989.29-2005
4.	Hardness ($CaCO_3$)	mg/L	174	500	SNI 06-6989.12-2004
5.	Manganese (Mn)	mg/L	< 0,030	0,5	SNI 6989.84:2019
6.	Nitrate as N (NO_3-N)	mg/L	**13,6**	10	4500-NO3 B#)
7.	Nitrite as N (NO_2-N)	mg/L	< 0,003	1	SNI 06-6989.9-2004
8.	Cyanide (CN)	mg/L	< 0,040	0,1	SNI 6989.77:2011
9.	Detergent as (MBAS)	mg/L	< 0,030	0,05	SNI 06-6989.51-2005
10.	Total Pesticide*)	mg/L	-	0,1	-
	ADDITIONAL PARAMETER :				
	C. CHEMISTRY				
1.	Mercury (Hg)	mg/L	< 0,0005	0,001	SNI 6989.78:2019
2.	Arsenic (As)	mg/L	< 0,002	0,05	SNI 6989.81:2018
3.	Cadmium (Cd)	mg/L	< 0,0001	0,005	SNI 06-6989.38-2005
4.	Valence Chromiumi 6 (Cr^{6+})	mg/L	< 0,016	0,05	SNI 6989.71:2009

No.	Parameter	Unit	Results	Quality Standard	Method
5.	Selenium (Se)	mg/L	< 0,002	0,01	SNI 6989.83:2018
6.	Zinc (Zn)	mg/L	< 0,035	15	SNI 6989.84:2019
7.	Sulfate (SO_4)	mg/L	16,5	400	SNI 6989.20:2019
8.	Lead (Pb)	mg/L	< 0,002	0,05	SNI 6989.46:2009
9.	Organic Substances ($KMnO_4$)	mg/L	< 0,170	10	4500-KMnO4 B#)

Source: Sucofindo Laboratory, 2023

Exceed the limit

Table 1 Water Quality of Situlu during the First Quarter of 2023

No.	Parameter	Unit	Results	Quality Standard	Method
1.	**MANDATORY PARAMETERS**				
	A. PHYSICS :				
1.	Turbidity	NTU	0,3	25	SNI 06-6989.25-2005
2.	Color	Pt-Co	< 2,5	50	SNI 6989.80:2011
3.	Total Dissolved Solids (TDS)	mg/L	178	1000	SNI 6989.27:2019
4.	Temperatur	^{0}C	19	Air Temperature ± 3	SNI 06-6989.23-2005
5.	Flavor	-	Tasteless	Tasteless	SNI 3554:2015 part 3.2.1
6.	Odor	-	Odorless	Odorless	SNI 3554:2015 part 3.2.2
	B. MICROBIOLOGY :				
1.	Total Coliform	Amount/100 ml	21	50	9222 B#)
2.	E. coli	Amount/100 ml	0	0	9222 G#)
	C. CHEMISTRY				
1.	pH	-	**5,6**	6,5 - 8,5	SNI 6989.11:2019
2.	Iron (Fe)	mg/L	< 0,030	1	SNI 6989.84:2019
3.	Florida (F)	mg/L	< 0,080	1,5	SNI 06-6989.29-2005
4.	Hardness ($CaCO_3$)	mg/L	141	500	SNI 06-6989.12-2004
5.	Manganese (Mn)	mg/L	< 0,030	0,5	SNI 6989.84:2019
6.	Nitrate as N (NO_3-N)	mg/L	**13,63**	10	4500-NO3 B#)
7.	Nitrite as N (NO_2-N)	mg/L	< 0,003	1	SNI 06-6989.9-2004
8.	Cyanide (CN)	mg/L	< 0,040	0,1	SNI 6989.77:2011

No.	Parameter	Unit	Results	Quality Standard	Method
9.	Detergent as (MBAS)	mg/L	< 0,030	0,05	SNI 06-6989.51-2005
10.	Total Pesticide*)	mg/L	-	0,1	-
	ADDITIONAL PARAMETER :				
	C. CHEMISTRY				
1.	Mercury (Hg)	mg/L	< 0,0005	0,001	SNI 6989.78:2019
2.	Arsenic (As)	mg/L	< 0,002	0,05	SNI 6989.81:2018
3.	Cadmium (Cd)	mg/L	< 0,0001	0,005	SNI 06-6989.38-2005
4.	Valence Chromiumi 6 (Cr^{6+})	mg/L	< 0,016	0,05	SNI 6989.71:2009
5.	Selenium (Se)	mg/L	< 0,002	0,01	SNI 6989.83:2018
6.	Zinc (Zn)	mg/L	< 0,035	15	SNI 6989.84:2019
7.	Sulfate (SO_4)	mg/L	< 2,0	400	SNI 6989.20:2019
8.	Lead (Pb)	mg/L	< 0,002	0,05	SNI 6989.46:2009
9.	Organic Substances ($KMnO_4$)	mg/L	< 0,170	10	4500-KMnO4 B#)

Source: Sucofindo Laboratory, 2023

	Exceed the limit

Table 2 Water Quality of Sidendang during the First Quarter of 2023

No.	Parameter	Unit	Results	Quality Standard	Method
1.	**MANDATORY PARAMETERS**				
	A. PHYSICS :				
1.	Turbidity	NTU	0,13	25	SNI 06-6989.25-2005
2.	Color	Pt-Co	< 2,5	50	SNI 6989.80:2011
3.	Total Dissolved Solids (TDS)	mg/L	166	1000	SNI 6989.27:2019
4.	Temperatur	^0C	19	Air Temperature $\pm$ 3	SNI 06-6989.23-2005
5.	Flavor	-	Tasteless	Tasteless	SNI 3554:2015 part 3.2.1
6.	Odor	-	Odorless	Odorless	SNI 3554:2015 part 3.2.2
	B. MICROBIOLOGY :				
1.	Total Coliform	Amount/100 ml	35	50	9222 B#)
2.	E. coli	Amount/100 ml	0	0	9222 G#)
	C. CHEMISTRY				
1.	pH	-	**5,8**	6,5 - 8,5	SNI 6989.11:2019

No.	Parameter	Unit	Results	Quality Standard	Method
2.	Iron (Fe)	mg/L	< 0,030	1	SNI 6989.84:2019
3.	Florida (F)	mg/L	< 0,080	1,5	SNI 06-6989.29-2005
4.	Hardness ($CaCO_3$)	mg/L	125	500	SNI 06-6989.12-2004
5.	Manganese (Mn)	mg/L	< 0,030	0,5	SNI 6989.84:2019
6.	Nitrate as N (NO_3-N)	mg/L	**13,53**	10	4500-NO3 B#)
7.	Nitrite as N (NO_2-N)	mg/L	< 0,003	1	SNI 06-6989.9-2004
8.	Cyanide (CN)	mg/L	< 0,040	0,1	SNI 6989.77:2011
9.	Detergent as (MBAS)	mg/L	< 0,030	0,05	SNI 06-6989.51-2005
10.	Total Pesticide*)	mg/L	-	0,1	-
	ADDITIONAL PARAMETER :				
	C. CHEMISTRY				
1.	Mercury (Hg)	mg/L	< 0,0005	0,001	SNI 6989.78:2019
2.	Arsenic (As)	mg/L	< 0,002	0,05	SNI 6989.81:2018
3.	Cadmium (Cd)	mg/L	< 0,0001	0,005	SNI 06-6989.38-2005
4.	Valence Chromiumi 6 (Cr^{6+})	mg/L	< 0,016	0,05	SNI 6989.71:2009
5.	Selenium (Se)	mg/L	< 0,002	0,01	SNI 6989.83:2018
6.	Zinc (Zn)	mg/L	< 0,035	15	SNI 6989.84:2019
7.	Sulfate (SO_4)	mg/L	< 2,0	400	SNI 6989.20:2019
8.	Lead (Pb)	mg/L	< 0,002	0,05	SNI 6989.46:2009
9.	Organic Substances ($KMnO_4$)	mg/L	< 0,170	10	4500-KMnO4 B#)

Source: Sucofindo Laboratory, 2023

	Exceed the limit

Table 3 Water Quality of Sidendang (Simpangan) during the Second Quarter of 2023

No.	Parameter	Unit	Results	Quality Standard	Method
1.	**MANDATORY PARAMETERS**				
	A. PHYSICS :				
1.	Turbidity	NTU	0,8	25	SNI 06-6989.25-2005
2.	Color	Pt-Co	< 2,5	50	SNI 6989.80:2011
3.	Total Dissolved Solids (TDS)	mg/L	426	1000	SNI 6989.27:2019

No.	Parameter	Unit	Results	Quality Standard	Method
4.	Temperatur	^{0}C	19	Air Temperature ± 3	SNI 06-6989.23-2005
5.	Flavor	-	Tasteless	Tasteless	SNI 3554:2015 part 3.2.1
6.	Odor	-	Odorless	Odorless	SNI 3554:2015 part 3.2.2
	B. MICROBIOLOGY :				
1.	Total Coliform	Amount/100 ml	25	50	9222 B#)
2.	E. coli	Amount/100 ml	0	0	9222 G#)
	C. CHEMISTRY				
1.	pH	-	7,1	6,5 - 8,5	SNI 6989.11:2019
2.	Iron (Fe)	mg/L	< 0,030	1	SNI 6989.84:2019
3.	Florida (F)	mg/L	0,49	1,5	SNI 06-6989.29-2005
4.	Hardness ($CaCO_3$)	mg/L	180	500	SNI 06-6989.12-2004
5.	Manganese (Mn)	mg/L	< 0,030	0,5	SNI 6989.84:2019
6.	Nitrate as N (NO_3-N)	mg/L	**13**	10	4500-NO3 B#)
7.	Nitrite as N (NO_2-N)	mg/L	< 0,003	1	SNI 06-6989.9-2004
8.	Cyanide (CN)	mg/L	< 0,040	0,1	SNI 6989.77:2011
9.	Detergent as (MBAS)	mg/L	< 0,030	0,05	SNI 06-6989.51-2005
10.	Total Pesticide*)	mg/L	-	0,1	-
	ADDITIONAL PARAMETER :				
	C. CHEMISTRY				
1.	Mercury (Hg)	mg/L	< 0,0005	0,001	SNI 6989.78:2019
2.	Arsenic (As)	mg/L	< 0,002	0,05	SNI 6989.81:2018
3.	Cadmium (Cd)	mg/L	< 0,0001	0,005	SNI 06-6989.38-2005
4.	Valence Chromiumi 6 (Cr^{6+})	mg/L	< 0,016	0,05	SNI 6989.71:2009
5.	Selenium (Se)	mg/L	< 0,002	0,01	SNI 6989.83:2018
6.	Zinc (Zn)	mg/L	< 0,035	15	SNI 6989.84:2019
7.	Sulfate (SO_4)	mg/L	16,8	400	SNI 6989.20:2019
8.	Lead (Pb)	mg/L	< 0,002	0,05	SNI 6989.46:2009
9.	Organic Substances ($KMnO_4$)	mg/L	< 0,170	10	4500-KMnO4 B#)

Source: Sucofindo Laboratory, 2023

	Exceed the limit

Table 4 Water Quality of Situlu River during the Second Quarter of 2023

No.	Parameter	Unit	Results	Quality Standard	Method
1.	**MANDATORY PARAMETERS**				
	A. PHYSICS :				
1.	Turbidity	NTU	0,23	25	SNI 06-6989.25-2005
2.	Color	Pt-Co	< 2,5	50	SNI 6989.80:2011
3.	Total Dissolved Solids (TDS)	mg/L	146	1000	SNI 6989.27:2019
4.	Temperatur	^{0}C	19	Air Temperature $\pm$ 3	SNI 06-6989.23-2005
5.	Flavor	-	Tasteless	Tasteless	SNI 3554:2015 part 3.2.1
6.	Odor	-	Odorless	Odorless	SNI 3554:2015 part 3.2.2
	B. MICROBIOLOGY :				
1.	Total Coliform	Amount/100 ml	29	50	9222 B#)
2.	E. coli	Amount/100 ml	0	0	9222 G#)
	C. CHEMISTRY				
1.	pH	-	7	6,5 - 8,5	SNI 6989.11:2019
2.	Iron (Fe)	mg/L	< 0,030	1	SNI 6989.84:2019
3.	Florida (F)	mg/L	0,6	1,5	SNI 06-6989.29-2005
4.	Hardness ($CaCO_3$)	mg/L	156	500	SNI 06-6989.12-2004
5.	Manganese (Mn)	mg/L	< 0,030	0,5	SNI 6989.84:2019
6.	Nitrate as N (NO_3-N)	mg/L	3,1	10	4500-NO3 B#)
7.	Nitrite as N (NO_2-N)	mg/L	0,006	1	SNI 06-6989.9-2004
8.	Cyanide (CN)	mg/L	< 0,040	0,1	SNI 6989.77:2011
9.	Detergent as (MBAS)	mg/L	< 0,030	0,05	SNI 06-6989.51-2005
10.	Total Pesticide*)	mg/L	-	0,1	-
	ADDITIONAL PARAMETER :				
	C. CHEMISTRY				
1.	Mercury (Hg)	mg/L	< 0,0005	0,001	SNI 6989.78:2019
2.	Arsenic (As)	mg/L	< 0,002	0,05	SNI 6989.81:2018
3.	Cadmium (Cd)	mg/L	< 0,0001	0,005	SNI 06-6989.38-2005
4.	Valence Chromiumi 6 (Cr^{6+})	mg/L	< 0,016	0,05	SNI 6989.71:2009

No.	Parameter	Unit	Results	Quality Standard	Method
5.	Selenium (Se)	mg/L	< 0,002	0,01	SNI 6989.83:2018
6.	Zinc (Zn)	mg/L	< 0,035	15	SNI 6989.84:2019
7.	Sulfate (SO_4)	mg/L	3,22	400	SNI 6989.20:2019
8.	Lead (Pb)	mg/L	< 0,002	0,05	SNI 6989.46:2009
9.	Organic Substances ($KMnO_4$)	mg/L	< 0,170	10	4500-KMnO4 B#)

Source: Sucofindo Laboratory, 2023

Exceed the limit

Table 5 Water Quality of Sidendang Springwater during Second Quarter of 2023

No.	Parameter	Unit	Results	Quality Standard	Method
1.	**MANDATORY PARAMETERS**				
	A. PHYSICS :				
1.	Turbidity	NTU	0,23	25	SNI 06-6989.25-2005
2.	Color	Pt-Co	< 2,5	50	SNI 6989.80:2011
3.	Total Dissolved Solids (TDS)	mg/L	146	1000	SNI 6989.27:2019
4.	Temperatur	^{0}C	19	Air Temperature ± 3	SNI 06-6989.23-2005
5.	Flavor	-	Tasteless	Tasteless	SNI 3554:2015 part 3.2.1
6.	Odor	-	Odorless	Odorless	SNI 3554:2015 part 3.2.2
	B. MICROBIOLOGY :				
1.	Total Coliform	Amount/100 ml	**57**	50	9222 B#)
2.	E. coli	Amount/100 ml	0	0	9222 G#)
	C. CHEMISTRY				
1.	pH	-	7,4	6,5 - 8,5	SNI 6989.11:2019
2.	Iron (Fe)	mg/L	< 0,030	1	SNI 6989.84:2019
3.	Florida (F)	mg/L	0,88	1,5	SNI 06-6989.29-2005
4.	Hardness ($CaCO_3$)	mg/L	124	500	SNI 06-6989.12-2004
5.	Manganese (Mn)	mg/L	< 0,030	0,5	SNI 6989.84:2019
6.	Nitrate as N (NO_3-N)	mg/L	2,31	10	4500-NO3 B#)
7.	Nitrite as N (NO_2-N)	mg/L	< 0,003	1	SNI 06-6989.9-2004
8.	Cyanide (CN)	mg/L	< 0,040	0,1	SNI 6989.77:2011

No.	Parameter	Unit	Results	Quality Standard	Method
9.	Detergent as (MBAS)	mg/L	< 0,030	0,05	SNI 06-6989.51-2005
10.	Total Pesticide*)	mg/L	-	0,1	-
	ADDITIONAL PARAMETER :				
	C. CHEMISTRY				
1.	Mercury (Hg)	mg/L	< 0,0005	0,001	SNI 6989.78:2019
2.	Arsenic (As)	mg/L	< 0,002	0,05	SNI 6989.81:2018
3.	Cadmium (Cd)	mg/L	< 0,0001	0,005	SNI 06-6989.38-2005
4.	Valence Chromiumi 6 (Cr^{6+})	mg/L	< 0,016	0,05	SNI 6989.71:2009
5.	Selenium (Se)	mg/L	< 0,002	0,01	SNI 6989.83:2018
6.	Zinc (Zn)	mg/L	< 0,035	15	SNI 6989.84:2019
7.	Sulfate (SO_4)	mg/L	< 2,0	400	SNI 6989.20:2019
8.	Lead (Pb)	mg/L	< 0,002	0,05	SNI 6989.46:2009
9.	Organic Substances ($KMnO_4$)	mg/L	< 0,170	10	4500-KMnO4 B#)

Source: Sucofindo Laboratory, 2023

	Exceed the limit

Based on the results of laboratory analysis for parameters of clean water in the Sidendang (Simpangan), Situlu and Sidendang springs which are around the PLTP Dieng Unit 2 project for the First quarter and Second quarter of 2023 as presented in the table above, it can be explained as follows:

1. Quarterly Period I of 2023

   Sidendang (Simpangan) Spring

   Based on the results of laboratory analysis, it can be seen that at the monitoring point of the Sidendang spring (Simpangan) in the first quarter period, there were pH parameters that did not meet the established quality standards with a result of 6.3. Then there is the Nitrate parameter which does not meet quality standards with a yield of 13.6 mg/L.

   Situlu Spring

   Based on the results of laboratory analysis, it can be seen that at the monitoring point of the Situlu spring in the first quarter period, there were pH parameters that did not meet the established quality standards with a result of 5.6. Then there is the Nitrate parameter which does not meet quality standards with a yield of 13.63 mg/L.

   Sidendang Spring

   Based on the results of laboratory analysis, it can be seen that at the monitoring point of the Sidendang spring in the first quarter, there were pH parameters that did not meet the established quality standards with a result of 5.8. Then there is the Nitrate parameter which does not meet quality standards with a yield of 13.53 mg/L.

2. Quarterly Period II of 2023

Sidendang (Simpangan) Spring

Based on the results of laboratory analysis, it can be seen that at the monitoring point of the Sidendang spring (Simpangan) in the second quarter period, there were Nitrate parameter which does not meet quality standards with a yield of 13 mg/L.

Situlu Spring

Based on the results of laboratory analysis, it can be seen that at the monitoring point of the Situlu spring in the second quarter, all parameters met the set quality standards.

Sidendang Spring

Based on the results of laboratory analysis, it can be seen that all parameters met the set quality standards during the second quarter monitoring.

5. Domestic Wastewater Quality

Testing the quality of domestic wastewater is conducted to assess the efficacy of wastewater treatment derived from domestic activities at the Dieng Unit 2 Geothermal Power Plant. Regular monitoring of domestic wastewater at four designated sampling points enables the verification of its safety before discharge into the surrounding environment. The locations of these domestic wastewater sampling points are presented in the table below.

Period	Per month
Standard	Regional Regulation of Central Java Province Number 5 th. 2012 concerning Amendments to Regional Regulations of Central Java Province No.4 of 2004 concerning changes to Wastewater Quality Standards for Businesses and/or Geothermal Exploration and Production activities.
Method	Laboratory analysis of domestic wastewater around the project site refers to the Regional Regulation of Central Java Province Number 5 of 2012). Analysis of water samples was carried out in the laboratory using standard methods (Standard Methods — for the Examination of Water and Wastewater — Issue 19, APHA, 1995)
Monitoring Location	1 PMU Temporary Office 1 (Front) 2 PMU Temporary Office 2 (Rear) 3 Portacamp Rig 4 Portacamp Workshop

The following shows the results of measuring the quality of domestic wastewater for Semester I 2023 at the monitoring point at the PMU Temporary Office, Portacamp Rig and Portacamp Workshop.

Table 26 Results of Domestic Wastewater Analysis at PMU Temporary Office 1 Semester I Period 2023

Parameter	Units	Results	Standard	Method
January				
pH	--	7,4	6 – 9	SNI 06-6989.11-2019

Parameter	Units	Results	Standard	Method
BOD. 5	mg/l	3,28	30	SNI 06-6989. 72-2009
COD	mg/l	11,1	100	SNI 06-6989.2-2019
Total Suspended Solids (TSS)	mg/l	14	30	SNI 06-6989.3-2019
Oil and fat	mg/l	< 2,5	5	SNI 06-6989.10-2011
Ammonia	mg/l	2,35	10	SNI 06-6989.30-2005
Total Coliforms	Amount / 100ml	$2,6x10^3$	3000	9222 B#)
February				
pH	--	7,3	6 – 9	SNI 06-6989.11-2019
BOD. 5	mg/l	14,6	30	SNI 06-6989. 72-2009
COD	mg/l	52,2	100	SNI 06-6989.2-2019
Total Suspended Solids (TSS)	mg/l	**34,5**	30	SNI 06-6989.3-2019
Oil and fat	mg/l	< 2,5	5	SNI 06-6989.10-2011
Ammonia	mg/l	**14**	10	SNI 06-6989.30-2005
Total Coliforms	Amount / 100ml	**$2x10^4$**	3000	9222 B#)
March				
pH	--	7,2	6 – 9	SNI 06-6989.11-2019
BOD. 5	mg/l	9,7	30	SNI 06-6989. 72-2009
COD	mg/l	38,5	100	SNI 06-6989.2-2019
Total Suspended Solids (TSS)	mg/l	25	30	SNI 06-6989.3-2019
Oil and fat	mg/l	< 2,5	5	SNI 06-6989.10-2011
Ammonia	mg/l	**13**	10	SNI 06-6989.30-2005
Total Coliforms	Amount / 100ml	$3x10^3$	3000	9222 B#)
April				
pH	--	6,2	6 – 9	SNI 06-6989.11-2019
BOD. 5	mg/l	9,46	30	SNI 06-6989. 72-2009
COD	mg/l	33,8	100	SNI 06-6989.2-2019
Total Suspended Solids (TSS)	mg/l	18	30	SNI 06-6989.3-2019
Oil and fat	mg/l	< 2,5	5	SNI 06-6989.10-2011
Ammonia	mg/l	0,58	10	SNI 06-6989.30-2005
Total Coliforms	Amount / 100ml	$2x10^2$	3000	9222 B#)
May				
pH	--	7,6	6 – 9	SNI 06-6989.11-2019
BOD. 5	mg/l	11,1	30	SNI 06-6989. 72-2009
COD	mg/l	39,6	100	SNI 06-6989.2-2019
Total Suspended Solids (TSS)	mg/l	19	30	SNI 06-6989.3-2019
Oil and fat	mg/l	< 2,5	5	SNI 06-6989.10-2011
Ammonia	mg/l	6,85	10	SNI 06-6989.30-2005
Total Coliforms	Amount / 100ml	$1x10^2$	3000	9222 B#)
June				
pH	--	7,1	6 – 9	SNI 06-6989.11-2019
BOD. 5	mg/l	10,7	30	SNI 06-6989. 72-2009
COD	mg/l	38,1	100	SNI 06-6989.2-2019

Parameter	Units	Results	Standard	Method
Total Suspended Solids (TSS)	mg/l	27	30	SNI 06-6989.3-2019
Oil and fat	mg/l	< 2,5	5	SNI 06-6989.10-2011
Ammonia	mg/l	**15**	10	SNI 06-6989.30-2005
Total Coliforms	Amount / 100ml	**$3,1x10^4$**	3000	9222 B#)

Source: Sucofindo Laboratory, 2023

Exceed the limit

Table 27 Results of Domestic Wastewater Analysis at PMU Temporary Office 2 for Semester I 2023

Parameter	Units	Results	Standard	Method
January				
pH	--	7,4	6 – 9	SNI 06-6989.11-2019
BOD. 5	mg/l	3,28	30	SNI 06-6989. 72-2009
COD	mg/l	11,7	100	SNI 06-6989.2-2019
Total Suspended Solids (TSS)	mg/l	9	30	SNI 06-6989.3-2019
Oil and fat	mg/l	< 2,5	5	SNI 06-6989.10-2011
Ammonia	mg/l	2,26	10	SNI 06-6989.30-2005
Total Coliforms	Amount / 100ml	$2,6x10^3$	3000	9222 B#)
February				
pH	--	7,3	6 – 9	SNI 06-6989.11-2019
BOD. 5	mg/l	14,6	30	SNI 06-6989. 72-2009
COD	mg/l	52,2	100	SNI 06-6989.2-2019
Total Suspended Solids (TSS)	mg/l	**34,5**	30	SNI 06-6989.3-2019
Oil and fat	mg/l	< 2,5	5	SNI 06-6989.10-2011
Ammonia	mg/l	**14**	10	SNI 06-6989.30-2005
Total Coliforms	Amount / 100ml	**$2x10^4$**	3000	9222 B#)
March				
pH	--	6,7	6 – 9	SNI 06-6989.11-2019
BOD. 5	mg/l	5,3	30	SNI 06-6989. 72-2009
COD	mg/l	19,7	100	SNI 06-6989.2-2019
Total Suspended Solids (TSS)	mg/l	17	30	SNI 06-6989.3-2019
Oil and fat	mg/l	< 2,5	5	SNI 06-6989.10-2011
Ammonia	mg/l	5,05	10	SNI 06-6989.30-2005
Total Coliforms	Amount / 100ml	$1x10^2$	3000	9222 B#)
April				
pH	--	6,2	6 – 9	SNI 06-6989.11-2019
BOD. 5	mg/l	9,46	30	SNI 06-6989. 72-2009
COD	mg/l	33,8	100	SNI 06-6989.2-2019
Total Suspended Solids (TSS)	mg/l	18	30	SNI 06-6989.3-2019

Parameter	Units	Results	Standard	Method
Oil and fat	mg/l	< 2,5	5	SNI 06-6989.10-2011
Ammonia	mg/l	0,58	10	SNI 06-6989.30-2005
Total Coliforms	Amount / 100ml	$2x10^2$	3000	9222 B#)
May				
pH	--	7,6	6 – 9	SNI 06-6989.11-2019
BOD. 5	mg/l	11,1	30	SNI 06-6989. 72-2009
COD	mg/l	39,6	100	SNI 06-6989.2-2019
Total Suspended Solids (TSS)	mg/l	19	30	SNI 06-6989.3-2019
Oil and fat	mg/l	< 2,5	5	SNI 06-6989.10-2011
Ammonia	mg/l	6,85	10	SNI 06-6989.30-2005
Total Coliforms	Amount / 100ml	$1x10^2$	3000	9222 B#)
June				
pH	--	6,8	6 – 9	SNI 06-6989.11-2019
BOD. 5	mg/l	5,63	30	SNI 06-6989. 72-2009
COD	mg/l	20,1	100	SNI 06-6989.2-2019
Total Suspended Solids (TSS)	mg/l	18	30	SNI 06-6989.3-2019
Oil and fat	mg/l	< 2,5	5	SNI 06-6989.10-2011
Ammonia	mg/l	5,25	10	SNI 06-6989.30-2005
Total Coliforms	Amount / 100ml	$1x10^2$	3000	9222 B#)

Source: Sucofindo Laboratory, 2023

	Exceed the limit

Table 8 Results of Domestic Wastewater Analysis at Portacamp Rig for Semester I 2023

Parameter	Units	Results	Standard	Method
January				
pH	--	-	6 – 9	SNI 06-6989.11-2019
BOD. 5	mg/l	-	30	SNI 06-6989. 72-2009
COD	mg/l	-	100	SNI 06-6989.2-2019
Total Suspended Solids (TSS)	mg/l	-	30	SNI 06-6989.3-2019
Oil and fat	mg/l	-	5	SNI 06-6989.10-2011
Ammonia	mg/l	-	10	SNI 06-6989.30-2005
Total Coliforms	Amount / 100ml	-	3000	9222 B#)
February				
pH	--	6,4	6 – 9	SNI 06-6989.11-2019
BOD. 5	mg/l	13,9	30	SNI 06-6989. 72-2009
COD	mg/l	49,6	100	SNI 06-6989.2-2019
Total Suspended Solids (TSS)	mg/l	29	30	SNI 06-6989.3-2019
Oil and fat	mg/l	< 2,5	5	SNI 06-6989.10-2011
Ammonia	mg/l	0,33	10	SNI 06-6989.30-2005
Total Coliforms	Amount / 100ml	$2,6x10^3$	3000	9222 B#)

Parameter	Units	Results	Standard	Method
March				
pH	--	-	6 – 9	SNI 06-6989.11-2019
BOD. 5	mg/l	-	30	SNI 06-6989. 72-2009
COD	mg/l	-	100	SNI 06-6989.2-2019
Total Suspended Solids (TSS)	mg/l	-	30	SNI 06-6989.3-2019
Oil and fat	mg/l	-	5	SNI 06-6989.10-2011
Ammonia	mg/l	-	10	SNI 06-6989.30-2005
Total Coliforms	Amount / 100ml	-	3000	9222 B#)
April				
pH	--	7,6	6 – 9	SNI 06-6989.11-2019
BOD. 5	mg/l	1,38	30	SNI 06-6989. 72-2009
COD	mg/l	4,92	100	SNI 06-6989.2-2019
Total Suspended Solids (TSS)	mg/l	5	30	SNI 06-6989.3-2019
Oil and fat	mg/l	< 2,5	5	SNI 06-6989.10-2011
Ammonia	mg/l	0,68	10	SNI 06-6989.30-2005
Total Coliforms	Amount / 100ml	$1x10^2$	3000	9222 B#)
May				
pH	--	6,8	6 – 9	SNI 06-6989.11-2019
BOD. 5	mg/l	4,98	30	SNI 06-6989. 72-2009
COD	mg/l	17,8	100	SNI 06-6989.2-2019
Total Suspended Solids (TSS)	mg/l	9	30	SNI 06-6989.3-2019
Oil and fat	mg/l	< 2,5	5	SNI 06-6989.10-2011
Ammonia	mg/l	0,37	10	SNI 06-6989.30-2005
Total Coliforms	Amount / 100ml	$7x10^2$	3000	9222 B#)
June				
pH	--	-	6 – 9	SNI 06-6989.11-2019
BOD. 5	mg/l	-	30	SNI 06-6989. 72-2009
COD	mg/l	-	100	SNI 06-6989.2-2019
Total Suspended Solids (TSS)	mg/l	-	30	SNI 06-6989.3-2019
Oil and fat	mg/l	-	5	SNI 06-6989.10-2011
Ammonia	mg/l	-	10	SNI 06-6989.30-2005
Total Coliforms	Amount / 100ml	-	3000	9222 B#)

Source: Sucofindo Laboratory, 2023

Exceed the limit

Table 9 Results of Domestic Wastewater Analysis at Portacamp Workshop for Semester I 2023

Parameter	Units	Results	Standard	Method
January				
pH	--	-	6 – 9	SNI 06-6989.11-2019
BOD. 5	mg/l	-	30	SNI 06-6989. 72-2009

Parameter	Units	Results	Standard	Method
COD	mg/l	-	100	SNI 06-6989.2-2019
Total Suspended Solids (TSS)	mg/l	-	30	SNI 06-6989.3-2019
Oil and fat	mg/l	-	5	SNI 06-6989.10-2011
Ammonia	mg/l	-	10	SNI 06-6989.30-2005
Total Coliforms	Amount / 100ml	-	3000	9222 B#)
February				
pH	--	-	6 – 9	SNI 06-6989.11-2019
BOD. 5	mg/l	-	30	SNI 06-6989. 72-2009
COD	mg/l	-	100	SNI 06-6989.2-2019
Total Suspended Solids (TSS)	mg/l	-	30	SNI 06-6989.3-2019
Oil and fat	mg/l	-	5	SNI 06-6989.10-2011
Ammonia	mg/l	-	10	SNI 06-6989.30-2005
Total Coliforms	Amount / 100ml	-	3000	9222 B#)
March				
pH	--	-	6 – 9	SNI 06-6989.11-2019
BOD. 5	mg/l	-	30	SNI 06-6989. 72-2009
COD	mg/l	-	100	SNI 06-6989.2-2019
Total Suspended Solids (TSS)	mg/l	-	30	SNI 06-6989.3-2019
Oil and fat	mg/l	-	5	SNI 06-6989.10-2011
Ammonia	mg/l	-	10	SNI 06-6989.30-2005
Total Coliforms	Amount / 100ml	-	3000	9222 B#)
April				
pH	--	7,4	6 – 9	SNI 06-6989.11-2019
BOD. 5	mg/l	4,68	30	SNI 06-6989. 72-2009
COD	mg/l	16,7	100	SNI 06-6989.2-2019
Total Suspended Solids (TSS)	mg/l	9	30	SNI 06-6989.3-2019
Oil and fat	mg/l	< 2,5	5	SNI 06-6989.10-2011
Ammonia	mg/l	5,53	10	SNI 06-6989.30-2005
Total Coliforms	Amount / 100ml	$1x10^2$	3000	9222 B#)
May				
pH	--	7,3	6 – 9	SNI 06-6989.11-2019
BOD. 5	mg/l	6,92	30	SNI 06-6989. 72-2009
COD	mg/l	24,7	100	SNI 06-6989.2-2019
Total Suspended Solids (TSS)	mg/l	16	30	SNI 06-6989.3-2019
Oil and fat	mg/l	< 2,5	5	SNI 06-6989.10-2011
Ammonia	mg/l	0,10	10	SNI 06-6989.30-2005
Total Coliforms	Amount / 100ml	$1x10^2$	3000	9222 B#)
June				
pH	--	-	6 – 9	SNI 06-6989.11-2019
BOD. 5	mg/l	-	30	SNI 06-6989. 72-2009
COD	mg/l	-	100	SNI 06-6989.2-2019
Total Suspended Solids (TSS)	mg/l	-	30	SNI 06-6989.3-2019

Parameter	Units	Results	Standard	Method
Oil and fat	mg/l	-	5	SNI 06-6989.10-2011
Ammonia	mg/l	-	10	SNI 06-6989.30-2005
Total Coliforms	Amount / 100ml	-	3000	9222 B#)

Source: Sucofindo Laboratory, 2023

Based on the Regional Regulation of Central Java Province Number 5 of 2012, which pertains to Amendments to Regional Regulation of Central Java Province Number 4 of 2004 concerning Changes in Wastewater Quality Standards for Geothermal Exploration and Production Businesses and/or Activities, the laboratory analysis of domestic wastewater parameters from Qo sampling points at the PMU Temporary Office revealed instances where certain test parameters exceeded the established environmental quality standards.

Specifically, the laboratory analysis results for the PMU Temporary Office monitoring point 1 indicated exceedance of quality standards for Ammonia parameters (in February, March, and June), Total Coliform (in February and June), and Total Suspended Solid in February. Similarly, at the PMU 2 monitoring point, parameters that exceeded quality standards included Total Suspended Solid, Ammonia, and Total Coliforms in February.

At the portacamp rig monitoring point, sampling was not carried out in January, March, and June due to a lack of activity. In February, April, and May, the laboratory analysis results met the predetermined quality standards.

For domestic wastewater sampling at the Portacamp Workshop, it was conducted in April and May, while no sampling occurred in January, February, March, and June due to dry water conditions. Notably, the results for the Portacamp Workshop monitoring point showed that all parameters remained below the quality standard.

Parameters Ammonia and Total Coliform can be attributed to the disposal of human and animal waste. Ammonia is formed from the decomposition of remaining organic matter by bacteria, while Total Coliform serves as an indicator for the presence of pathogens in the air.

Overall, the analysis of domestic wastewater parameters indicates the need for close monitoring and appropriate wastewater treatment measures to ensure compliance with the environmental quality standards as outlined in the relevant regulations

6. Produced Water Quality

Monitoring Description

The results of monitoring the parameters of produced water in the Dieng Unit 2 location area for Semester I 2023 can be seen in the following table:

Period	Semester
Standard	Regional Regulation of Central Java Province Number 5 th. 2012 concerning Amendments to Regional Regulations of Central Java

	Province No.4 of 2004 concerning changes to Wastewater Quality Standards for Geothermal Exploration and Production Businesses and/or Activities
Method	Nitrate testing of produced water using a spectrophotometer. Nitrate levels in ultraviolet spectrophotometer with a wavelength of 220 nm and 275 nm. Reduce the adsorption reading at a wavelength of 220 nm and a wavelength of 275 nm as the adsorption value of nitrate in the sample (SNI 06-6989.30-2005)
Monitoring Location	Pad 7 Pad 9 Pad 30 Pad 31 Pad 29

Table 25 Results of Laboratory Analysis of Produced Water Samples for the First Semester of 2023

Parameter	units	Results					Quality standards	Method
		Pad 7	Pad 9	Pad 30	Pad 31	Pad 29		
Sulfides (as H_2S)	mg/L	< 0,020	< 0,020	< 0,020	< 0,020	< 0,020	1	SNI 06-6989. 70-2009
Ammonia (as NH3-N)	mg/L	9,45	6,15	6,74	**14**	9,21	10	SNI 06-6989.30-2005
Mercury (Hg)	mg/L	< 0,0005	< 0,0005	< 0,0005	< 0,0005	< 0,0005	0.005	SNI 06-6989.78-2019
Arsenic (As)	mg/L	< 0,002	< 0,002	< 0,002	< 0,002	< 0,002	0.5	SNI 06-6989.81-2018
Temperature (on site)	^oC	**50**	**50**	22	23	33	45	SNI 06-6989.23-2005
pH (on site)	-	**5,5**	**4,7**	7,3	5,8	5,6	6.0 – 9.0	SNI 06-6989.11-2019

Source: Laboratory Analysis Result PT. Sucofindo 2022

	Exceed the limit

The results of measuring the parameters of produced water in Semester I of 2023 reveal that at multiple monitoring locations, namely Pond Pad 7, Pad 9, Pad 30, Pad 31, and Pad 29, certain test parameters exceed the environmental quality standards set forth in accordance with Regional Regulation of Central Java Province Number 5 of 2012. This regulation pertains to Amendments to Regional Regulation of Central Java Province Number 4 of 2004 concerning changes to the Wastewater Quality Standard for Geothermal Exploration and Production Businesses and/or activities.

Specifically, the Ammonia parameter in Pad 31 showed a value of 14 mg/L, surpassing the quality standard. Additionally, the temperature value in Pad 7 and Pad 9 exceeded the quality standard, reaching 50^o C. Moreover, the pH value in Pad 7 recorded 5.5, and in Pad 9, it measured 4.7, both not complying with the quality standard. These findings highlight the need for attention and remedial measures to ensure that the produced water meets the stipulated environmental quality standards, as specified in the relevant regional regulation. Effective measures should be taken to control Ammonia

levels, temperature, and pH values at the identified monitoring points in order to minimize their impact on the environment and adhere to the prescribed standards.

7. Solid Waste

Domestic solid waste management is carried out by providing separate trash bins at each work location. At work locations where there is no drilling activity, the management of domestic solid waste is carried out by the Sikunang Village KPSM. Domestic solid waste from each work location will be collected at the GDE Dieng Integrated Waste Management Site (TPST), then it will be further sorted and managed by the Sikunang Village KPSM. Whereas at work locations where there is drilling activity, the management of domestic solid waste is carried out by PT PPLI (PT Prasadha Pamunah Limbah Industri) in collaboration with CV. Kembang Jaya.

Period	Quarterly
Method	Checking the availability of trash cans, locations for temporary landfills, disposal methods, MSDS, etc. Recording volume of organic-inorganic waste
Monitoring Points	1 Pad 7 2 Pad 9 3 Pad 10 4 Pad 30 5 Pad 31 6 Mess PLN

Waste Management By CV. Kembang Jaya

Waste Management By Sikunang Village KPSM (Integrated TPST)

Waste Management by PPLI (PT Prasadha Pamunah Limbah Industri)

Figure 5 Solid Waste Management Semester I 2023 Period

8. Erosion and Landslide

Monitoring Description

The results of monitoring the erosion and landslide components in the Dieng Unit 2 project location area for the Semester I of 2023 can be seen in the following table:

Period	Semester
Method	Conduct observations and observations in the field and identify evidence of management activities that have been carried out.
Monitoring Location	1 Mess PLN 2 Pad 30 3 Master pond Pad 31 4 Pad 9 5 Pad 7 6 Pond Pad 29

Table 31 Erosion and Landslide Monitoring Result

Location	Coordinate	Erosion		Avalanche		Information
		Depth(cm)	Distance (m)	Distribution Length (m)	Distance (m)	
Ex PLN Mess (Pad 38)	7°12'34.70"S 109°53'4.27"E	< 10	3-6	-	-	Light, eroded by surface runoff. most of the area is still covered with vegetation
Pond Sileri	7°11'30.09"S 109°52'55.11"E	< 10	< 10	-	-	Light, eroded by surface runoff. slopes around Pond Sileri are covered with retaining walls and fences.
Pad 30	7°11'39.67"S 109°54'0.73"E	< 10	< 10	-	-	Light, eroded by surface runoff. slopes around PAD 30 are covered with retaining walls, fences, and vegetation (grass and trees)
Master pond Pad 31	7°12'10.72"S 109°53'50.79"E	< 10	< 10	-	-	Light, eroded by surface runoff. slopes around PAD 31 are covered with retaining walls, fences, and vegetation (grass and trees)
Pad 9	7°12'39.77"S 109°53'16.69"E	< 10	< 10	-	-	Light, eroded by surface runoff. slopes around PAD 9 are covered with retaining walls, fences, and vegetation (grass and trees)
Pad 7	7°12'5.20"S 109°53'5.72"E	< 10	< 10	-	-	Light, eroded by surface runoff. slopes around PAD 7 are covered with retaining

Location	Coordinate	Erosion		Avalanche		Information
		Depth(cm)	Distance (m)	Distribution Length (m)	Distance (m)	
						walls, fences, and vegetation (grass and trees)
Pond Pad 29	7°11'49.35"S 109°52'49.99"E	< 10	< 10	-	-	Light, eroded by surface runoff. slopes around PAD 29 are covered with retaining walls, fences, and vegetation (grass and trees)

Source: Field Observations, June 2023

Table 32 Erosion and Landslide Monitoring Documentation for Semester I 2023

No	Location	Notes	Documentation	
1	Pond Sileri 7°11'30.09"S 109°52'55.11"E	Light erosion (<10 cm deep <10m long), erosion by surface runoff. the slopes around Pond Sileri are covered with retaining walls, and fences.		
				
2	Ex PLN Mess (Pad 38) 7°12'34.70"S 109°53'4.27"E	Light erosion (<10 cm deep <10m long), erosion by surface runoff. most of the area is still covered with vegetation.		
				

No	Location	Notes	Documentation	
3	Area Drilling PAD 30 7°11'39.67"S 109°54'0.73"E	Light erosion (<10 cm deep <10m long), erosion by surface runoff. the slopes around PAD 30 are covered with retaining walls, and tree planting on the slopes is accompanied by a ban on cutting trees.		
				
4	Master Pond Pad 31 7°12'10.72"S 109°53'50.79"E	Light erosion (<10 cm deep <10m long), erosion by surface runoff. the slopes around PAD 31 are covered with retaining walls, and tree planting on the slopes is accompanied by a ban on cutting trees		
5	Pad 9 7°12'39.77"S 109°53'16.69"E	Light erosion (<10 cm deep <10m long), erosion by surface runoff. the slopes around PAD 9 are covered with retaining walls, and tree planting on the slopes is accompanied by a ban on cutting trees		
6	Pad 7 7°12'5.20"S 109°53'5.72"E	Light erosion (<10 cm deep <10m long), erosion by surface runoff. the slopes around PAD 7 are covered with retaining walls, and tree planting on the slopes is accompanied by a ban on cutting trees		

No	Location	Notes	Documentation	
7	Pond Pad 29 7°11'49.35"S 109°52'49.99"E	Light erosion (<10 cm deep <10m long), erosion by surface runoff. the slopes around PAD 29 are covered with retaining walls, and tree planting on the slopes is accompanied by a ban on cutting trees		

Source: Field Observations, June 2023

Erosion and landslide observations were conducted at seven locations: the Dieng Unit 2 PLTP project site (Ex Mess PLN/Pad 38) with coordinates 7°12'34.70" South Latitude - 109°53'4.27" East Longitude, Pond Sileri with coordinates 7°11'30.09"S 109°52'55.11"E, Area Drilling PAD 30 with coordinates 7°11'39.67"S 109°54'0.73"E, Master Pond Pad 31 with coordinates 7°12'10.72"S 109°53'50.79"E, Pad 9 with coordinates 7°12'39.77"S 109°53'16.69"E, Pad 7 with coordinates 7°12'5.20"S 109°53'5.72"E, and Pond Pad 29 with coordinates 7°11'49.35"S 109°52'49.99"E.

Based on monitoring at the PLTP Dieng Unit 2 activity plan, no landslides occurred at the activity site or in the surrounding environment. Although some erosion was present, it can be categorized as mild. The erosion was caused by the flow of rainwater at certain points with a depth of less than 10 cm and a length of less than 10 m. Currently, the planned location for the Dieng Unit 2 PLTP itself has no construction activities and is covered with quite dense vegetation.

Similarly, at Pond Sileri, Area Drilling Pad 30, Master Pond Pad 31, Pad 9, Pad 7, and Pond Pad 29 locations, no landslides were observed, and the erosion was relatively mild, with rainwater flow causing minor surface disturbances at certain points with a depth of less than 10 cm and a length of less than 10 cm. During Semester I of 2023, the operation of Pad took place, and all slopes in Pad were equipped with retaining walls, fences, and vegetation (grass and trees) to prevent landslides, particularly on lands with steep slopes.

9. Traffic and Road Safety

Monitoring Description

Road Traffic and Transportation Safety is a condition in which everyone is protected from the risk of accidents during traffic caused by humans, vehicles, roads, and/or the environment Traffic safety monitoring in the Dieng Unit 2 area for the Semester I 2023 period consists of monitoring traffic accidents related to the Dieng 2 Project, Conditions of the Dieng 2 Access Road Project and Dieng 2 Project Access Road Traffic Volume (Level of Service).

Period	Quarterly
Method	Traffic Accident Records related to the Dieng 2 Project from the PMC or the local Police office Visual inspection of Access Road Conditions

	Measurement of Access Road Service Level (Vc Ratio)
Monitoring Location	1 Kejajar Terminal / Market 2 Dieng Kulon intersection 3 Dieng Wetan intersection 4 Karang Tengah 5 Bakal 6 Kepakisan

a. Traffic Accident

Environmental monitoring activities for Semester I 2023 period for traffic accident parameters are carried out by collecting data on traffic accidents (January – June 2023) that occurred around the Dieng Unit 2 project site at the Batur Police and Kejajar Police, as well as data from contractors/PMC. According to data from the PMC and data from the Laka Unit of the Wonosobo Police and Banjarnegara Police in Semester I of 2023 there were traffic accidents that occurred around the work area of PT Geo Dipa Energi (Persero) Unit Dieng as presented in the following table

Table 39 Traffic Accident

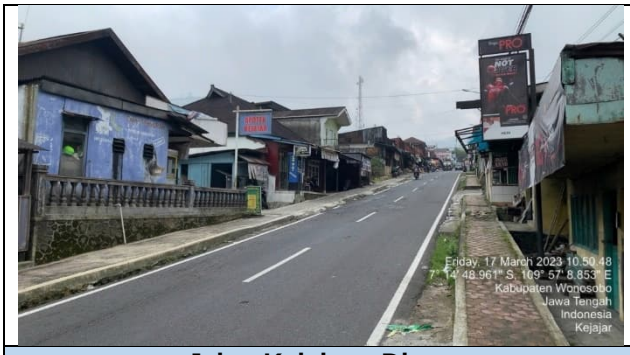
No	Time	Location	Status	Chronological	Data/Information Sources
1	Monday 21 January 2023, at 17.30 WIB	Main road in Sumberejo Village, Batur Sub-district, Banjarnegara Regency	Minor injuries	Originally Motorcycle No. Pol. AA-3044-DZ driven by WONTEN walked from west to east at moderate speed, arriving at the location of the incident allegedly from the north of the road there was a car. No. Pol. R-1878-NW driven by TUSLAM was about to enter the traffic flow/enter the lane to the east, because the distance was too close which resulted in an accident.	Banjarnegara Police Laka Unit
2	-	Wonosobo Main Road also Ds. Serang, Kec. Kejajar Kab. Wonosobo	Minor injuries	-	Wonosobo Police Laka Unit
3	-	Main Road also Ds. Tambi Kec. Kejajar Kab. Wonosobo.	Minor injuries	-	Wonosobo Police Laka Unit
4	-	Main Road Dieng – Wonosobo also Demangan, Kec. Kejajar Kab. Wonosobo	Major injuries	-	Wonosobo Police Laka Unit
5	-	Main Road Dieng – Wonosobo also Jojogan, Kec. Kejajar Kab. Wonosobo	Minor injuries	-	Wonosobo Police Laka Unit

Source: GDE Data, Juni 2023

b. Road Condition

Environmental monitoring of road access conditions is carried out to see whether construction and operational activities of the Dieng PLTP have an impact on road damage. Monitoring activities are carried out by field observations (visual) on access roads that are used to be related to the mobilization route for employee operational vehicles, equipment and materials.

Documentation of environmental monitoring activities related to road conditions around the Dieng PLTP for Semester I of 2023 can be seen in the following figure.



Jalan Kejajar – Dieng

Crossroads – Kepakisan

Access Road to Pad 9 (Karang Tengah)

Access Road to Pad 31 (Dieng Kulon – Karangtengah)

Access Road to Pad 30 (Pawuhan)

Access Road to PLTP Unit 2 (Bakal –Batur)

Figure 3 Road Conditions Around the Dieng PLTP for Semester I 2023

Based on environmental monitoring survey activities for road conditions around the Dieng PLTP for Semester I of 2023 which was carried out in January until June 2023, it is known that overall the road conditions around the Dieng PLTP are in the category of good to slightly damaged conditions. Based on the results of field observations, it is known that the existing road has a width of ± 3.5 - 4 meters. Road conditions that are still relatively good include Jalan Kejajar-Dieng, Jalan Dieng-Batur, around the Dieng Kulon and Dieng Wetan sections. Meanwhile, roads with minor and relatively small damage categories (width ± 2 - 2.5 m) are in Pawuhan Hamlet heading to Pad 30. The condition of Simpang - Kepakisan Road and access Road to Pad 31 (Dieng Kulon - Karangtengah) is at relatively very good condition because just finished re-asphalt.

c. Traffic

Road Traffic and Transportation is a condition of traffic and the use of transportation that is free from obstacles and congestion on the road. The smoothness of traffic is influenced by road capacity and traffic volume. Road capacity is the ability of a road segment to accommodate the ideal traffic volume per unit time, expressed in vehicles/hour or passenger car units (pcu)/hour. Meanwhile, the volume/capacity ratio (V/C ratio) is the ratio beQeen traffic volume and road capacity.

Monitoring traffic conditions around the Dieng PLTP is carried out using the calculation of the V/C Ratio or Road Service Level. The level of service (Level of Service) of a road is indicated by a comparison or comparison beQeen traffic volume (pcu/hour) and road capacity (pcu/hour). busy, day or night. The level of road service is measured by the level of service, the amount of which is shown in the following table:

Table 40 Value of V/C Ratio for 1st quarter of 2023

Time	Number of vehicles (veh/hour)			Number of vehicles (pcu/hour)			Total Vehicle V (pcu/hour)	Road Capacity C (pcu/hour)	Road Service Level (V/C ratio)	
	LV[1]	HV[2]	MC[3]	LV	HV	MC				
Dieng Kulon										
06.30-07.30	132	54	414	132	70,2	207	409,2	5705,7	0,0717	A
12.15-13.15	250	72	702	250	93,6	351	694,6	5705,7	0,1217	
16.00-17.00	222	54	372	222	70,2	186	478,2	5705,7	0,0838	
Dieng Wetan										
06.30-07.30	156	108	474	156	140,4	237	533,4	5532,8	0,0964	A
12.15-13.15	228	90	672	228	117	336	681	5532,8	0,1231	
16.00-17.00	198	42	360	198	54,6	180	432,6	5532,8	0,0781	
Kejajar Market										
06.30-07.30	228	72	948	228	93,6	474	795,6	4195,2	0,1896	B
12.15-13.15	312	126	1152	312	163,8	576	1051,9	4195,2	0,2507	
16.00-17.00	282	108	852	282	140,4	426	848,4	4195,2	0,2022	
Kepakisan										
06.30-07.30	42	6	120	42	7,8	60	109,8	4195,2	0,0261	A
12.15-13.15	126	18	294	126	23,4	147	296,4	4195,2	0,0706	
16.00-17.00	96	12	150	96	15,6	75	186,6	4195,2	0,0444	
Karang Tengah										
06.30-07.30	186	84	420	186	109,2	210	505,2	5705,7	0,0885	A
12.15-13.15	240	84	618	240	109,2	309	658,2	5705,7	0,1153	
16.00-17.00	250	25	630	250	32,5	315	597,5	5705,7	0,1047	
Bakal										
06.30-07.30	178	50	346	178	65	173	416	5705,7	0,0729	A
12.15-13.15	146	59	427	146	76,7	213,5	436,2	5705,7	0,0764	
16.00-17.00	110	52	609	110	67,6	304,5	482,1	5705,7	0,0844	

d.

Table 41 Value of V/C Ratio for 2nd quarter of 2023

Time	Number of vehicles (veh/hour)			Number of vehicles (pcu/hour)			Total Vehicle V (pcu/hour)	Road Capacity C (pcu/hour)	Road Service Level (V/C ratio)	
	LV[1]	HV[2]	MC[3]	LV	HV	MC				
Dieng Kulon										
06.30-07.30	186	84	1032	186	109,2	516	811,2	5705,7	0,1421	A
12.15-13.15	288	102	792	288	132,6	396	816,6	5705,7	0,1431	
16.00-17.00	426	42	888	426	54,6	444	924,6	5705,7	0,1620	
Dieng Wetan										

Time	Number of vehicles (veh/hour)			Number of vehicles (pcu/hour)			Total Vehicle V (pcu/hour)	Road Capacity C (pcu/hour)	Road Service Level (V/C ratio)	
	LV[1]	HV[2]	MC[3]	LV	HV	MC				
06.30-07.30	198	60	517	198	78	258,5	534,4	5532,8	0,0966	A
12.15-13.15	186	36	468	186	46,8	234	466,8	5532,8	0,0843	
16.00-17.00	288	66	594	288	85,8	297	670,8	5532,8	0,1212	
Pasar Kejajar										
06.30-07.30	276	24	798	276	31,2	399	706,2	4195,2	0,1683	B
12.15-13.15	228	120	930	228	156	465	849	4195,2	0,2023	
16.00-17.00	270	96	934	270	124,8	467	861,8	4195,2	0,2054	
Kepakisan										
06.30-07.30	90	24	588	90	31,2	294	415,2	4195,2	0,0989	A
12.15-13.15	132	6	336	132	7,8	168	307,8	4195,2	0,0733	
16.00-17.00	138	24	492	138	31,2	246	415,2	4195,2	0,0989	
Karang Tengah										
06.30-07.30	96	48	324	96	62,4	162	320,4	5705,7	0,0561	A
12.15-13.15	138	84	342	138	109,2	171	418,2	5705,7	0,0732	
16.00-17.00	114	30	510	114	39	255	408	5705,7	0,0715	
Bakal										
06.30-07.30	78	50	288	78	65	144	287	5705,7	0,0503	A
12.15-13.15	66	59	168	66	76,7	84	226,7	5705,7	0,0397	
16.00-17.00	114	52	345	114	67,6	172,5	354,1	5705,7	0,0620	

Source: Sucofindo Primary Data, June 2023
Information:
LV1 (Light Vehicle: Qo-wheeled motor vehicle with a wheelbase of 2.0 - 3.0 m)
HV2 (Heavy motorized vehicles with a wheelbase of more than 3.50 meters)
MC3 (Motorcycles: Qo or three wheeled motorized vehicles)
Road Service Level:

A	*Free flow conditions with high speed and low traffic volume. The driver can choose the desired speed without a hitch*	*0.00-0.19*
B	*In the steady current zone. The driver has sufficient freedom to choose the speed*	*0.20-0.44*
C	*In the steady current zone. Drivers are limited in choosing their speed*	*0.45-0.74*
D	*Approaching unstable currents where most drivers will be limited. Service volume is related to tolerable (acceptable) capacity*	*0.75-0.85*
E	*Traffic volume is approaching or at capacity. Current is unstable with conditions that often stop*	*0.85-1.00*
F	*Forced or stalled current at slow speed. Long queues and big hurdles*	*>1.00*

Based on the table above, the highest service level value on Jalan Dieng Kulon - Batur (V / C Ratio) in the first quarter on weekdays is 0.1217 (Afternoon). Then the level of service of Dieng Kulon – Batur road (V/C Ratio) on weekdays has level of service A with characteristics close to free flow with high speed and low traffic volume. Whereas in the second quarter, the highest service level value on the Dieng Kulon - Batur road (V/C Ratio) on weekdays is 0.1620 (Afternoon) with level of service A with characteristics close to free flow with high speed and low traffic volume, Drivers can choose the desired speed without a hitch.

In the first quarter, the Dieng Wetan - Dieng Kulon road section on weekdays has the highest service level value of 0.1231 (Noon). Then the level of service of Dieng Wetan - Dieng Kulon Road (V / C Ratio) on weekdays has a level of service A with characteristics close to free flow with high speed and low traffic volume. Whereas in the second quarter the Dieng Wetan - Dieng Kulon road section on weekdays has the highest service level value of 0.1212 (Afternoon) including the level of service A with characteristics approaching free flow with high speed and low traffic volume. Drivers can choose the desired speed without a hitch.

In the first quarter of the Kejajar - Dieng road section on weekdays the highest service level value is 0.2507 (Afternoon). Then the level of service of Kejajar - Dieng Road (V/C Ratio) on weekdays has a level of service B with stable flow zone characteristics. As for the second quarter, the Kejajar – Dieng road section on weekdays has the highest service level value of 0.2054 (Afternoon) with a level of service B with stable flow zone characteristics. Drivers have sufficient freedom to choose speed.

The highest level of service on Simpangan – Kepakisan road (V/C Ratio) in the first quarter on weekdays is 0.0706 (Afternoon). Then the level of service on Simpangan – Kepakisan road (V/C Ratio) on weekdays has level of service A with characteristics close to free flow with high speed and low traffic volume. The highest level of service on Jalan Simpangan - Kepakisan (V/C Ratio) in the second quarter on weekdays is 0.0989 (Morning) including in level of service A with characteristics close to free flow with high speed and low traffic volume. Drivers can choose the desired speed without a hitch.

In the first quarter, Karangtengah - Kepakisan road section has the highest service level value of 0.1153 (Afternoon) which is included in level of service A with characteristics approaching free flow with high speed and low traffic volume. In the second quarter, the Karangtengah - Kepakisan road section has the highest service level value of 0.0732 (Afternoon) which is included in level of service A with characteristics close to free flow with high speed and low traffic volume. Drivers can choose the desired speed without a hitch.

In the first quarter, the Bakal - Batur road section had the highest service level value of 0.0844 (afternoon). Then the level of service of Bakal - Batur Road (V / C Ratio) on weekdays has a level of service A with characteristics close to free flow with high speed and low traffic volume. The results of the second quarter on the Bakal - Batur road section have the highest service level value of 0.0620 (Afternoon) which is included in level of service A with characteristics close to free flow with high speed and low traffic volume. Drivers can choose the desired speed without a hitch.

Documentation of measuring traffic volume at the Dieng Unit 2 location for the Semester I 2023 period can be seen in the following figure.

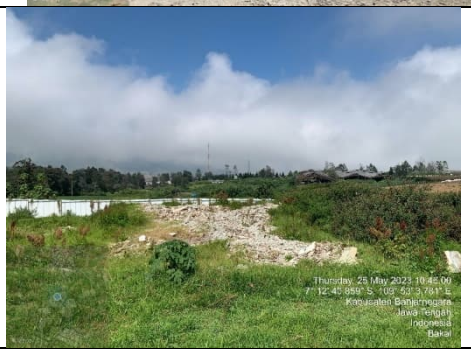
	
Bakal Village	Dieng Wetan Village

	
Kejajar Market	Kepakisan Village
	
Dieng Kulon Village	Karang Tengah Village

Figure 4 Collection of Traffic Data for Semester I of 2023

Table 42 Waste Management Monitoring Results for Semester I of 2023

No	Location	Notes	Documentation		
1.	Pad 7	There are domestic trash cans. Garbage is transported once a week to the GDE Dieng TPST by officers.			
2.	Pad 9	There are domestic trash cans. Garbage is transported once a week to the GDE Dieng TPST by officers.			
3.	Pad 10	There is a well revitalization activity in Pad 10, where waste management is carried out independently by a third party/work contractor (PT Poeser Indonesia)			

No	Location	Notes	Documentation
4.	Pad 30	There are domestic trash cans. Garbage is transported once a week to the GDE Dieng TPST by officers.	  
5.	Pad 31	There is no worker activity on Pad 31.	  
6.	Pad 38 (Ex Mess PLN)	There were demolition activities of the former PLN mess building at the Pad 38 location.	  

Source: results of field observations, June 2023

10. Aquatic Biota

Monitoring Description

Monitoring of aquatic biota components in the Dieng Unit 2 area for Semester I 2023 was carried out in the Sidandang River, Situlu River and Siranthi River with monitoring results can be seen in the following table:

Period	Quarterly
Method	Analysis of data on the number of species, composition, abundance, and diversity of plankton and benthic
Location	1. Situlu River 2. Sidandang River 3. Siranthi River

Table 29 Monitoring Results of Aquatic Biota for the First Quarter of 2023

Situlu River

Organism	Results	Method
FITOPLANKTON		Enumeration (Census-SRC) / APHA 2017 (10200 F)
BACILLARIOPHYCEAE		
Coscinodiscus sp.	17000	
Cyclotella sp.	7000	
Navicula sp.	40000	
Nitzschia sp.	22000	
Pinnularia sp.	102000	
Pleurosigma sp.	7000	
Synedra sp.	17000	
EUGLENOPHYCEAE		
Lepocinclis sp.	6000	
Taxa (S)	**8**	
Abundance (Sel/ m^3)	**225000**	
Diversity Index (H')	**1.62**	
Equitability Index (E)	**0.78**	
Dominance Index (D)	**0.27**	

Organism	Results	Method
ZOOPLANKTON		Enumeration (Census-SRC) / APHA 2017 (10200G)
CILIATA	0	
Taxa (S)	**0**	
Abundance (Ind/ m^3)	**0**	

Organism	Results	Method
Diversity Index (H')	**0.00**	
Equitability Index (E)	**0.00**	
Dominance Index (D)	**0.00**	

Organism	Results	Method
MACROBENTHOS		SNI 03-3401-1994
HYDROPHILOIDEA	22	
Taxa (S)	**1**	
Abundance (Ind/m^2)	**21**	
Diversity Index (H')	**0.00**	
Equitability Index (E)	**0.00**	
Dominance Index (D)	**1.00**	

Source: Sucofindo Laboratory, 2023

Sidandang River

Organism	Results	Method
PHYTOPLANKTON		Enumeration (Census-SRC) / APHA 2017 (10200 F)
BACILLARIOPHYCEAE		
Achnanthes sp.	25000	
Fragillaria sp.	100000	
Navicula sp.	52500	
Nitzschia sp.	15000	
Pleurosigma sp.	10000	
Synedra sp.	15000	
Taxa (S)	**6**	
Abundance (Cell/m^3)	**217500**	
Diversity Index (H')	**1.46**	
Equitability Index (E)	**0.81**	
Dominance Index (D)	**0.29**	

Organism	Results	Method
ZOOPLANKTON		Enumeration (Census-SRC) / APHA 2017 (10200G)
CILIATA	55000	
SPIROTRICHEA		
Euplotes sp.	2500	
TUBULINEA		
Centropyxis sp.	5000	
MONOGONONTA		
Colurella sp.	5000	
HELIOZOA		
Actinophrys sp.	2500	
IMBRICATEA		

Organism	Results	Method
Euglypha sp.	5000	
Trinema sp.	15000	
Taxa (S)	**7**	
Abundance (Ind/m^3)	**90000**	
Diversity Index (H')	**1.28**	
Equitability Index (E)	**0.66**	
Dominance Index (D)	**0.41**	

Organism	Results	Method
MACROBENTHOS		
Lymnaea sp.	0	
Taxa (S)	**0**	
Abundance (Ind/m^2)	**0**	SNI 03-3401-1994
Diversity Index (H')	**0.00**	
Equitability Index (E)	**0.00**	
Dominance Index (D)	**0.00**	

Source: Sucofindo Laboratory, 2023

Table 30 Monitoring Results of Aquatic Biota Second Quarter of 2023

Situlu River

Organism	Results	Method
PHYTOPLANKTON		
BACILLARIOPHYCEAE		
Coscinodiscus sp.	150	
Epithemia sp.	150	
Fragillaria sp.	300	
Grammatophora sp.	300	
Licmophora sp.	150	
Navicula sp.	3000	
Nitzschia sp.	600	
Surirella sp.	1650	
Synedra sp.	1050	
CHLOROPHYCEAE		Enumeration (Census-SRC) / APHA 2017 (10200 F)
Golenkinia sp.	600	
CYANOPHYCEAE		
Merismopedia sp.	300	
ZYGNEMATOPHYCEAE		
Gonatozygon sp.	450	

Organism	Results	Method
Taxa (S)	**12**	
Abundance (Cell/m^3)	**8700**	
Diversity Index (H')	**2.02**	
Equitability Index (E)	**0.81**	
Dominance Index (D)	**0.19**	

Organism	Results	Method
ZOOPLANKTON		Enumeration (Census-SRC) / APHA 2017 (10200G)
CILIATA	750	
TUBULINEA		
Arcella sp.	74700	
MONOGONONTA		
Brachionus sp.	300	
Lecane sp.	900	
Proales sp.	150	
Taxa (S)	**5**	
Abundance (Ind/m^3)	**76800**	
Diversity Index (H')	**0.16**	
Equitability Index (E)	**0.10**	
Dominance Index (D)	**0.95**	

Organism	Results	Method
MACROBENTHOS		SNI 03-3401-1994
GASTROPODA		
Melanoides sp.	19	
Taxa (S)	**1**	
Abundance (Ind/m^2)	**19**	
Diversity Index (H')	**0.00**	
Equitability Index (E)	**0.00**	
Dominance Index (D)	**1.00**	

Source: Sucofindo Laboratory, 2023

Sidandang River

Organism	Results	Method
PHYTOPLANKTON		Enumeration (Census-SRC) / APHA 2017 (10200 F)
BACILLARIOPHYCEAE		
Cyclotella sp.	300	

Organism	Results	Method
Fragillaria sp.	150	
Navicula sp.	900	
Nitzschia sp.	450	
Stauroneis sp.	150	
Surirella sp.	300	
Triceratium sp.	150	
CHLOROPHYCEAE		
Golenkinia sp.	150	
CYANOPHYCEAE		
Merismopedia sp.	300	
Taxa (S)	**9**	
Abundance (Cell/m^3)	**2850**	
Diversity Index (H')	**1.99**	
Equitability Index (E)	**0.90**	
Dominance Index (D)	**0.17**	

Organism	Results	Method
ZOOPLANKTON		Enumeration (Census-SRC) / APHA 2017 (10200G)
CILIATA	450	
TUBULINEA		
Arcella sp.	42150	
Centropyxis sp.	600	
BDELLOIDEA		
Rotaria sp.	150	
MONOGONONTA		
Lecane sp.	450	
IMBRICATEA		
Euglypha sp.	1500	
Taxa (S)	**6**	
Abundance (Ind/m^3)	**45300**	
Diversity Index (H')	**0.35**	
Equitability Index (E)	**0.19**	
Dominance Index (D)	**0.87**	

Organism	Results	Method
MACROBENTHOS		SNI 03-3401-1994
GASTROPODA		
Melanoides sp.	0	
Taxa (S)	**0**	
Abundance (Ind/m^2)	**0**	
Diversity Index (H')	**0.00**	
Equitability Index (E)	**0.00**	
Dominance Index (D)	**0.00**	

Source: Sucofindo Laboratory, 2023

Siranthi River

Organism	Results	Method
PHYTOPLANKTON		Enumeration (Census-SRC) / APHA 2017 (10200 F)
BACILLARIOPHYCEAE		
Coscinodiscus sp.	20000	
Navicula sp.	120000	
Nitzschia sp.	20000	
Pinnularia sp.	30000	
CHLOROPHYCEAE		
Pediastrum sp.	10000	
Scenedesmus sp.	110000	
ZYGNEMATOPHYCEAE		
Gonatozygon sp.	50000	
Taxa (S)	**7**	
Abundance (Cell/m^3)	**360000**	
Diversity Index (H')	**1.63**	
Equitability Index (E)	**0.84**	
Dominance Index (D)	**0.24**	

Organism	Results	Method
ZOOPLANKTON		Enumeration (Census-SRC) / APHA 2017 (10200G)
CILIATA	70000	
SPIROTRICHEA		
Aspidisca sp.	90000	
OLIGOHYMENOPHOREA		
Vorticella sp.	20000	
TUBULINEA		
Arcella sp.	50000	
Centropyxis sp.	50000	
Difflugia sp.	50000	
IMBRICATEA		
Trinema sp.	330000	
FORAMINIFERA		
Gumbellina sp.	20000	
Taxa (S)	**8**	
Abundance (Ind/m^3)	**680000**	
Diversity Index (H')	**1.64**	
Equitability Index (E)	**0.79**	
Dominance Index (D)	**0.28**	

Organism	Results	Method
MACROBENTHOS		SNI 03-3401-1994
OLIGOCHAETA		
Lumbricus sp.	57	
Taxa (S)	**1**	
Abundance (Ind/m^2)	**57**	
Diversity Index (H')	**0.00**	
Equitability Index (E)	**0.00**	
Dominance Index (D)	**1.00**	

Source: Sucofindo Laboratory, 2023

Based on the laboratory analysis results of aquatic biota parameters in the Situlu, Sidandang, and Siranthi Rivers surrounding the PLTP Dieng Unit 2 project during the First and Second quarters of 2023, as presented in the table above, the following observations can be made:

Quarter I of 2023:

Situlu River: The laboratory analysis revealed the presence of 8 species of phytoplankton in the Situlu River, with Pinnularia sp. being the dominant species. The diversity index (H') for phytoplankton in the

Situlu River is 1.62. According to the pollution criteria, the Shannon-Wiener index falls within the range 1<H'<3, indicating a category of medium biota community stability. However, no zooplankton or identified macrobenthos species were found in the Situlu River.

Sidandang River: The laboratory analysis identified 6 types of phytoplankton in the Sidandang River, with Fragillaria sp. as the dominant type. The diversity index (H') for phytoplankton in the Sidandang River is 1.46, falling within the range 1<H'<3, indicating medium biota community stability. Additionally, 7 types of zooplankton were found in the Sidandang River, with ciliates dominating. The diversity index (H') for zooplankton is 1.28, also indicating medium biota community stability. However, no identified benthos species were observed.

Siranthi River: During the first quarter monitoring, no analysis was conducted on the Siranthi River due to its dry condition.

Quarter II of 2023:

Situlu River: The laboratory analysis indicated the presence of 12 species of phytoplankton in the Situlu River, with Navicula sp. as the dominant species. The diversity index (H') for phytoplankton is 2.02, falling within the range 1<H'<3, indicating medium biota community stability. Additionally, zooplankton Arcella sp. was found with a diversity index (H') of 0.16. However, no identified macrobenthos species were observed.

Sidandang River: The laboratory analysis revealed 9 types of phytoplankton in the Sidandang River, with Navicula sp. as the dominant type. The diversity index (H') for phytoplankton in the Sidandang River is 1.99, indicating medium biota community stability. Furthermore, 6 types of zooplankton were identified, with Arcella sp. dominating. The diversity index (H') for zooplankton is 0.35, indicating medium biota community stability. However, no identified benthos species were observed.

Siranthi River: The laboratory analysis indicated the presence of 7 types of phytoplankton in the Siranthi River, with Navicula sp. as the dominant type. The diversity index (H') for phytoplankton is 1.63, falling within the range 1<H'<3, indicating medium biota community stability. Moreover, 8 types of zooplankton were identified, with Trinema sp. dominating. The diversity index (H') for zooplankton is 1.64, indicating medium biota community stability. Additionally, Lumbricus sp. was found as a benthos species with a diversity index value (H') of 0.

Overall, the analysis of the aquatic biota parameters in the rivers surrounding the PLTP Dieng Unit 2 project during both quarters shows varying levels of medium biota community stability, while some parameters were not identified.

B. Patuha Unit 2 Sub Project

This summary of environmental monitoring report is referred to the Environmental Permit Implementation report of Patuha Unit 2 Geothermal Power Plant Development Project prepared by PT Sucofindo Indonesia.

The scope of environmental monitoring includes:

1. Ambient air quality monitoring;
2. Noise monitoring;
3. Surface water quality monitoring;
4. Traffic monitoring;
5. Road infrastructure damage monitoring;
6. Slope stability (soil erosion) monitoring; and
7. Biodiversity monitoring.

This monitoring is undertaken in quarterly basis. The distribution of monitoring is showed in the following figures and the results of monitoring are provided in the following sections.

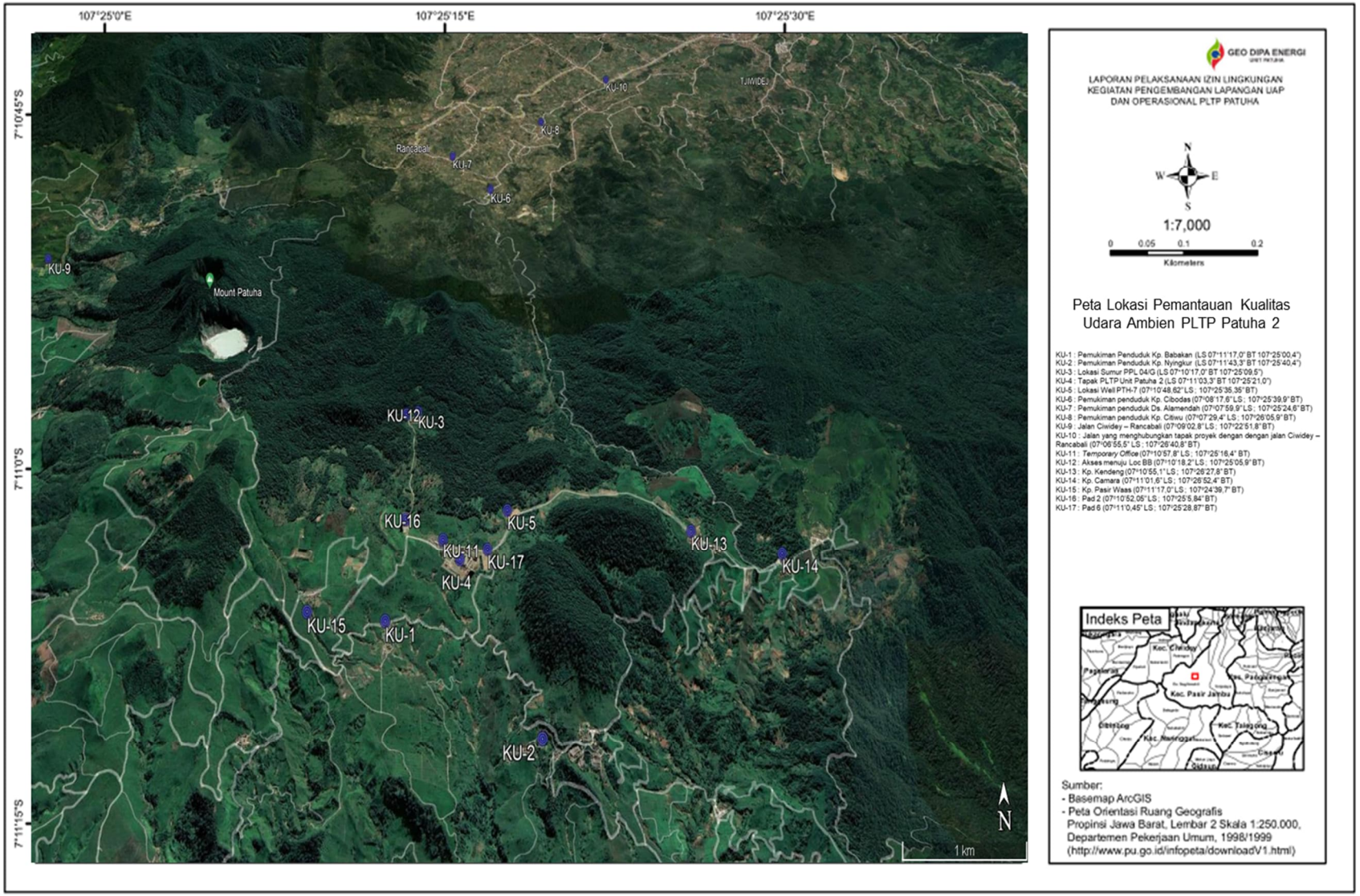


Figure 6 Ambient Air Quality Sampling Locations

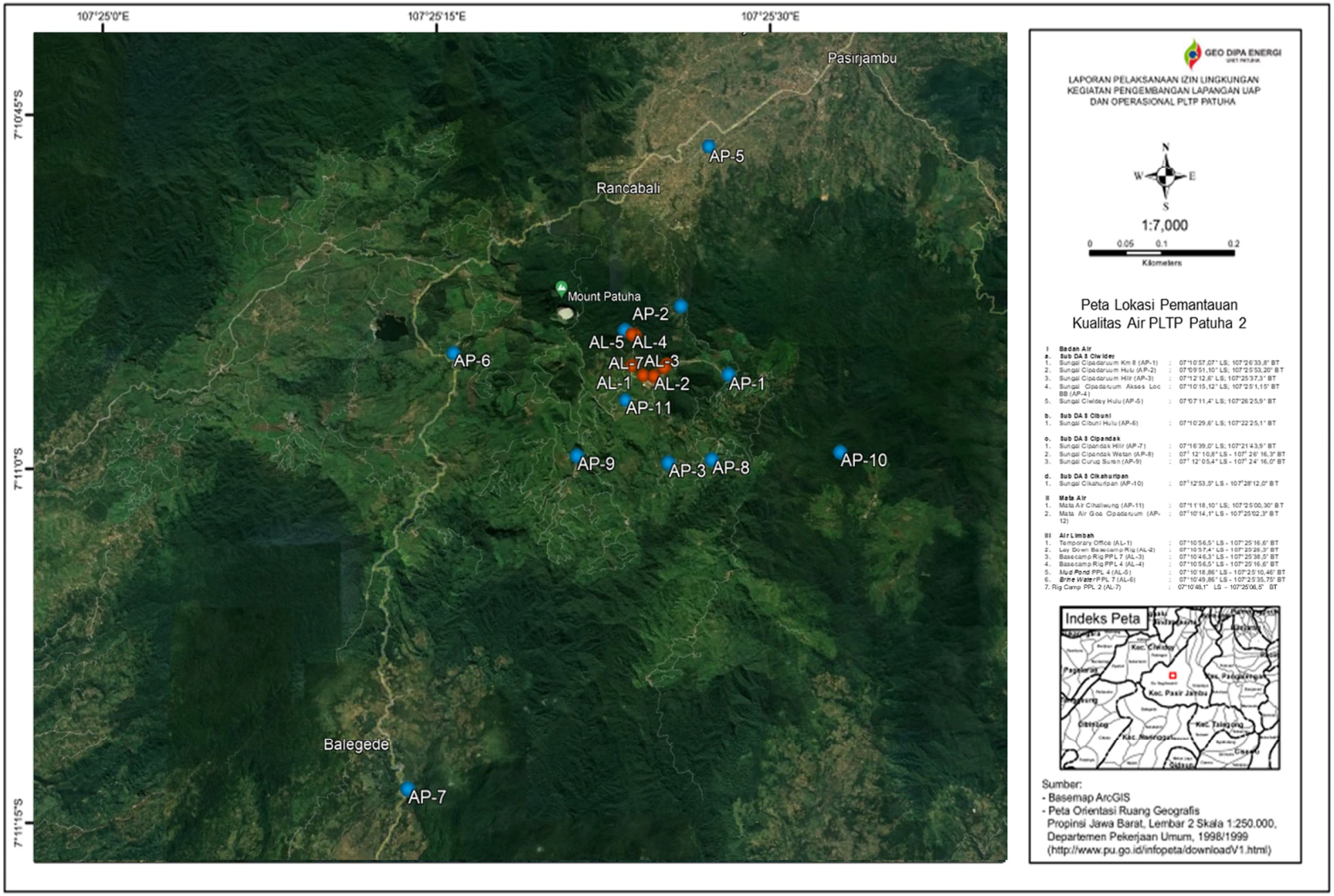


Figure 7 Surface Water Sampling Locations

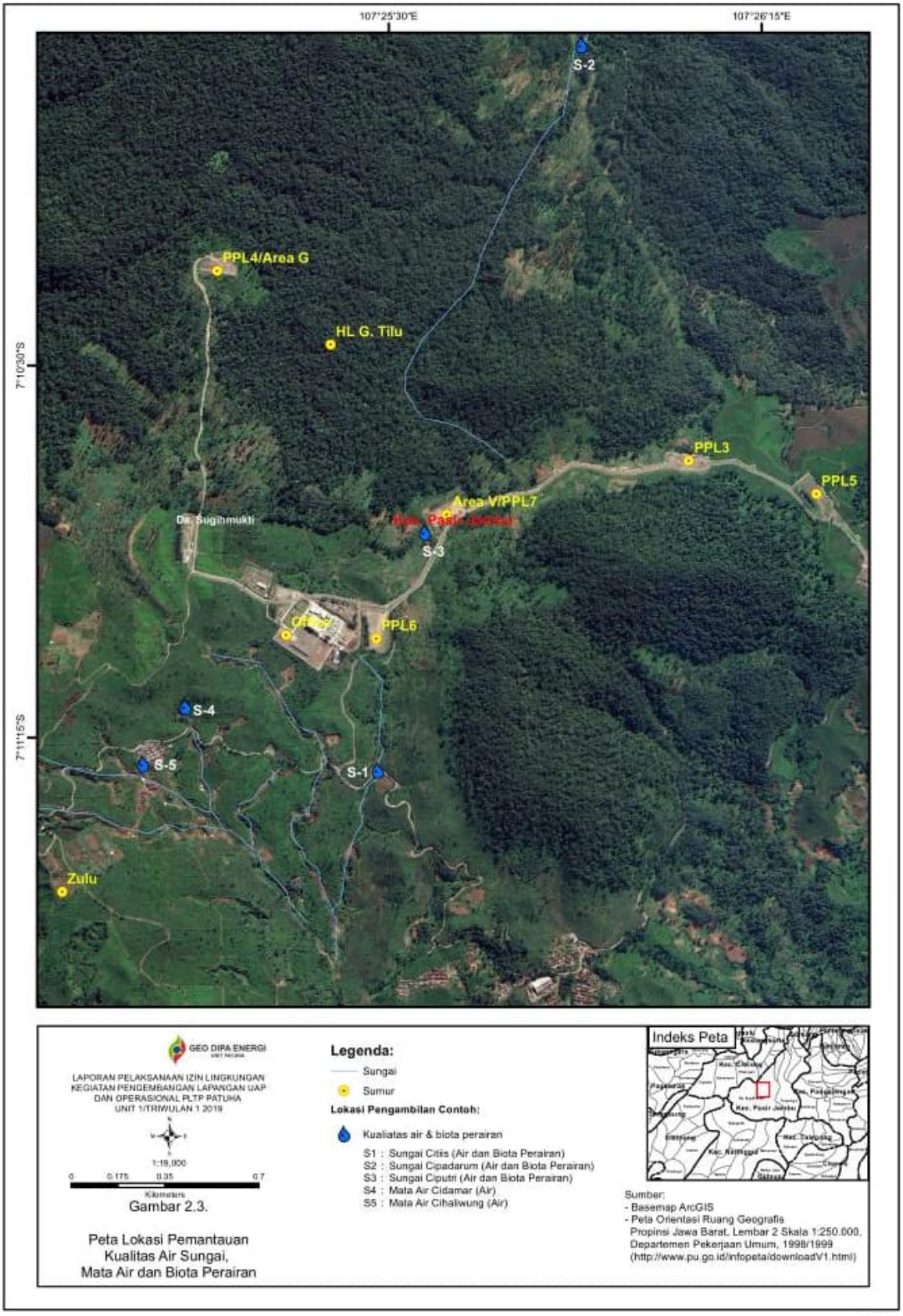
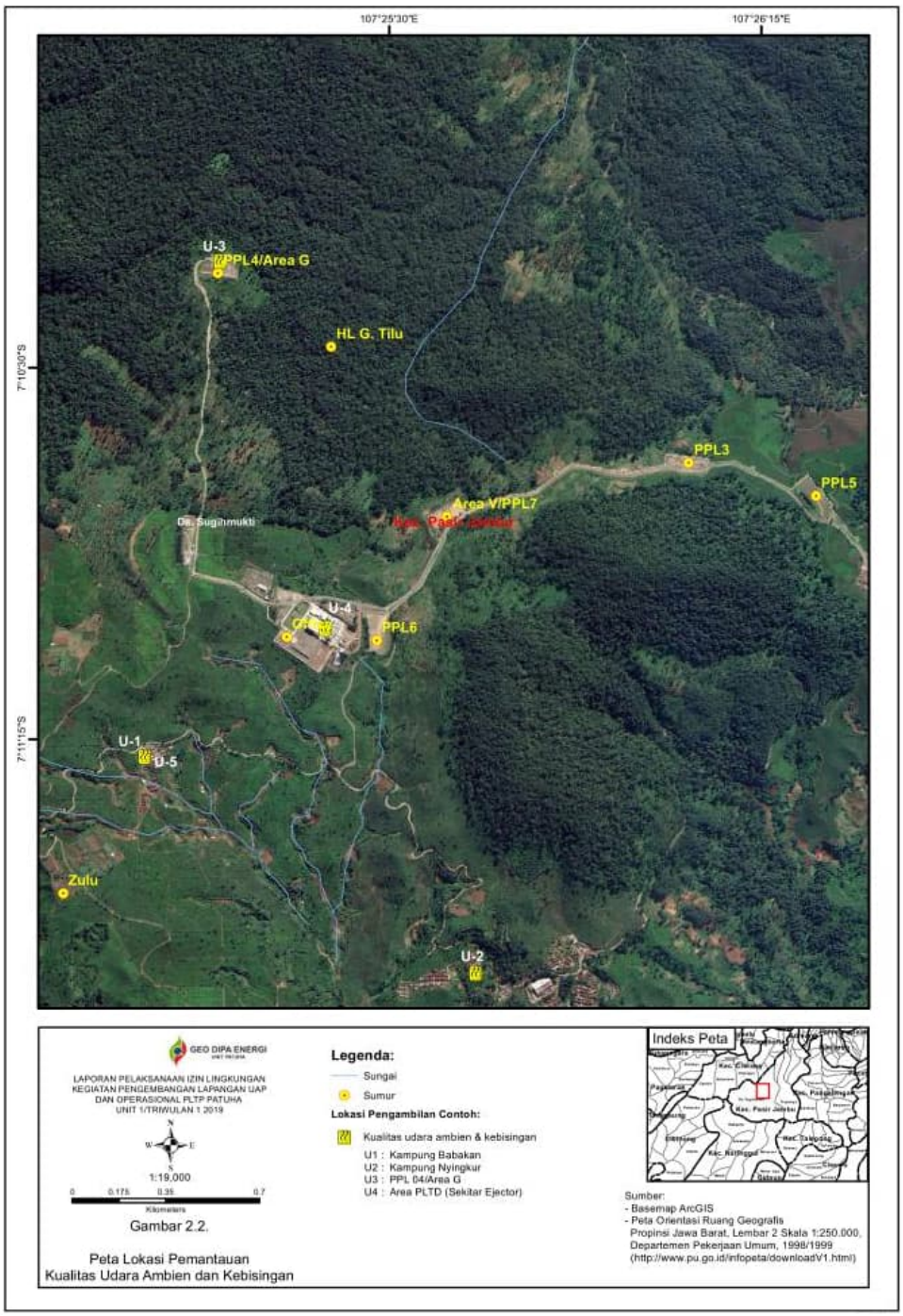


Figure 8 Springwater Quality Monitoring Sampling Locations



Gambar 2.2.

Peta Lokasi Pemantauan
Kualitas Udara Ambien dan Kebisingan

Figure 9. Noise Sampling Locations

1. Ambient Air Quality

Data on the trend of changes in ambient air quality in the construction activities of PLTP Patuha Unit 2 are presented in the following Table 43 with monitoring locations as follows:

- KU-1 : Kp. Babakan Settlement (LS 07°11'17.0" E 107°25'00.4")
- KU-2 : Kp. Nyingkur Settlement (LS 07°11'43.3" E 107°25'40.4")
- KU-3 : Well Location PPL 04/G (LS 07°10'17.0" E 107°25'09.5")
- KU-4 : PLTP Site Unit Patuha 2 (LS 07°11'03.3" E 107°25'21.0")
- KU-5 : Location of Well PTH-7 (07 o 10'48.62" LS; 107 o 25'35.35"BT)
- KU-6 : Settlement of Kp. Cibodas (07 o08'17.6" LS; 107º25'39.9" BT)
- KU-7 : Settlement of Ds. Alamendah (07 o07'59.9" LS ; 107º25'24.6" E)
- KU-8 : Settlement of Kp. Citiwu (07 o 07'29.4"LS; 107 o 26'05.9"BT)
- KU-9 : Jalan Ciwidey – Rancabali (07 o09'02.8" LS; 107 o 22'51.8"E)
- KU-10 : Road connecting the project site with Ciwidey – Rancabali road (07 o06'55.5" LS; 107º26'40.8" BT)
- KU-11 : *Temporary Office* (07 o 10'57.8" LS; 107 o 25'16.4"BT)
- KU-12 : Access to Loc BB (07 o10'18.2" LS; 107º25'05.9" E)
- KU-13 : Kp. Kendeng (07 o10'55.1" LS; 107º26'27.8" BT)
- KU-14 : Kp. Camara (07 o 11'01.6"LS; 107 o 26'52.4"E)
- KU-15 : Kp. Pasir Waas (07 o11'17.0" LS; 107º24'39.7" E)
- KU-16 : Pad 2 (07 o10'52.05" LS; 107º25'5.84" E)
- KU-17 : Well Pad U/ PPL 6 (07 o 10'59.8" LS; 107 o 25'29.4"E)
- KU-18 : Wellpad BB/ PTH 9 (07 o 10'18.2" LS; 107 º25'05.9" E)
- KU-19 : Well Pad H / PPL 2 (07 o 11'03.3" LS; 107º25'21.0" BT)

Drilling and well testing are the on-going activities of Patuha Unit 2 Geothermal Power Plant development during this period. Referring to the monitoring results below, there is no indication of exceeding concentration of ambient air quality parameters. It can be seen in table below that concentration of all parameters met the applicable ambient quality standards.

Table 43 Ambient Air Quality Trends of Patuha Unit 2 Development in 2021-2023

PARAMETERS			SO_2	CO.	$NO._2$	TSP	PM_{10}	$PM_{2.5}$	NH_3	H_2S
QUALITY STANDARDS			150	10.000	200	230	75	55	2	0,02
UNIT			µ/nm³	µ/nm³	µ/nm³	µ/nm³	µ/nm³	µ/nm³	Ppm	Ppm
METHOD			SNI.7119.7:2017	SNI.7119.10:2017	SNI.7119.2:2017	SNI.7119.3:2017	SNI.7119.14:2016	SNI.7119.14:2016	SNI 19-7119.1 - 2005	RSNI3. 7119. 11:2007
KU-1	2021	Q-1	26,73	< 11.45	12,81	39,24	20,36	8,25	< 0.02	< 0.001
		Q-2	25,65	< 11.45	11,37	32,21	16,66	72,59	< 0.02	< 0.001
		Q-3	24,78	< 11.45	11,83	31,45	16,66	7,06	< 0.02	< 0.001
		Q-4	20,3	< 11.45	12,6	31,54	11,76	7,1	< 0.02	< 0.001
	2022	Q-1	< 21.30	< 11.45	9,12	28,2	12,45	8,06	< 0.02	< 0.001

PARAMETERS			SO_2	CO.	NO_{-2}	TSP	PM_{10}	$PM_{2.5}$	NH_3	H_2S
QUALITY STANDARDS			150	10.000	200	230	75	55	2	0,02
UNIT			µ/nm^3	µ/nm^3	µ/nm^3	µ/nm^3	µ/nm^3	µ/nm^3	Ppm	Ppm
METHOD			SNI.7119.7:2017	SNI.7119.10:2017	SNI.7119.2:2017	SNI.7119.3:2017	SNI.7119.14:2016	SNI.7119.14:2016	SNI 19-7119.1 - 2005	RSNI3.7119.11:2007
		Q-4	20,3	< 11.45	12,6	31,54	11,76	7,1	< 0.02	< 0.001
	2022	Q-1	< 21.30	< 11.45	9,12	28,2	12,45	8,06	< 0.02	< 0.001
		Q-2	N/a	N/a	N/a	N/a	N/a	N/a	< 0.02	< 0.005
		Q-3	21,53	< 11	< 14	28,36	10,17	5,61	< 0.02	< 0.001
		Q-4	20,74	< 11	< 14	27,61	10,92	4,86	0,02	< 0.001
	2023	Q-1	23,1	57,3	15,2	40,5	22,9	11,7	N/a	N/a
		Q-2	22,16	115	16,01	48,87	23,44	13,12	N/a	N/a
KU-2	2021	Q-1	26,42	< 11.45	11,54	35,55	18,74	7,38	< 0.02	<0.001
		Q-2	25,25	< 11.45	12,26	30,53	14,08	8,79	< 0.02	< 0.001
		Q-3	25,06	< 11.45	11,29	34,91	16,04	8,47	< 0.02	< 0.001
		Q-4	20,3	< 11.45	12,6	31,54	11,76	7,1	< 0.02	<0.001
	2022	Q-1	N/a	N/a	N/a	N/a	N/a	N/a	< 0.02	< 0.001
		Q-2	N/a	N/a	N/a	N/a	N/a	N/a	N/a	N/a
		Q-3	N/a	N/a	N/a	N/a	N/a	N/a	N/a	N/a
		Q-4	N/a	N/a	N/a	N/a	N/a	N/a	N/a	N/a
KU-3	2021	Q-1	26,68	< 11.45	13,57	38,31	16,54	8,63	< 0.02	0,004
		Q-2	26,32	< 11.45	13,84	36,17	20,13	9,66	< 0.02	0,002
		Q-3	26,7	< 11.45	13,73	30,54	19,22	8,42	< 0.02	0,002
		Q-4	24,6	< 11.45	13,88	45,3	16,2	8,1	< 0.02	0,005
	2022	Q-1	21,3	45,8	13,5	37,62	13,4	9,56	< 0.02	0,004
		Q-2	N/a	N/a	N/a	N/a	N/a	N/a	N/a	N/a
		Q-3	27,3	1.717,80	22,45	69,17	20,06	7,92	< 0.02	0,007
		Q-4	26,9	< 11	17,47	45,03	19,31	7,17	< 0.02	0,002
	2023	Q-1	23,2	515	16,1	53,9	27,0	11,5	N/a	N/a
		Q-2	21,88	458	16,71	55,72	28,36	12,36	N/a	0,0078
KU-4	2021	Q-1	28,61	< 11.45	13,77	33,79	20,78	6,89	< 0.02	0,007
		Q-2	25,73	< 11.45	12,92	35,26	17,37	9,43	< 0.02	0,003
		Q-3	25,82	< 11.45	13,08	35,84	17,42	8,35	< 0.02	0,004
		Q-4	25,3	< 11.45	12,9	38,3	13,1	6,85	< 0.02	0,004
	2022	Q-1	23,12	< 11.45	10,56	30,54	11,44	8,43	< 0.02	0,008
		Q-2	N/a	N/a	N/a	N/a	N/a	N/a	< 0.02	< 0.005
		Q-3	26,46	< 11	< 14	29,05	14,76	5,58	< 0.02	0,006
		Q-4	25,61	< 11	14,13	31,35	15,52	6,35	< 0.02	0,005
	2023	Q-1	< 17	< 11	< 14	30,1	14,2	7,80	N/a	N/a
		Q-2	18,04	< 11	< 14	29,36	13,56	7,61	N/a	N/a
KU-5	2021	Q-1	27,65	< 11.45	11,42	40,7	18,8	9,78	< 0.02	0,004
		Q-2	25,1	< 11.45	11,93	38,41	15,6	9,36	< 0.02	0,001
		Q-3	25,07	< 11.45	11,29	32,34	19,55	7,66	< 0.02	0,001
		Q-4	28,3	1.145	18,4	61,33	32,67	16,45	< 0.02	0,002
	2022	Q-1	32,5	2.290	19,6	42,3	20,15	11,45	0,05	0,01
		Q-2	26,92	2.863	13,18	21,2	15,85	9,6	< 0.02	< 0.007
		Q-3	26,36	< 11	17,68	39,77	14,18	8,18	< 0.02	0,006
		Q-4	26,92	2.863	13,18	21,2	15,85	9,6	< 0.02	< 0.007
KU-6	2021	Q-1	24,88	34,4	13,28	42,42	17,55	9,05	< 0.02	< 0.001
		Q-2	27,34	114,5	17,91	47,49	26,74	11,39	< 0.02	< 0.001
		Q-3	< 17	1.718	28,6	39,7	11,3	6,26	< 0.02	< 0.001
		Q-4	23,37	172	18,16	55,75	28,69	13,27	< 0.02	< 0.001
	2022	Q-1	N/a	N/a	N/a	N/a	N/a	N/a	N/a	N/a
		Q-2	N/a	N/a	N/a	N/a	N/a	N/a	N/a	N/a

PARAMETERS			SO_2	CO.	NO_{-2}	TSP	PM_{10}	$PM_{2.5}$	NH_3	H_2S
QUALITY STANDARDS			150	10.000	200	230	75	55	2	0,02
UNIT			µ/nm^3	µ/nm^3	µ/nm^3	µ/nm^3	µ/nm^3	µ/nm^3	Ppm	Ppm
METHOD			SNI.7119.7:2017	SNI.7119.10:2017	SNI.7119.2:2017	SNI.7119.3:2017	SNI.7119.14:2016	SNI.7119.14:2016	SNI 19-7119.1 - 2005	RSNI3.7119.11:2007
		Q-3	N/a	N/a	N/a	N/a	N/a	N/a	N/a	N/a
		Q-4	N/a	N/a	N/a	N/a	N/a	N/a	N/a	N/a
KU-7	2021	Q-1	27,5	114,5	15,27	50,21	32,5	13,3	< 0.02	< 0.001
		Q-2	26,74	57,3	15,94	53,72	25,13	11,29	< 0.02	< 0.001
		Q-3	< 17	3.550	40,5	67,6	14,5	7,93	< 0.02	< 0.001
		Q-4	22,81	115	15,11	46,81	24,9	11,03	< 0.02	< 0.001
	2022	Q-1	N/a	N/a	N/a	N/a	N/a	N/a	N/a	N/a
		Q-2	N/a	N/a	N/a	N/a	N/a	N/a	N/a	N/a
		Q-3	N/a	N/a	N/a	N/a	N/a	N/a	N/a	N/a
		Q-4	N/a	N/a	N/a	N/a	N/a	N/a	N/a	N/a
KU-8	2021	Q-1	25,82	57,3	13,92	38,3	19,2	11,62	< 0.02	< 0.001
		Q-2	24,16	34,4	16,86	54,14	31,08	9,29	< 0.02	< 0.001
		Q-3	< 17	4.581	29,2	41,2	11,8	6,45	< 0.02	< 0.001
		Q-4	22,61	229	15,37	48,51	27,9	13,02	< 0.02	< 0.001
	2022	Q-1	N/a	N/a	N/a	N/a	N/a	N/a	N/a	N/a
		Q-2	N/a	N/a	N/a	N/a	N/a	N/a	N/a	N/a
		Q-3	N/a	N/a	N/a	N/a	N/a	N/a	N/a	N/a
		Q-4	N/a	N/a	N/a	N/a	N/a	N/a	N/a	N/a
KU-9	2021	Q-1	32,4	183,2	16,24	51,73	30,5	14,64	< 0.02	< 0.001
		Q-2	29,27	858,9	18,96	62,14	32,61	13,86	< 0.02	< 0.001
		Q-3	< 17	8.589	42,3	93,6	24,4	13,4	< 0.02	< 0.001
		Q-4	26,76	1.145	19,68	63,43	33,06	16,31	< 0.02	< 0.001
	2022	Q-1	N/a	N/a	N/a	N/a	N/a	N/a	N/a	N/a
		Q-2	N/a	N/a	N/a	N/a	N/a	N/a	< 0.02	< 0.005
		Q-3	31,21	1.059,30	27,58	47,65	23,86	11,3	< 0.02	< 0.001
		Q-4	30,42	1.145	26,99	49,14	23,12	10,56	< 0.02	< 0.001
	2023	Q-1	25,8	1.088	27,6	78,2	34,0	24,2	N/a	N/a
		Q-2	28,93	1.099	28,26	83,29	37,01	25,45	N/a	N/a
KU-10	2021	Q-1	28,21	183,2	15,22	51,73	30,5	14,64	< 0.02	< 0.001
		Q-2	30,31	858,9	18,52	62,14	32,61	13,86	< 0.02	< 0.001
		Q-3	< 17	8.589	47,1	93,6	24,4	13,4	< 0.02	< 0.001
		Q-4	25,36	1.145	17,8	63,43	33,06	16,31	< 0.02	< 0.001
	2022	Q-1	22,3	69	15,41	40,51	26,51	12,48	< 0.02	< 0.001
		Q-2	N/a	N/a	N/a	N/a	N/a	N/a	N/a	N/a
		Q-3	30,73	1.325,20	25,14	53,68	24,42	9,87	< 0.02	< 0.001
		Q-4	29,95	859	24,5	55,16	23,68	10,62	< 0.02	< 0.001
	2023	Q-1	29,0	973	24,9	75,1	32,9	23,1	N/a	N/a
		Q-2	28,13	1.031	26.08	78,24	35,80	24,71	N/a	N/a
KU-11	2022	Q-1	22,5	45,8	13,62	36,52	12,45	6,78	< 0.02	0,002
		Q-2	N/a	N/a	N/a	N/a	N/a	N/a	< 0.02	< 0.005
		Q-3	25,19	< 11	< 14	33,81	15,18	5,78	< 0.02	0,004
		Q-4	26,14	< 11	< 14	36,06	18,93	5,03	< 0.02	0,003
	2023	Q-1	24,7	299	17,9	57,4	29,1	14,2	N/a	N/a
		Q-2	23,89	286	18,98	57,03	30,02	15,82	N/a	N/a
KU-12	2022	Q-1	22,61	229	17,25	35,6	15,2	8,9	0,07	< 0.001
		Q-2	N/a	N/a	N/a	N/a	N/a	N/a	< 0.02	< 0.005
		Q-3	25,7	613,5	20,67	62,8	19,93	9,96	< 0.02	0,003
		Q-4	24,91	573	18,93	47,7	20,68	9,21	< 0.02	0,003

PARAMETERS			SO_2	CO.	NO_{-2}	TSP	PM_{10}	$PM_{2.5}$	NH_3	H_2S
QUALITY STANDARDS			150	10.000	200	230	75	55	2	0,02
UNIT			µ/nm^3	µ/nm^3	µ/nm^3	µ/nm^3	µ/nm^3	µ/nm^3	Ppm	Ppm
METHOD			SNI.7119.7:2017	SNI.7119.10:2017	SNI.7119.2:2017	SNI.7119.3:2017	SNI.7119.14:2016	SNI.7119.14:2016	SNI 19-7119.1 - 2005	RSNI3.7119.11:2007
	2023	Q-1	29,0	687	20,9	63,4	31,2	14,7	N/a	N/a
KU-13	2022	Q-1	22,45	57,25	12,6	29,4	10,5	8,25	0,03	0,004
		Q-2	N/a	N/a	N/a	N/a	N/a	N/a	< 0.02	< 0.005
		Q-3	21,5	< 11	< 14	36,28	15,85	5,48	< 0.02	< 0.001
		Q-4	20,71	< 11	< 14	34,78	16,6	6,23	< 0.02	< 0.001
	2023	Q-1	20,4	< 11	14,1	37,2	20,6	10,7	N/a	N/a
		Q-2	19,61	< 11	14,05	39,09	21,95	12,01	N/a	N/a
KU-14	2022	Q-1	19,26	< 11.45	9,5	26,64	13,52	8,5	< 0.02	< 0.001
		Q-2	N/a	N/a	N/a	N/a	N/a	N/a	< 0.02	< 0.005
		Q-3	22,39	< 11	< 14	41,87	11,84	4,75	< 0.02	< 0.001
		Q-4	20,8	< 11	< 14	40,36	12,6	5,51	< 0.02	< 0.001
	2023	Q-1	21,4	< 11	14,4	38,4	21,6	10,9	N/a	N/a
		Q-2	21,39	57,26	14,78	41,67	21,95	12,37	N/a	N/a
KU-15	2022	Q-1	22,3	< 11.45	9,82	26,54	10,22	5,6	< 0.02	< 0.001
		Q-2	N/a	N/a	N/a	N/a	N/a	N/a	< 0.02	< 0.005
		Q-3	22,4	< 11	< 14	29,13	11,62	6,72	< 0.02	< 0.001
		Q-4	21,6	< 11	< 14	28,37	12,38	5,96	< 0.02	< 0.001
	2023	Q-1	< 17	< 11	< 14	35,95	16,3	9,71	N/a	N/a
		Q-2	17,20	< 11	< 14	34,41	17,54	9,19	N/a	N/a
KU-16	2022	Q-2	N/a	N/a	N/a	N/a	N/a	N/a	< 0.02	< 0.005
		Q-3	N/a	N/a	N/a	N/a	N/a	N/a	N/a	N/a
		Q-4	N/a	N/a	N/a	N/a	N/a	N/a	N/a	N/a
KU-17	2022	Q-2	N/a	N/a	N/a	N/a	N/a	N/a	< 0.02	< 0.005
		Q-3	N/a	N/a	N/a	N/a	N/a	N/a	N/a	N/a
		Q-4	N/a	N/a	N/a	N/a	N/a	N/a	N/a	N/a
	2023	Q-2	18,21	115	15,20	49,79	21,96	12,48	N/a	< 0.001
KU-18	2022	Q-4	N/a	N/a	N/a	N/a	N/a	N/a	< 0.02	0,003
	2023	Q-2	24,76	744	21,94	70,17	32,80	16,00	N/a	0,0086
KU-19	2023	Q-1	25,9	286	17,3	56,5	28,8	13,1	N/a	N/a
		Q-2	22,32	515	18,62	58,76	29,23	15,53	N/a	0,0029

Source : Laboratory measurement results of PT. Sucofindo, 2021 to June 2023

**) Quality standards refer to PP RI No. 22 of 2021 concerning the Implementation of Environmental Protection and Management Annex VII concerning Ambient Air Quality Standards; **) Quality standards refer to KepMenLH No. 50 of 1996 concerning Odor Level Standards; N/A (no measurement taken)*

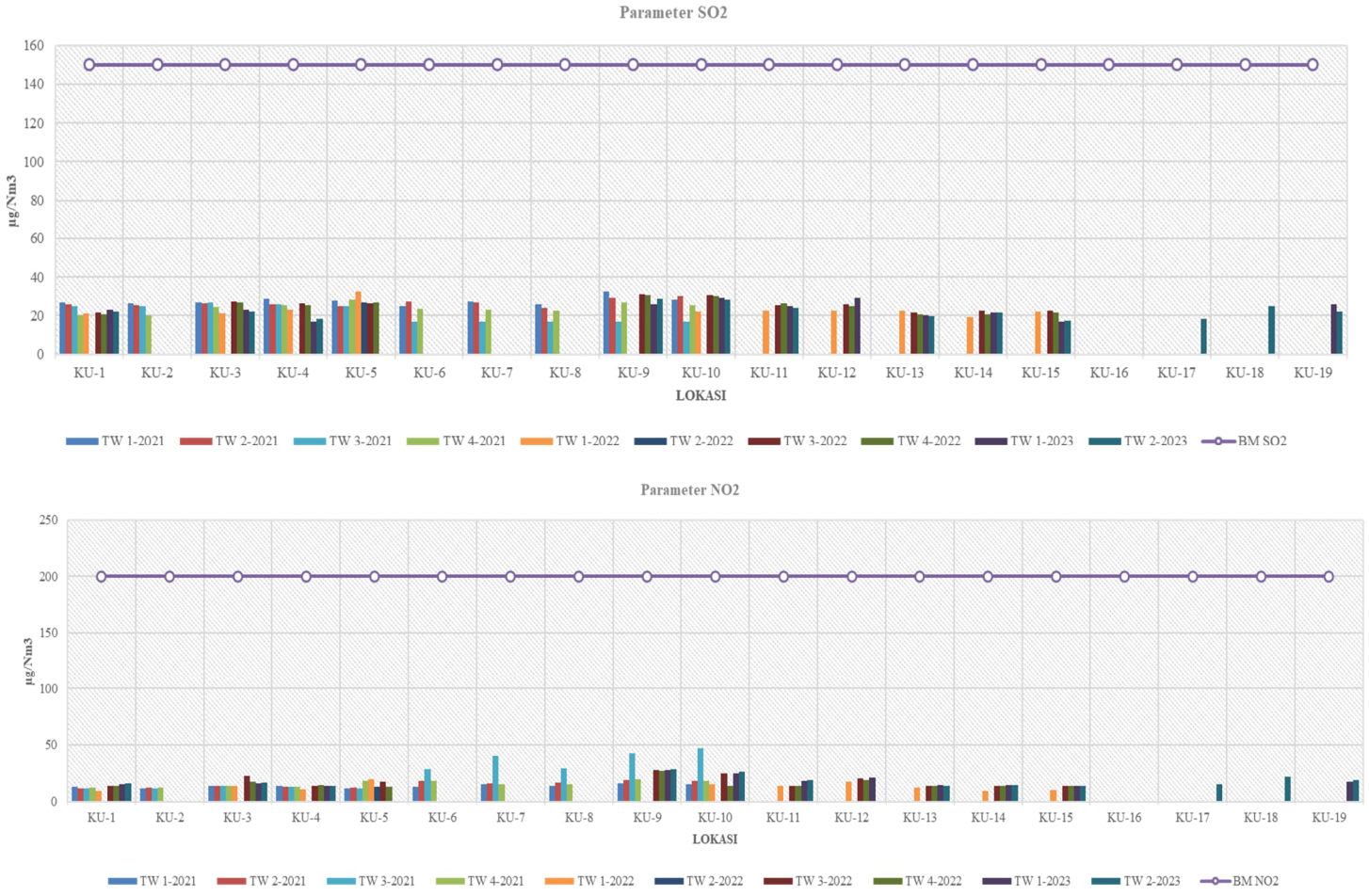


Figure 7 Fluctuations of SO_2 and NO_2 Concentration of Patuha Unit 2 Development

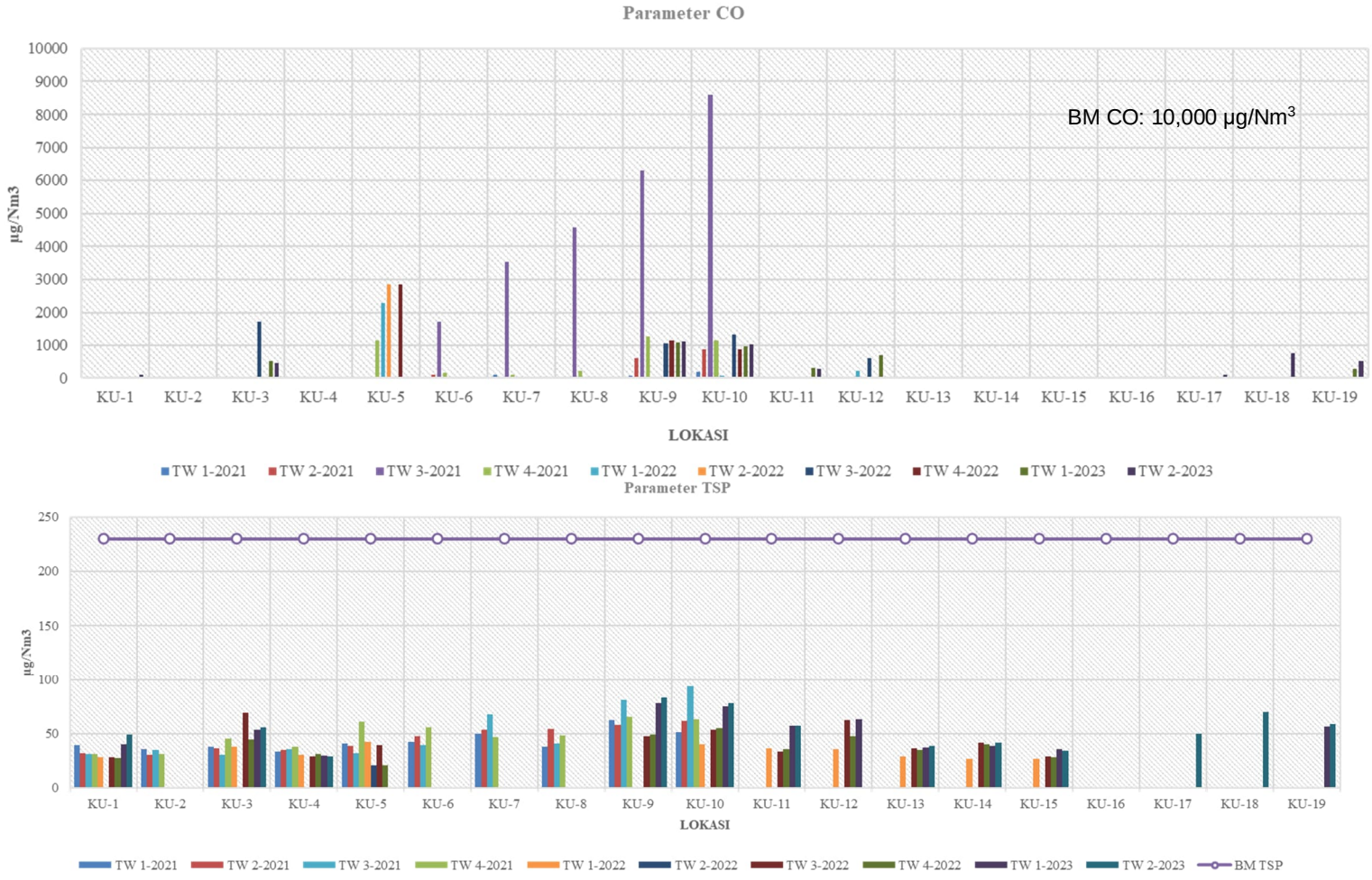


Figure 8 Fluctuations of CO and TSP Concentrations of Patuha Unit 2 Development

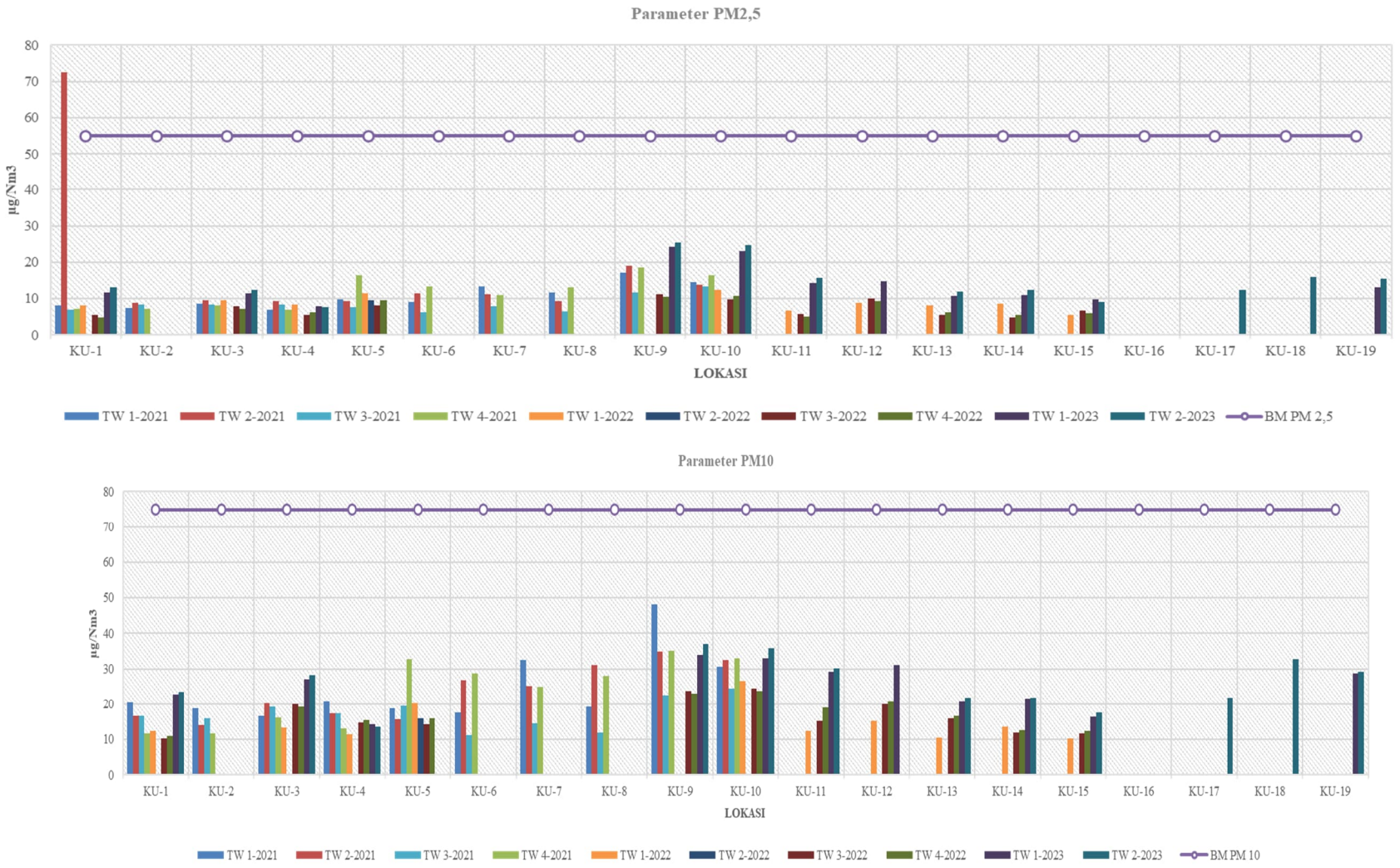


Figure 9 Fluctuations of PM $_{10}$ and PM$_{2.5}$ Concentrations of Patuha Unit 2 Development

2. Noise Intensity

Noise intensity measurements were undertaken at the following locations:

- KB-1 : Kp. Babakan Settlement (LS 07°11'17.0" E 107°25'00.4")
- KB-2 : Kp. Nyingkur Settlement (LS 07°11'43.3" E 107°25'40.4")
- KB-3 : Well Location PPL 04/G (LS 07°10'17.0" E 107°25'09.5")
- KB-4 : Site of PLTP Unit Patuha 2 (LS 07°11'03.3" E 107°25'21.0")
- KB-5 : Location of Well PTH-7 (07 o 10'48.62" LS; 107 o 25'35.35"BT)
- KB-6 : Settlement of Kp. Cibodas (07 o08'17.6" LS; 107º25'39.9" BT)
- KB-7 : Settlement of Ds. Alamendah (07 o07'59.9" LS; 107º25'24.6" E)
- KB-8 : Settlement of Kp. Citiwu (07 o 07'29.4"LS; 107 o 26'05.9"E)
- KB-9 : Jalan Ciwidey – Rancabali (07 o09'02.8" LS; 107 o 22'51.8"BT)
- KB-10 : Road connecting the project site with Ciwidey – Rancabali road (07 o06'55.5" LS; 107º26'40.8" BT)
- KB-11 : *Temporary Office* (07 o 10'57.8" LS; 107 o 25'16.4"BT)
- KB-12 : Access to Loc BB (07 o10'18.2" LS; 107º25'05.9" E)
- KB-13 : Kp. Kendeng (07 o10'55.1" LS; 107º26'27.8" BT)
- KB-14 : Kp. Camara (07 o 11'01.6"LS; 107 o 26'52.4"E)
- KB-15 : Kp. Pasir Waas (07 o11'17.0" LS; 107º24'39.7" E)
- KU-16 : Well Pad H / PPL 2 (07 o 11'03.3" LS; 107 o 25'21.0" BT)
- KB-17 : Well Pad U/ PPL 6 (07 o 10'59.8" LS; 107 o 25'29.4"BT)

Referring to the monitoring results during Quarter II of 2023, it can be seen that the average day-night (L-sm) noise intensity measured in 10 (ten) monitoring locations still meets the noise level standards required by KepMenLH No. 48. Year 1996 on standard noise levels. The results of measuring the average noise day – night (L-sm) from the pre-construction activities - construction of PLTP Patuha Unit 2 during monitoring Quarter I of 2021 to monitoring Quarter II Year 2023 are presented in following Table and figures.

Table 44 Trend of Average Day-Night Noise Intensity (L-sm) during Pre-Construction Activities - Construction of PLTP Patuha Unit 2

NO	ERA	MONITORING RESULT (dba)																
		KB-1	KB-2	KB-3	KB-4	KB-5	KB-6	KB-7	KB-8	KB-9	KB-10	KB-11	KB-12	KB-13	KB-14	KB-15	KB-16	KB-17
1.	Q 1-2021	44,7	43,2	50,3	**85.3^**	43,6	47,8	52	42,9	53,6	43,7	N/a	N/a	N/a	N/a	N/a	N/a	N/a
2.	Q 2-2021	43,5	44,1	45,7	70,1	53,4	**60.1^**	**66.2^**	**70.2^**	60,5	58,7	N/a	N/a	N/a	N/a	N/a	N/a	N/a
3.	Q 3-2021	44,2	46,2	43,8	68,0	51,8	49,4	54,6	**62.2^**	62,8	65,3	N/a	N/a	N/a	N/a	N/a	N/a	N/a
4.	Q 4-2021	46,4	42,6	49,3	63,1	55,4	**68.4^**	45,0	**70.5^**	68,0	68,8	N/a	N/a	N/a	N/a	N/a	N/a	N/a
5.	Q 1-2022	40,9	41,7	53,9	64,3	66,8	N/a	N/a	N/a	N/a	56,9	53,0	60,6	44,9	43,4	40,9	N/a	N/a
6.	Q 2-2022	42,2	N/a	N/a	63,8	66,8	N/a	N/a	N/a	53,4	51,2	51,7	53,5	45,2	44,8	45,6	N/a	N/a
7.	Q 3-2022	42,8	N/a	69,5	61,3	**73.7^**	N/a	N/a	N/a	56,5	55,8	50,1	54,5	44,2	43,2	40,7	N/a	N/a
8.	Q 4-2022	45,7	N/a	46,3	59,9	66,8	N/a	N/a	N/a	57,4	57,6	52,9	54,2	46,5	43,1	46,8	N/a	N/a
9.	Q 1-2023	N/a	N/a	N/a	63,5	N/a	N/a	N/a	N/a	61,3	59,6	57,8	68,8	44,9	43,4	44,6	93.1^	
10.	Q 2-2023	N/a	N/a	N/a	64,0	N/a	N/a	N/a	N/a	62,5	61,4	57,4	68,1	44,7	45,8	44,9	61,8	59,5
Raw Rate Noise		**55***	**55***	**70****	**70****	**70****	**55***	**55***	**55***	**70*****	**70*****	**70****	**70****	**55***	**55***	**55***	**70****	**70****
Method		SNI 8427 : 2017																

Source : Laboratory measurement results of PT. Sucofindo, 2021 to June 2023

*Description: Quality Standards Based on KepMen LH No. 48 of 1996 concerning Noise Level Standards where *) 55 dBA is for residential and residential areas, **) 70 dBA is for industrial areas;) 70 dBA designation of trade and services areas; (^) Above standard noise level*

	Exceed the limit

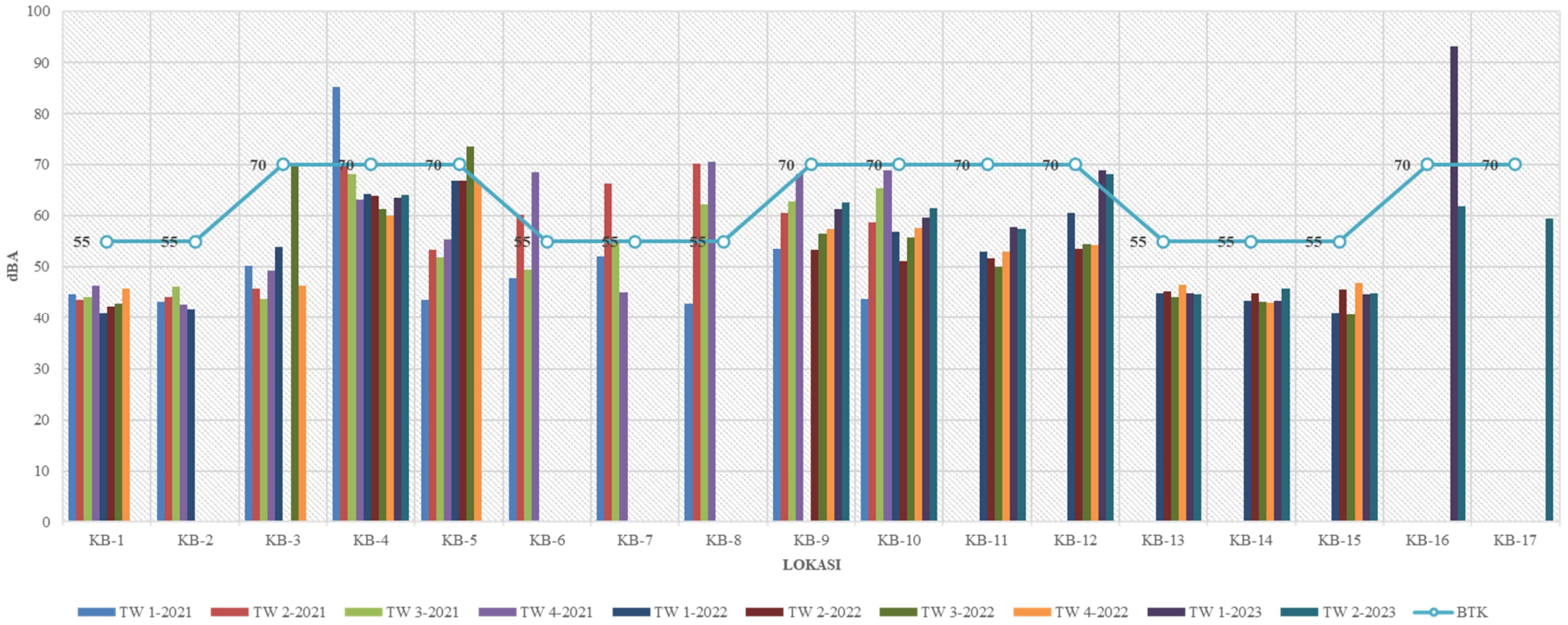


Figure 10 Fluctuation of Average Day-Night Noise Level (L-sm) From Pre-Construction Activities - Construction of PLTP Patuha Unit 2

3. Water Quality

1. Evaluation of Trends in Source (Domestic Wastewater)

Monitoring of domestic wastewater during the implementation of steam field development and construction of PLTP Patuha Unit 2, has been carried out since the first quarter of 2022. Thus, the comparison of domestic wastewater quality conditions in the first quarterof 2023, can be compared with conditions in previous monitoring periods. Evaluation of trends in domestic wastewater quality is also carried out by comparing the quality of domestic wastewater obtained from laboratory analysis with wastewater quality standards based on Minister of Environment and Forestry Regulation No. 68 of 2016 concerning Domestic Wastewater Quality Standards.

In the second quarter of 2023, the quality of wastewater generated from activities in the *Temporary Office*, against the parameters tested (pH, TSS, BOD 5, COD, NH_3 and Total Coliform) as a whole is still meet the quality standards required in PermenLHK No.68 of 2016 concerning Domestic Wastewater Quality Standards. Domestic wastewater from all construction activities of PLTP Patuha Unit 2 is managed exitu so that it does not have the potential to cause pollution to surface water around the Patuha area. Evaluation of the tendency of domestic wastewater produced to domestic wastewater quality standards, in full is presented in the following figures.

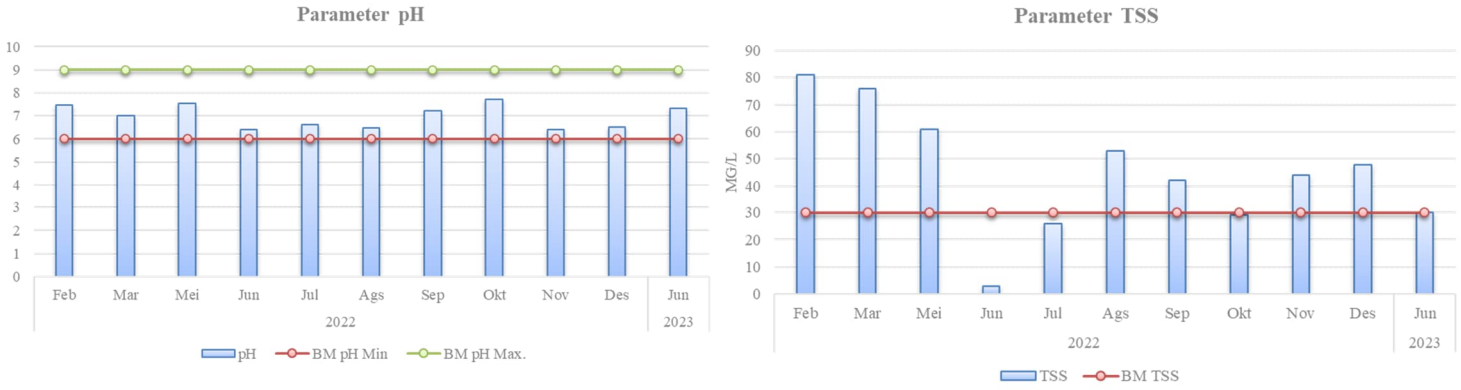


Figure 11 Fluctuations of pH and TSS Concentration in Domestic Wastewater at WWTP Temporary Office Outlets

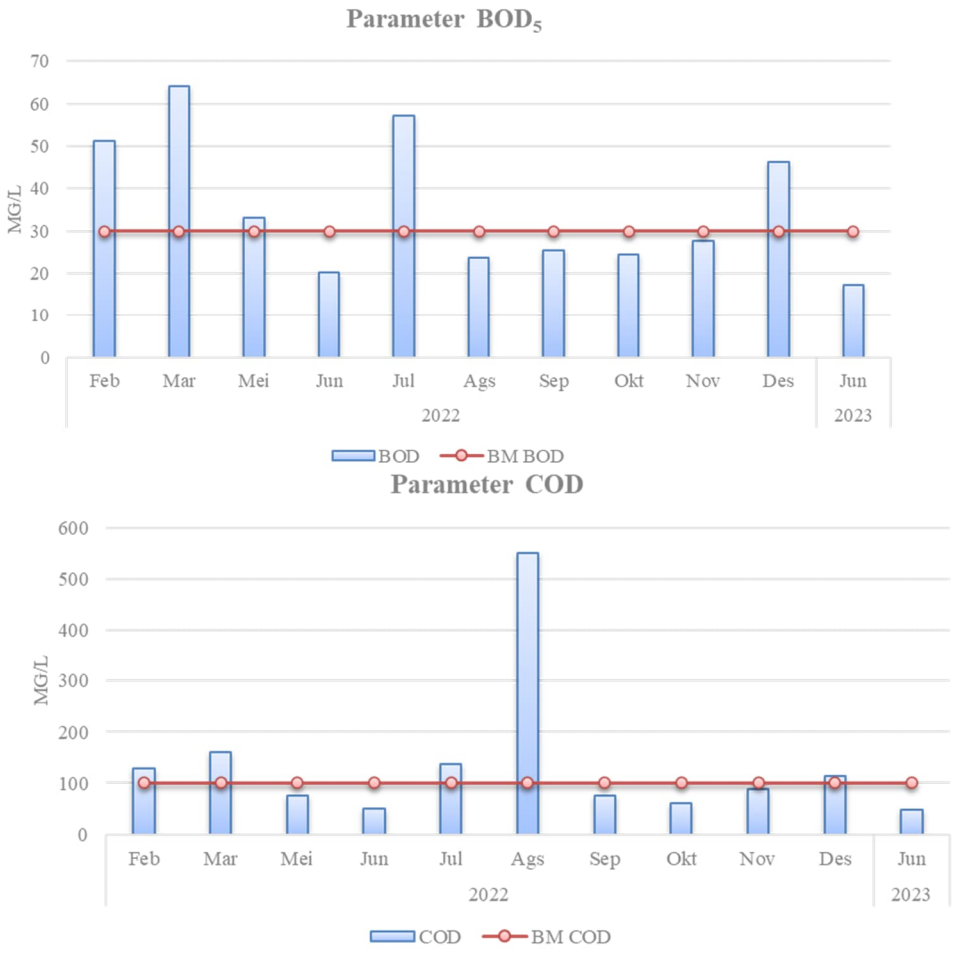


Figure 12 Fluctuation of BOD_5 and COD Concentration in Domestic Wastewater at WWTP Temporary Office Outlet

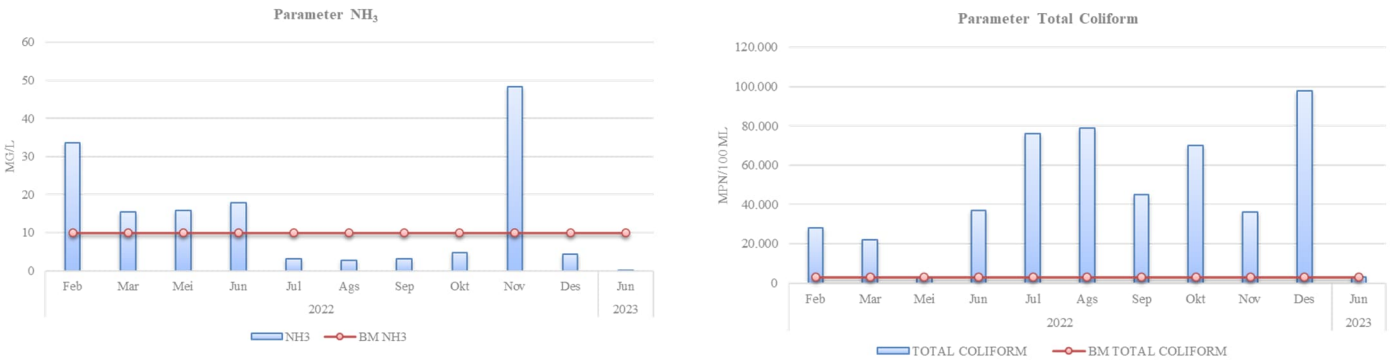


Figure 13 Fluctuations in NH_3 Parameters and Total Coliform in Domestic Wastewater From WWTP Temporary Office Outlets

2. Surface Water Trends Analysis

The results of calculating the status of water quality using the river water Pollution Index (IP) method during the implementation of pre-construction activities and the initial construction of PLTP Patuha Unit 2 are in **Table** . Based on**Table** , in 5 (five) waters monitored in the second quarter of 2023 have a light pollution index. The trend of surface water IP for rivers is shown in **Figure** , where in the second quarter of 2023 monitoring, in general, river water IP in 5 (five) monitoring locations is in the Light Pollution category.

Table 45 Results of Calculation of Surface Water Quality Status of PLTP Patuha Unit 2 Activities

YEAR	MONITORING PERIOD	S. CIWIDEY HULU		S. CIBUNI HULU		S. CIPANDAK WETAN		S. CIKAHURIPAN		S. CIPAKU	
		IP	STATUS	IP	STATUS	IP	STATUS	IP	STATUS	IP	STATUS
2021	Q-1	0,56	Good	0,82	Good	1,55	Light contaminants	0,90	Good	-	-
	Q-2	1,01	Light contaminants	0,84	Good	0,49	Good	0,53	Good	-	-
	Q-3	0,53	Good	0,54	Good	1,58	Light contaminants	1,56	Light contaminants	-	-
	Q-4	0,60	Good	0,85	Good	0,77	Good	2,17	Light contaminants	-	-
2022	Q-1	-	-	-	-	0,54	Good	-	-	-	-
	Q-2	0,50	Good	0,52	Good	0,51	Good	0,56	Good	-	-
	Q-3	0,59	Good	0,53	Good	1,86	Light contaminants	0,58	Good	-	-
	Q-4	0,57	Good	3,43	Light contaminants	0,53	Good	0,53	Good	-	-
2023	Q-1	2,16	Light contaminants	0,91	Good	1,64	Light contaminants	0,53	Good	1,80	Light contaminants
	Q-2	2,35	Light contaminants	2,29	Light contaminants	1,66	Light contaminants	3,54	Light contaminants	2,10	Light contaminants

Source : Calculation results, 2016 – June 2023
Description: (-) Data not available

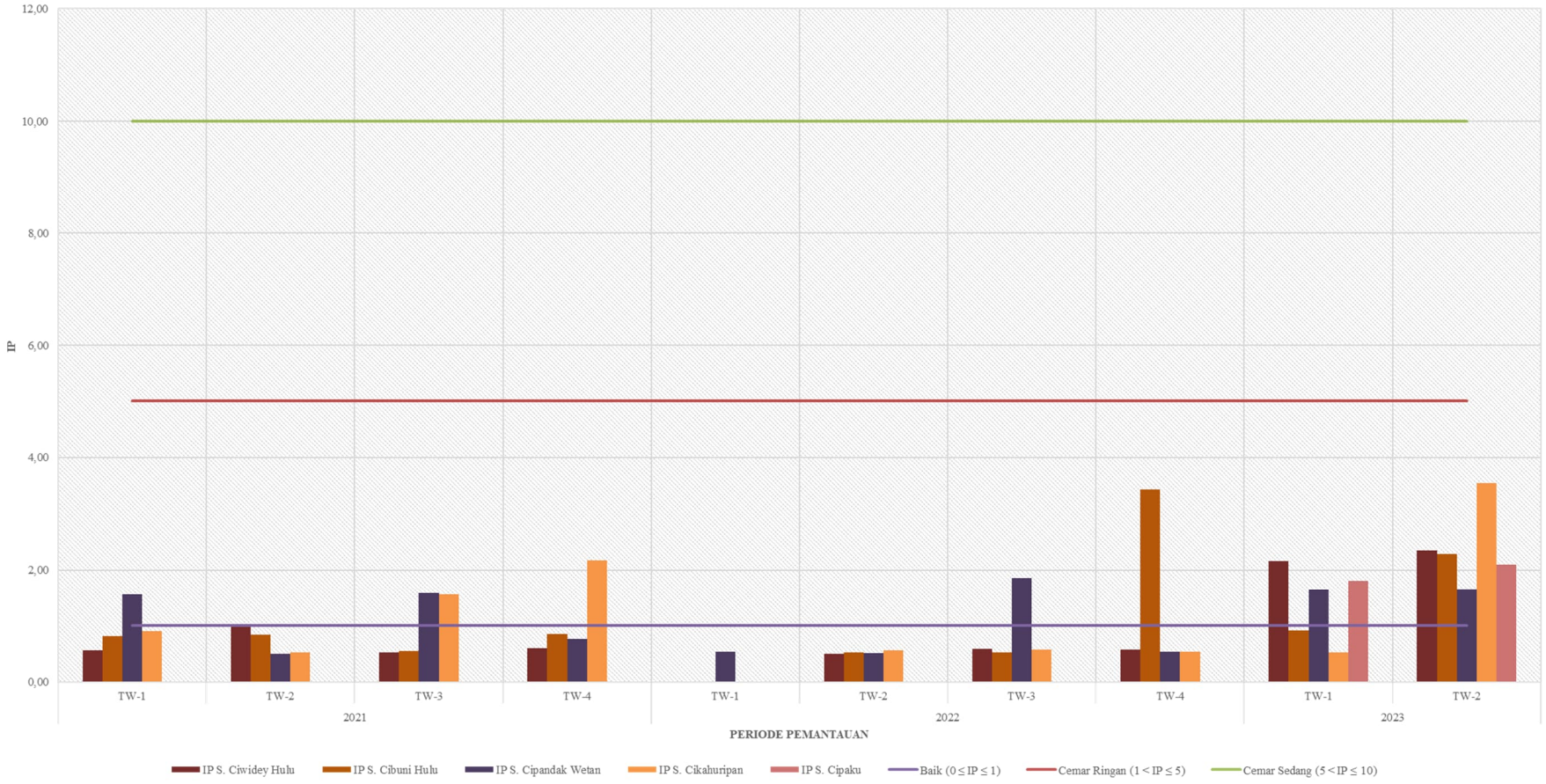


Figure 14 Trend of Tendency of Surface Water Pollution Index (IP) of Patuha PLTP Unit 2 Activities

4. Traffic Monitoring

Traffic conditions monitored from the first quarter of 2021 to the second quarter of 2023 at the locations of Jl. Ciwidey - Rancabali and Jl. Simpang Kendeng showed fluctuating results. The following is a table that presents the average value of VCR on Jl. Ciwidey – Rancabali and Jl. Simpang Kendeng sections during the monitoring period of 2021 to the second quarter of 2023.

Table 43 Changes in Road Capacity in the Study Area for the Q-I to Q-II period in 2023

LOCATION	AVERAGE VCR									
	2021				2022				2023	
	Q-1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2
Jl. Ciwidey - Rancabali (Direction Bandung)	0,98	0,96	0,97	0,69	1,01	0,81	0,89	0,85	0,40	0,50
Jl. Ciwidey - Rancabali (Direction Ciwidey)	0,66	0,67	0,67	0,85	0,72	0,55	1,27	1,02	0,44	0,37
Jl. Simpang Kendeng (Direction Jl. Ciwidey - Rancabali)	0,22	0,21	0,22	0,34	0,33	0,14	0,16	0,16	0,17	0,20
Jl. Simpang Kendeng (PLTP Direction)	0,26	0,23	0,23	0,25	0,42	0,21	0,17	0,18	0,15	0,16

Source: Analysis results, 2021 to June 2023

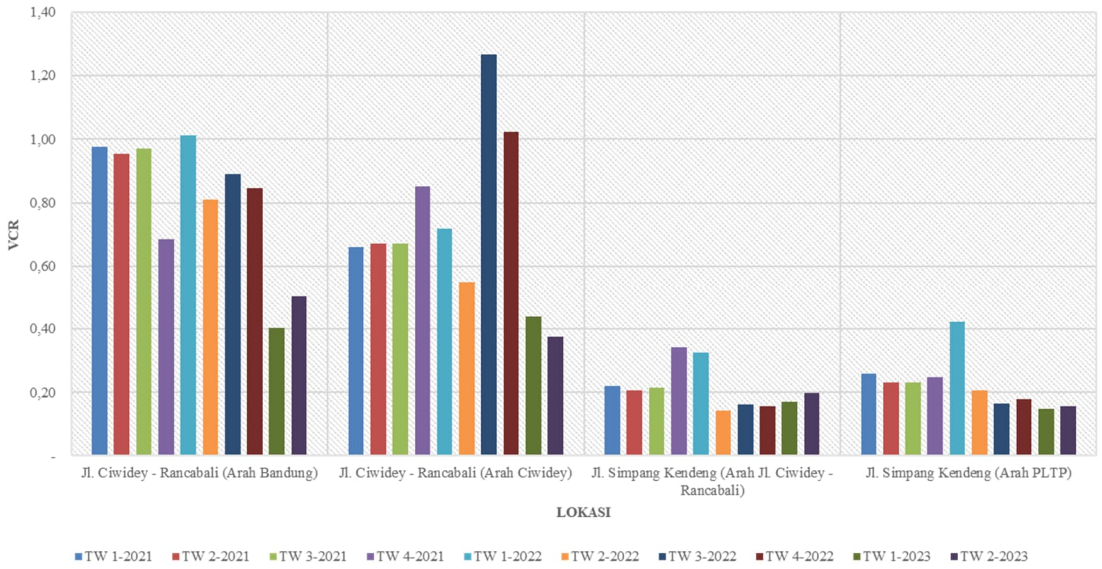


Figure 6 Average VCR Value Trends in the First Quarter of 2021 – Second Quarter of 2023

5. Road Infrastructure Damage

In the monitoring period of the first quarter of 2022 3, the physical condition of road sections in the study area tends not to experience significant changes when compared to road conditions in the monitoring period of the first quarter of2023. Along 5,683 meters of damaged roads, this is estimated to be caused by the absence of road drainage that can drain *the run-off* that occurs, especially during rain. So that the *run-off* that appears after rain, will pool on the road body, where it can affect the decline in the quality of road pavement.

6. Slope Stability (Soil Erosion)

Based on the results of observations in the field and information from the community around the location of PT. Geo Dipa Energi (Persero) Patuha Unit during the monitoring period of Quarter II of 2023, it can be concluded that there were no landslides due to natural soil movement or caused by land maturation activities of the construction of PLTP Patuha Unit 2. This condition tends not to experience significant changes when compared to conditions during the previous monitoring period. However, there are several potential landslide points in the Loc BB area (S 7 0 10' 04.3" – E 107 0 24' 57.7"), where slopes without vegetation are found that have the potential to cause surface erosion especially during rain, which can also cause the potential for rockblock collapse and can cause damage to portacamp in the Loc BB area.

Based on the results of field observations, during the monitoring period of the first quarter of 2023, it can be concluded that locations that have the potential for erosion are on road access to Loc BB and in the Loc BB area, considering that land clearing is being carried out in these locations. Small-scale erosion occurred in the Loc BB area and *laydown area*, but did not cause avalanches. The influence of slope slope on erosion is due to surface flow velocity. The more sloped the slope, the faster the water flows. Handling potential erosion at Loc BB has been minimized by installing tarpaulins in land clearing areas and installing gabion.

7. Biodiversity

Flora

Based on the elevation, the type of vegetation community at protected forest surrounding the pad BB and access road is categorized into a mountainous natural forest (van Steenis, 2006). The ongoing activity at the Patuha 2 Project Site is the construction of new production wells after a 2.85 Ha land clearing activity.

The entire forest where the biodiversity monitoring undertaken is located at 1,983 above msl. Based on the altitudinal zonation of forest vegetation, this forest vegetation at monitoring location is located at montane zone (van Steenis, 2006). The species richness among the period of monitoring (Quarter 4 of 2022 to Quarter 2 of 2023) advised that total number of species ranged between 31-58. The highest number of species was record in Quarter 2 of 2023 (Table 46). This is good indication for knowing that there is no significant Project impact to the flora community at the forest where well development is on-going.

Given the monitoring location is located at the area where the project impact is less, the observations in March (Quarter or Q-1) and June (Q-2) 2023 advised that there is no significant different of Shannon-Wiener species diversity index (H') for all vegetation stages (tree, pole, stake and seedling) between those quarter monitoring periods. The Shannon & Wiener species diversity index for all vegetation stage categories between Q-1 and Q-2 is classified into medium ($1<H'<3$). More details figure of flora diversity can be seen in the following table and figure.

Table 46 Floristic Species Composition at Monitoring Site of Pad BB

NO	2nd Quarter Monitoring				1st Quarter Monitoring			
	FAMILY/ ORDO	LOCAL NAME	SCIENTFIC NAME	CONSERVATION STATUS	FAMILY/ ORDO	LOCAL NAME	SCIENTFIC NAME	CONSERVATION STATUS
1	Actinidiaceae	Ki leho	*Saurauia Bracteosa*	VU	Sapindaceae	Acer	*Acer laurinum*	LC
2	Araliaceae	Cerem	*Macropanax dispermus*	LC	Rutaceae	Ki jeruk	*Acronychia pedunculata*	LC
3	Arecaceae	Binbin	*Cyrtostachys* sp.		Primulaceae	DC0112	*Ardisia villosa*	
4		Kirinyuh	*Chromolaena odorata*		Euphorbiaceae	Talingkup	*Claoxylon longifolium*	LC
5		Harega	*Bidens pilosa*		Lauraceae	Huru	*Cryptocarya densiflora*	LC
6		Jotang	*Acmella paniculata*		Podocarpaceae	Jamuju	*Dacrycarpus imbricatus*	LC
7	Balanophoraceae	Balanophora	*Balanophora fungosa*		Juglandaceae	Ki hujan	*Engelhardia spicata*	LC
8	Begoniaceae	Begonia	*Begonia* sp		Moraceae	Beunying	*Ficus fistulosa*	
9	Cyperceae	Rumput Kenop	*Kylinga monocephala*		Flacourtiaceae	Rukem	*Flacourtia rukam*	
10	Dicksoniaceae	Paku Tiang	*Dicksonia antarctica*		Phyllanthaceae		*Glochidion sp.*	
11	Euphorbiaceae	Talingkup	*Claoxylon longifolium*	LC	Proteaceae	Helicia	*Helicia serrata*	
12		Kareumbi	*Homalanthus populneus*		Euphorbiaceae	Kareumbi	*Homalanthus populneus*	
13		Mara	*Macaranga tanarius*		Rubiaceae	Lasianthus	*Lasianthus sp.1*	
14	Fabaceae	Putri Malu	*Mimosa pudica*		Lauraceae		*Lindera lucida*	LC
15	Fagaceae	Pasang	*Lithocarpus indutus*	VU	Fagaceae	Pasang	*Lithocarpus indutus*	VU
16		Pasang	*Lithocarpus pallidus*		Fagaceae		*Lithocarpus pallidus*	
17	Flacourtiaceae	Rukem	*Flacourtia rukam*		Lauraceae	Litsea	*Litsea diversifolia*	
18	Juglandaceae	Ki hujan	*Engelhardia spicata*	LC	Araliaceae	Cerem	*Macropanax dispermus*	LC
19	Lauraceae	Huru	*Cryptocarya densiflora*	LC	Sabiaceae		*Meliosma sp.*	
20		Huru	*Lindera lucida*	LC	Lauraceae		*Persea rimosa*	
21		Litsea	*Litsea diversifolia*		Actinidiaceae	Ki leho	*Saurauia Bracteosa*	VU
22		Huru	*Persea rimosa*		Theaceae	Puspa	*Schima walichii*	
23	Lecanorales	Likhen	*Graphis sp.*		Myrtaceae	Ki tambaga	*Syzygium antisepticum*	
24		Lumut jenggot	*Usnea sp*		Myrtaceae	Syzygium	*Syzygium sp.1*	
25	Lycopodiaceae	Kumpay	*Huperzia selago*		Myrtaceae	Ki sireum	*Syzygium lineatum*	
26		Kumpay ekor monyet	*Huperzia squarrosa*		Rubiaceae	Urophyllum	*Urophyllum arboreum*	
27	Malvaceae	Sidagori	*Sida rhombifolia*		Rubiaceae	Ki kopi	*Urophyllum sp.*	
28	Moraceae	Beunying	*Ficus fistulosa*		Polyosmaceae		*Polysma ilicifolia*	
29		Murbai hutan	*Morus alba*		Rutaceae		*Acronychia sp.1*	
30	Myrtaceae	Ki tambaga	*Syzygium antisepticum*		Podocarpaceae	Ki putri	*Podocarpus neriifolius*	LC
31		Syzygium	*Syzygium sp.1*		Balanophoraceae	Balanophora	*Balanophora fungosa*	
32		Ki sireum	*Syzygium lineatum*		Orchidaceae	Kalante	*Calanthe flava*	App II
33	Orchidaceae	Kalante	*Calanthe flava*	App II				
34		Anggrek	*Dendrobium excavantum*	App II				
35		Anggrek	*Bulbophyllumovalifolium*	App II				
36	Parmeliaceae	Lumut jenggot	*Bryoria* sp					
37	Peltigeraceae	Likhen	*Pseudocyohelaria* sp.					
38		Likhen	*Sticta sp1*					
39		Likhen	*Sticta sp2*					
40		Likhen	*Sticta sp3*					
41	Phyllanthaceae	Glochidion	*Glochidion sp.*					
42	Podocarpaceae	Jamuju	*Dacrycarpus imbricatus*	LC				
43		Ki putri	*Podocarpus neriifolius*	LC				
44	Polyosmaceae	Ki Apu	*Polysma ilicifolia*					
45	Primulaceae	Ardisia	*Ardisia villosa*					
46	Proteaceae	Helicia	*Helicia serrata*					
47	Rubiaceae	Lasianthus	*Lasianthus sp.1*					
48		Urophyllum	*Urophyllum arboreum*					
49		Ki kopi	*Urophyllum sp.*					
50	Rutaceae	Ki jeruk	*Acronychia pedunculata*	LC				
51		Jerukan	*Acronychia sp.1*					
52	Sabiaceae	Meliosma	*Meliosma sp.*					
53	Sapindaceae	Acer	*Acer laurinum*	LC				
54	Theaceae	Puspa	*Schima walichii*					
55	Verbenaceae	Saliara	*Lantana camara*					
56	Asteraceae	Teklan	*Eupatorium triplinerve*					

NO	2nd Quarter Monitoring				1st Quarter Monitoring			
	FAMILY/ ORDO	LOCAL NAME	SCIENTFIC NAME	CONSERVATION STATUS	FAMILY/ ORDO	LOCAL NAME	SCIENTFIC NAME	CONSERVATION STATUS
57	Balsaminaceae	Pacar tere	*Impatiens balsamina*					
58	Pandanaceae	Cangkuang	*Pandanus Furcatus*					

Source: Field Observation, March and June 2023, Quarterly Environmental Permit Implementation Report 1st Quarter Monitoring and 2nd Quarter Monitoring

Note:

- *LC = Least Concern, IUCN Red List*
- *VU = Vulnerable, IUCN Red List*
- *App II (CITES - Convention of International Trade in Endangered Species of Wild Fauna and Flora) includes species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival.*

Table 47 Biodiversity Index (H') at Monitoring Site of Pad BB

NO	LOCAL NAME	SCIENTIFIC NAMES	1st Quarter Monitoring					2nd Quarter Monitoring				
			FR (%)	KR (%)	DR (%)	INP (%)	H'	FR (%)	KR (%)	DR (%)	INP (%)	H'
Tree												
1	Puspa	*Schima walichii*	37.50	56.00	69.57	163.07		33,33	48,48	47,10	128,92	
2	Ki tambaga	*Syzygium antisepticum*	18.75	16.00	20.38	55.13		12,50	12,12	27,80	52,42	
3	Cerem	*Macropanax dispermum*	18.75	12.00	4.75	35.50		12,50	9,09	19,77	41,36	
4	Huru	*Persea rimosa*	6.25	4.00	1.26	11.51		4,17	3,03	0,84	8,04	
5	Ki hujan	*Engelhardia spicata*	6.25	4.00	1.13	11.38	1.33	12,50	9,09	0,75	22,34	1,64
6	Pasang	*Lithocarpus sp.*	12.50	8.00	2.91	23.41		12,50	9,09	1,38	22,97	
7	Ki leho	*Saurauia Bracteosa*						4,17	3,03	0,56	7,76	
8	Huru	*Lindera lucida*						8,33	6,06	1,79	16,19	
Total			100,00	100,00	100,00	300,00		100,00	100,00	100,00	300,00	
Pole												
1	Ki tambaga	*Syzygium antisepticum*	5.56	8.70	7.31	21.56		5,00	8,00	10,90	23,90	
2	Huru	*Cryptocarya densiflora*	27.78	21.74	14.51	64.03		25,00	20,00	5,34	50,34	
3	Cerem	*Macropanax dispermum*	27.78	30.43	41.41	99.62		25,00	28,00	2,46	55,46	
4		*Lindera lucida*						5,00	8,00	5,97	18,97	
5	Urophyllum	*Urophyllum arboreum*	5.56	4.35	9.46	19.37		5,00	4,00	12,74	21,74	
6	Puspa	*Schima walichii*	5.56	4.35	4.75	14.65	1.83	5,00	4,00	6,29	15,29	2,02
7	Ki kopi	*Urophyllum sp.*	5.56	4.35	4.75	14.65		5,00	4,00	20,22	29,22	
8	Talingkup	*Claoxylon longifolium*						15,00	16,00	20,71	51,71	
9	Ki sireum	*Syzygium lineatum*						5,00	4,00	11,11	20,11	
10	Ki putri	*Podocarpus neriifolius*						5,00	4,00	4,26	13,26	
Total			100,00	100,00	100,00	300,00		100,00	100,00	100,00	300,00	
Stake												
1	Syzygium	*Syzygium sp.1*	2.44	1.92	0.19	4.56		2,33	1,85	0,19	4,36	
2	Helicia	*Helicia serrata*	2.44	1.92	2.17	6.53		2,33	1,85	2,23	6,41	
3	Huru	*Cryptocarya densiflora*						9,30	9,26	16,72	35,28	
4	Ki kopi	*Urophyllum sp.1*	14.63	23.08	15.85	53.56		13,95	22,22	15,39	51,56	
5	Jamuju	*Dacrycarpus imbricatus*	7.32	5.77	1.21	14.30		6,98	5,56	1,31	13,84	
6	Lasianthus	*Lasianthus sp.1*						2,33	1,85	0,74	4,92	
7	Ardisia	*Ardisia villosa*	2.44	1.92	0.09	4.45		2,33	1,85	0,12	4,30	
8	Talingkup	*Claoxylon longifolium*	9.76	9.62	9.46	28.83		9,30	9,26	9,20	27,76	
9	Polyosma	*Polyosma ilicifolia*	2.44	1.92	0.78	5.14		2,33	1,85	0,74	4,92	
10	Mirip rambutan	*Lindera lucida*	7.32	5.77	12.99	26.08		6,98	5,56	12,86	25,39	
11	Puspa	*Schima walichii*	4.88	5.77	0.52	11.17		4,65	5,56	0,53	10,73	
12	Glochidion	*Glochidion sp.*	4.88	3.85	8.75	17.47	2.65	4,65	3,70	8,32	16,68	2,79
13	Ki tambaga	*Syzygium antisepticum*	4.88	3.85	2.51	11.24		4,65	3,70	2,51	10,86	
14	Meliosma	*Meliosma sp.*	2.44	3.85	0.69	6.98		2,33	3,70	0,69	6,72	
15	Litsea	*Litsea diversifolia*	7.32	5.77	2.25	15.34		6,98	5,56	2,35	14,88	
16	Ki leho	*Saurauia bracteosa*	4.88	3.85	12.91	21.63		4,65	3,70	12,45	20,80	
17	Beunying	*Ficus fistulosa*	4.88	3.85	2.51	11.24		4,65	3,70	2,39	10,74	
18	Mirip salam	*Syzygium sp.2*	2.44	1.92	1.39	5.75		2,33	1,85	1,32	5,50	
19	Kareumbi	*Homalanthus populneus*						2,33	3,70	7,87	13,90	
20	Acer	*Acer laurinum*						2,33	1,85	1,52	5,70	
21	Kareumbi	*Homalanthus populneus*	2.44	3.85	7.80	14.08		2,33	1,85	0,56	4,73	
Total								100,00	100,00	100,00	300,00	
Seedling												
1	Lithocarpus	*Lithocarpus* sp.1	7.69	6.25	7.14	21.09		6,67	4,55	5,41	16,62	
2	Jamuju	*Dacrycarpus imbricatus*	7.69	6.25	7.14	21.09		6,67	4,55	10,81	22,02	
3	Helicia	*Helicia serrata*	7.69	6.25	7.14	21.09		6,67	13,64	5,41	25,71	
4	Puspa	*Schima walichii*						6,67	4,55	5,41	16,62	
5	Cerem	*Macropanax dispermum*	15.38	12.50	14.29	42.17		13,33	9,09	8,11	30,53	
6	Ki kopi	*Urophyllum sp.*						6,67	4,55	5,41	16,62	
7	Rukem	*Flacourtia rukam*	15.38	25.00	17.86	58.24		13,33	27,27	16,22	56,82	
8	Acer	*Acer laurinum*	7.69	6.25	7.14	21.09	2.25	6,67	4,55	5,41	16,62	2,33
9	Ki jeruk	*Acronychia pedunculata*	7.69	6.25	7.14	21.09		6,67	4,55	5,41	16,62	
10	Litsea	*Litsea glutinosa*	7.69	12.50	10.71	30.91		6,67	9,09	16,22	31,97	
11	Ki hujan	*Engelhardia spicata*	7.69	6.25	7.14	21.09		6,67	4,55	2,70	13,91	
12	Huru	*Lindera lucida*						6,67	4,55	8,11	19,32	
13	Pasang	*Lithocarpus indutus*	7.69	6.25	7.14	21.09		6,67	4,55	5,41	16,62	
Total			100,00	100,00	100,00	300,00		100,00	100,00	100,00	300,00	
Bush												
1	Dichroa	*Dichroa febrifuga*	6.67	0.93	0.01	7.61		3,33	0,68	0,33	4,34	
2	Bubukuan	*Strobilanthes cernua*	66.67	91.59	99.30	257.55		33,33	66,67	3,96	103,96	
3		*Scuttelaria discolor*	6.67	0.93	0.01	7.61		3,33	0,68	0,33	4,34	
4	Harendong	*Melastoma malabathricum*	6.67	1.87	0.51	9.04		3,33	1,36	9,57	14,26	
5	Sereh Leweng	*Piper sulcatum*	6.67	0.93	0.17	7.77		3,33	0,68	0,33	4,34	
6	Kirinyuh	*Austroeupatorium inulaefolium*	6.67	3.74	0.01	10.42		3,33	2,72	0,33	6,38	
7	Begonia	*Begonia* sp					0.41	13,33	6,12	8,25	27,71	1,23
8	Saliara	*Lantana camara*						6,67	1,36	0,66	8,69	
9	Murbai hutan	*Morus alba*						6,67	1,36	0,66	8,69	
10	Putri Malu	*Mimosa pudica*						10,00	2,04	0,99	13,03	
11	Rumput Kenop	*Kylinga monocephala*						6,67	14,29	72,94	93,89	
12	Sidagori	*Sida rhombifolia*						6,67	2,04	1,65	10,36	
Total			100,00	100,00	100,00	300,00		100,00	100,00	100,00	300,00	
Florest Floor (Undergrowth)												
1	Rendeu badak	*Cyrtandra picta*	4.00	18.97	7.14	30.11		4,00	18,97	7,14	30,11	
2	Ilat	*Scleria sp.*	4.00	3.45	3.57	11.02		4,00	3,45	3,57	11,02	
3	Hareueus	*Rubus*	4.00	1.72	3.57	9.30		4,00	1,72	3,57	9,30	
4	Ardisia	*Ardisia sp.*	8.00	3.45	8.93	20.38		8,00	3,45	8,93	20,38	
5	Ardisia bulu	*Ardisia villosa*	4.00	1.72	3.57	9.30		4,00	1,72	3,57	9,30	
6	Bubukuan	*Strobilanthes cernua*	16.00	10.34	14.29	40.63		16,00	10,34	14,29	40,63	
7	Piper	*Piper sulcatum*	12.00	5.17	12.50	29.67	2.25	12,00	5,17	12,50	29,67	2,25
8	Pinding	*Hornstedtia sp.*	4.00	3.45	3.57	11.02		4,00	3,45	3,57	11,02	
9		*Scuttelaria discolor*	8.00	3.45	5.36	16.81		8,00	3,45	5,36	16,81	
10	Ki kores	*Psychotria montana*	12.00	18.97	10.71	41.68		12,00	18,97	10,71	41,68	
11	Teklan	*Ageratina riparia*	8.00	8.62	8.93	25.55		8,00	8,62	8,93	25,55	
12	Popohan	*Pilea melastomoides*	8.00	17.24	10.71	35.96		8,00	17,24	10,71	35,96	
13	Begonia putih	*Begonia multangula*	8.00	3.45	7.14	18.59		8,00	3,45	7,14	18,59	
Total			100,00	100,00	100,00	300,00		100,00	100,00	100,00	300,00	

Source: Field Observation, March and June 2023, Quarterly Environmental Permit Implementation Report 1st Quarter Monitoring and 2nd Quarter Monitoring
Note: FR = Relative Frequency, KR =Relative Density, DR = Relative Dominance, INP or H' = Important Value Index

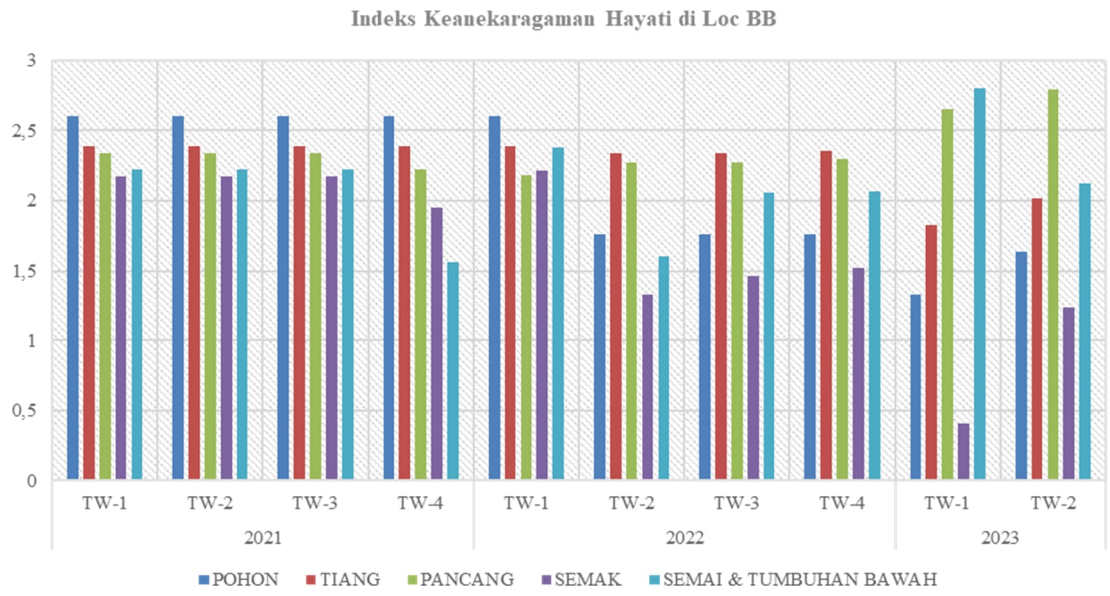


Figure 15 Biodiversity Index (H') at Monitoring Site of Pad BB

Figure 15 above shows that the diversity index in particularly stake to tree vegetation category as monitored during 2021 (Q-1 – Q4), 2022 (Q-1 – Q4) and 2023 (Q-1 – Q2) are not quite different. It means there is no significant impact of Project to the forest at surrounding area of Project site.

Figure 16 Vegetation nearby the Project Site Outer Boundary on Pad BB

Figure 17 Interior of Protected Forest outside Pad BB and Flora Primary Data Collection

Fauna

The good conditions of habitat will affect to the fauna species richness. The monitoring of flora indicated that there is no significant Project impact to the flora community at the forest where well development is on-going. It was reflected to the trend of fauna species richness and diversity where the wildlife monitoring during 2021 (Q-1 – Q4), 2022 (Q-1 – Q4) and 2023 (Q-1 – Q2) shows that there is no significant declining of wildlife community during Project activity on pad BB.

a. Avifauna

The monitoring during 2021 (Q-1 – Q4), 2022 (Q-1 – Q4) and 2023 (Q-1 – Q2) shows that Shannon-Wiener diversity index of avifauna is relatively stable. It ranged between 3.1 and 3.6 (see Figure 18). It assumed that there is no significant threat to the avifauna community during the on-going well development. The disturbance due to noise is relatively small and it didn't cause the significant migration of avifauna from their existing habitat. The smooth fluctuation of diversity index indicated that the response of avifauna to the noise or other disturbance is not significantly change compared to the condition before the Project commencement.

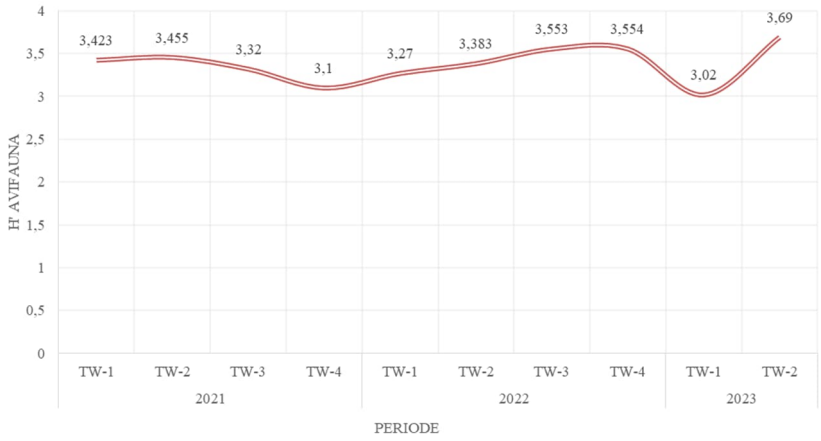


Figure 18 Trend of Avifauna Diversity Index (H') at Monitoring Site of Pad BB

b. Mammalia

The monitoring of mammals shows the different figure compared to avifauna where the species richness in the beginning of Project commencement is low compared to the latest monitoring in Q-1 and Q-2 of 2023 (see 19 and Table 48 below). This figure indicates that the Project impact temporary affected the mammals. They temporary move to avoid Project site

as their response for avoiding any potential physical disturbances (i.e., noise and lights) due to well development activity. Fortunately, they came back to their existing home range as used before the Project commencement.

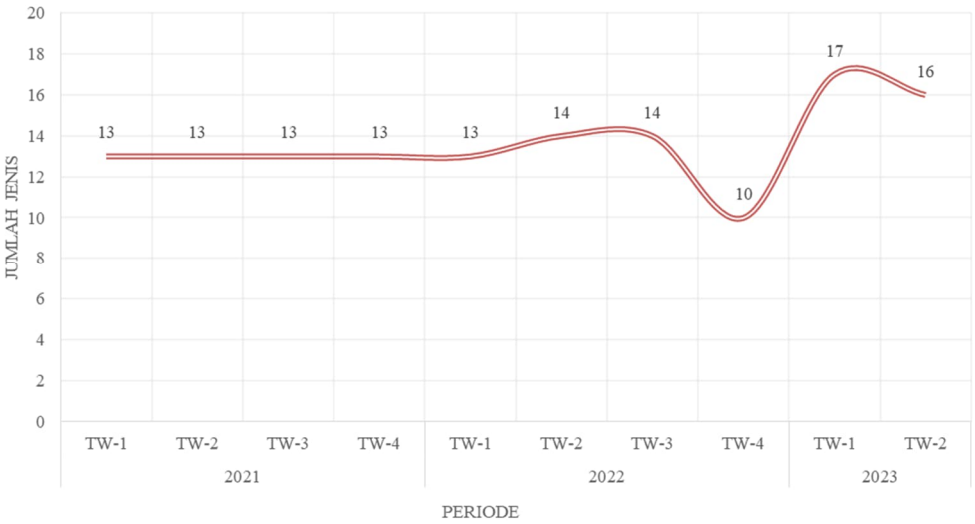


Figure 19 Trend of Mammal Species Richness at Monitoring Site of Pad BB

Table 48 Mammal Species Recorded at Monitoring Site of Pad BB

NO	LOCAL NAME	SCIENTIFC NAMES	CONSERVATION STATUS	MONITORING PERIOD									
				2021				2022				2023	
				Q-1	Q-2	Q-3	Q-4	Q-1	Q-2	Q-3	Q-4	Q-1	Q-2
1	Babi hutan	*Sus scrofa*	LC	I	I	I	I	I	I	I	I	I	I
2	Bajing kelapa	*Callosciurus notatus*	LC	O,I	O,I	O,I	O,I	O,I	O	O	O	O	O
3	Garangan	*Herpestes javanicus*	LC	I	I	I	I	I	I	I	I	I	I
4	Kelelawar/codot	*Cynopterus minutus*	LC	I	I	I	I	I	I	I	-	-	-
5	Kijang	*Muntiaus muntjak*	P/LC	-	-	-	-	-	-	-	CT	I	I
6	Kucing hutan	*Prionailurus bengalensis*	P/LC	I	I	I	I	I	I	I	CT	I	I
7	Linsang	*Prionodon linsang*	LC	I	I	I	I	I	I	I	-	-	-
8	Lutung	*Trachypithecus auratus*	P/LC	I	I	I	I	I	O	O	O	I	I
9	Monyet ekor panjang	*Macaca fascicularis*	LC	I	I	I	I	I	O	I	I	I	I
10	Musang Luwak	*Paradoxurus hermaphrodites*	LC	I	I	I	I	I	I	I	I	I	I
11	Sigung	*Mydaus javanensis*	LC	I	I	I	I	I	I	I	-	-	-
12	Surili	*Presbytis comate*	P/EN	O,I	O,I	O,I	O,I	O,I	O	O	O	O	O
13	Tikus	*Rattus exulans*	LC	I	-	-	-	-	I	I	-	-	-
14	Tikus belukar	*Rattus tiomanicus*	LC	I	O,I	O,I	O,I	O,I	O	I	I	I	I
15	Tupai kekes	*Tupaia javanicus*	LC	-	I	I	I	I	I	I	O	O	O
16	Trenggiling	*Manis javanica*	P/LC	-	-	-	-	-	-	-	-	I	I
17	Macan tutul Jawa	*Panthera pardus melas*	P/EN	-	-	-	-	-	-	-	-	I	I
18	Landak	*Hystrix javanica*	P/LC	-	-	-	-	-	-	-	-	I	I
19	Sero	*Amblonyx cinerea*	VU	-	-	-	-	-	-	-	-	I	I
20	Kukang	*Nycticebus javanicus*	P/CR	-	-	-	-	-	-	-	-	I	I
21	Musang Pandan	*Viverricula indica*	LC	-	-	-	-	-	-	-	-	I	I
22	Careh bulan	*Paguma larvata*	LC	-	-	-	-	-	-	-	-	I	I
23	Biul	*Melogale orientalis*	LC	-	-	-	-	-	-	-	-	I	I
Jumlah				13	13	13	13	13	14	14	10	17	17

Source: Feld Observation 2021 - June 2023, Quarterly Environmental Permit Implementation Report 2021, 2022 and 2023 (1st Quarter Monitoring and 2nd Quarter Monitoring)

Note:

- *Q=Quarter, I= Interview, O=Observed, F= Footprint, CT= Camera Trap*
- *P=Protected by Minister of Environment and Forestry No.P.106/MENLHK/SETJEN/KUM.1/12/2018.*
- *CR = Critically Endangered, IUCN Red List*
- *EN = Endangered, IUCN Red List*
- *LC = Least Concern, IUCN Red List*
- *VU = Vulnerable IUCN Red List*

- *App II (CITES - Convention of International Trade in Endangered Species of Wild Fauna and Flora) includes species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival.*

c. Herpetofauna (Amphibians and Reptiles)

Herpetofauna monitoring shows the similar trend with mammal monitoring. Their response to the Project impact is also similar when they temporary avoid Project site for avoiding any potential physical disturbances (i.e., noise and lights) due to well development activity. It seems they came back to their existing home range as used before the Project commencement.

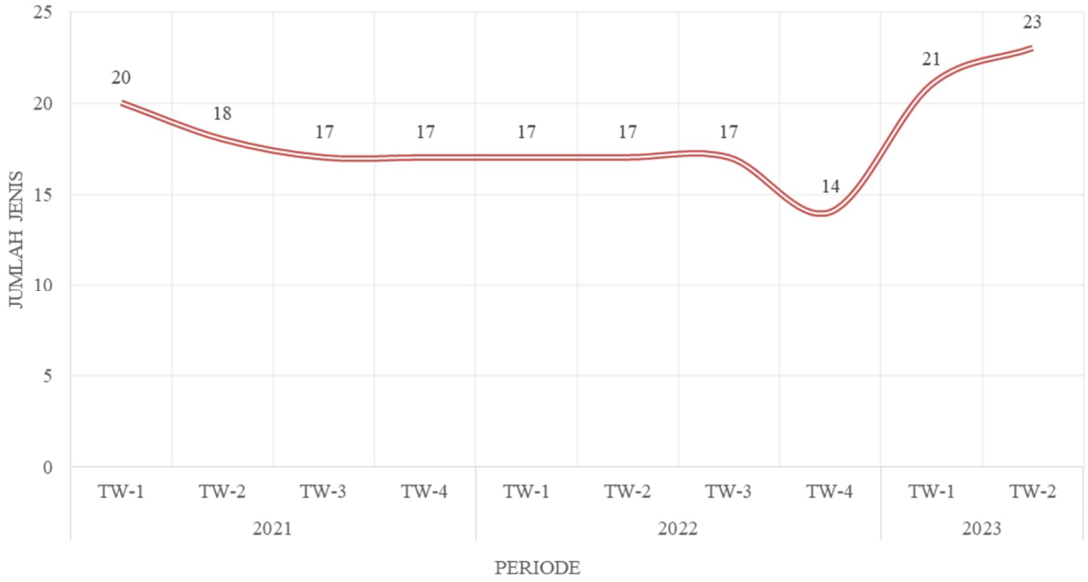
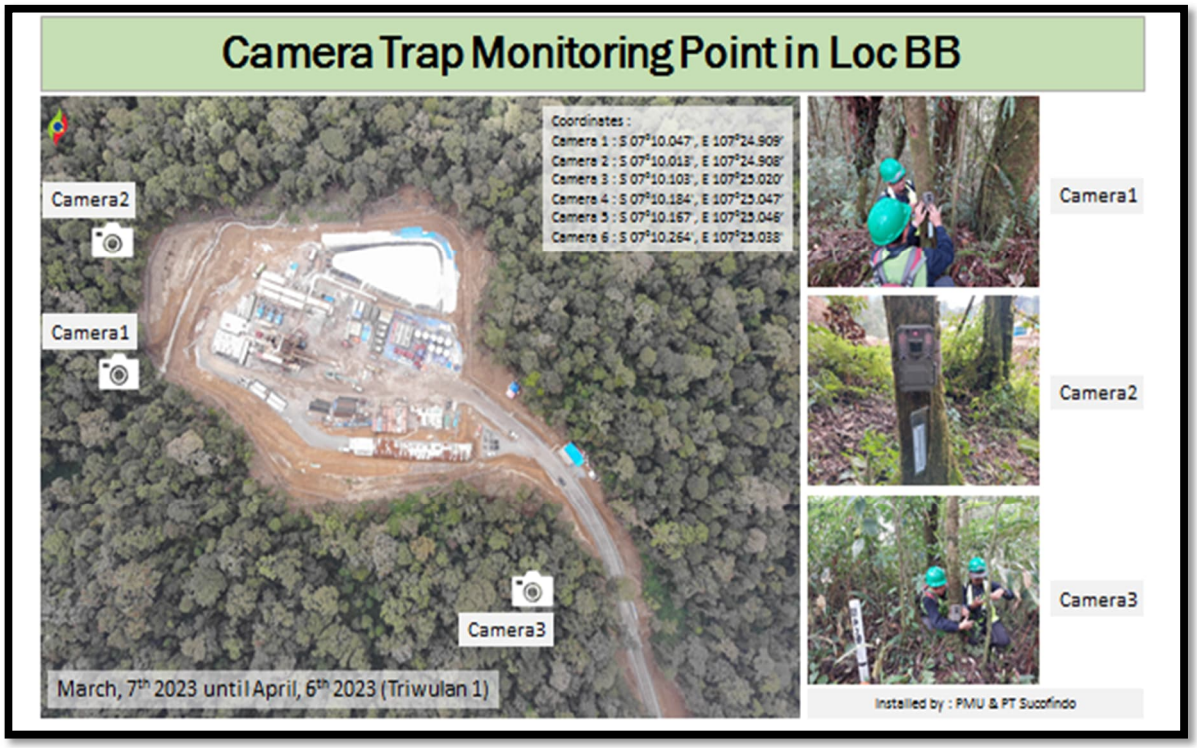


Figure 18 Trend of Changes in the Number of Herpetofauna Species in Loc BB Area



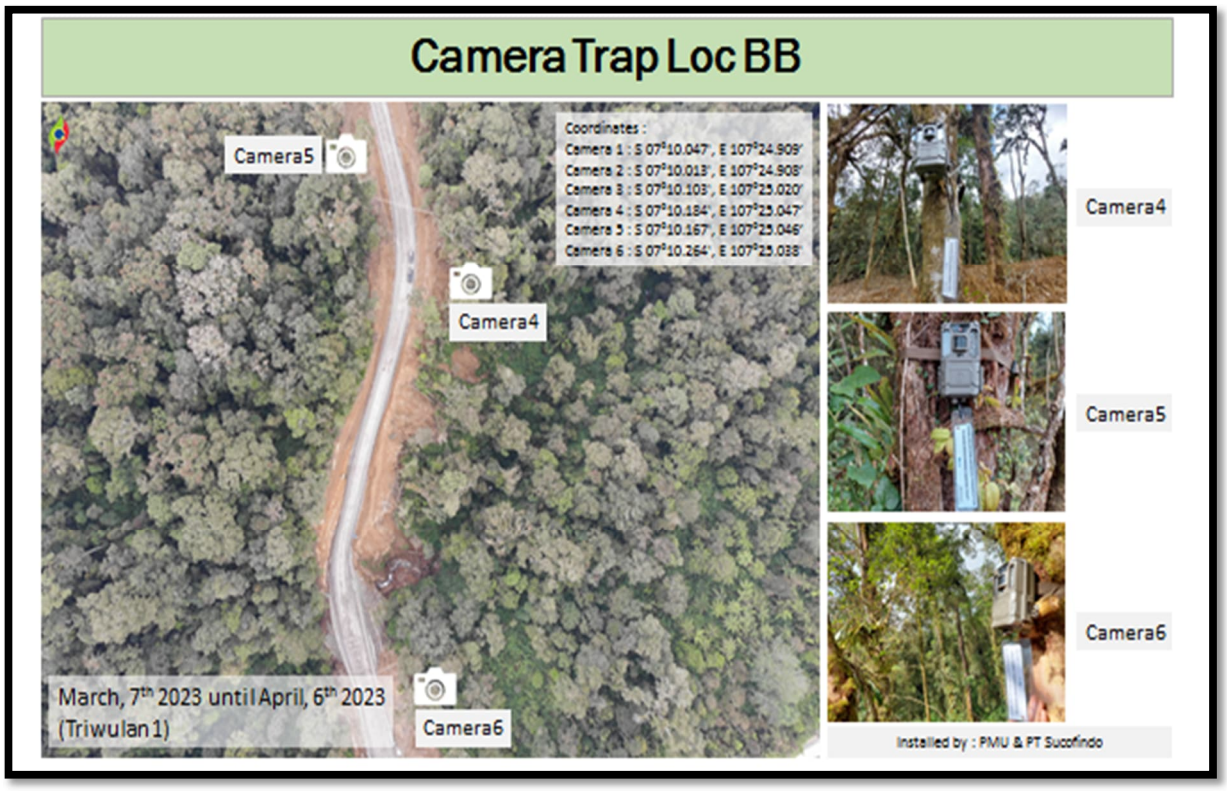


Figure 19 Camera Traps Distribution at Surrounding Pad BB

Figure 20 Camera Trap #1 captured Muntjak Deer (*Muntiaus muntjac*) on 4th March 2023

1. Aquatic Biota

The trend of Patuha Unit 2 Geothermal Power Plant development impact on the decline in productivity of aquatic biota can be seen from the biological impact indicators for surface water quality, namely diversity index of the monitored aquatic biota, in this case plankton and benthos. Based on the monitoring results of the Q-1 of 2023, the plankton diversity index value did not experience significant changes compared to previous monitoring results. Similarly, benthos diversity index is not significantly different with the first quarter of 2023, where no benthos was found. However, the trends during monitoring years, both plankton and benthos tend to fluctuate, so that the diversity index is always changing. It is indicated that the ongoing Project activity might not significantly affect the aquatic biota community. It means the Project impact to the water river quality at the surroings area of Project site is less.

The detailed results of aquatic biota monitoring are provided in the following tables.

Table 49 Plankton Species Diversity Index of surrounding Rivers of P2 Project Site

MONITORING PERIOD		MONITORING LOCATION					
		S. CIPADARUUM KM 8	S. CIPANDAK HILIR	S. CIPANDAK WETAN	S. CIPADARUUM HILIR	S. CIPADARUUM HULU (Pad BB)	S. CIPAKU
2020	Q-1	2,21	-	-	-	-	-
	Q-2	1,89	-	-	-	-	-
	Q-3	1,95	-	-	-	-	-
	Q-4	1,91	-	-	-	-	-
2021	Q-1	1,55	2,64	2,61	-	-	-
	Q-2	2,21	-	2,52	-	-	-
	Q-3	0,54	-	-	-	-	-
	Q-4	0,54	-	-	-	-	-
2022	Q-1	2,65	-	2,72	2,686	2,589	-
	Q-2	0,69	-	-	-	0,85	-
	Q-3	1,43	1,24	0,60	1,00	1,14	-
	Q-4	1,01	0,83	1,39	0,64	0,00	-
2023	Q-1	-	-	1,37	0,64	0	-
	Q-2	-	-	1,37	-	-	0,33
Average		**1,17**	**1,57**	**1,80**	**1,24**	**0,92**	**0,33**

Source: Measurement results from 2020 to June 2023
Noted: (-) Data not available

Table 50 Benthos Species Diversity Index of surrounding Rivers of P2 Project Site

MONITORING PERIOD							
		S. CIPADARUUM KM 8	S. CIPANDAK HILIR	S. CIPANDAK WETAN	S. CIPADARUUM HILIR	S. CIPADARUUM HULU (Pad BB)	S. CIPAKU
2020	Q-1	0,69	-	-	-	-	-
	Q-2	-	-	-	-	-	-
	Q-3	0,69	-	-	-	-	-
	Q-4	0,995	-	-	-	-	-
2021	Q-1	1,01	1,33	0,69	-	-	-
	Q-2	0,693	-	1,10	-	-	-
	Q-3	-	-	-	-	-	-
	Q-4	-	-	-	-	-	-

MONITORING PERIOD		S. CIPADARUUM KM 8	S. CIPANDAK HILIR	S. CIPANDAK WETAN	S. CIPADARUUM HILIR	S. CIPADARUUM HULU (Pad BB)	S. CIPAKU
2022	Q-1	1,332	-	1,06	1,04	-	-
	Q-2	-	-	0,00	-	-	-
	Q-3	0,92	0,00	0,00	0,65	0,72	-
	Q-4	0,00	0,00	0,00	0,00	0,00	-
2023	Q-1	-	-	0,00	0,00	0,00	-
	Q-2	-	-	0,00	-	-	0,00
Average		**0,44**	**0,44**	**0,36**	**0,34**	**0,35**	**0,00**

Source: Measurement results from 2020 to June 2023
Note: (-) Data not available

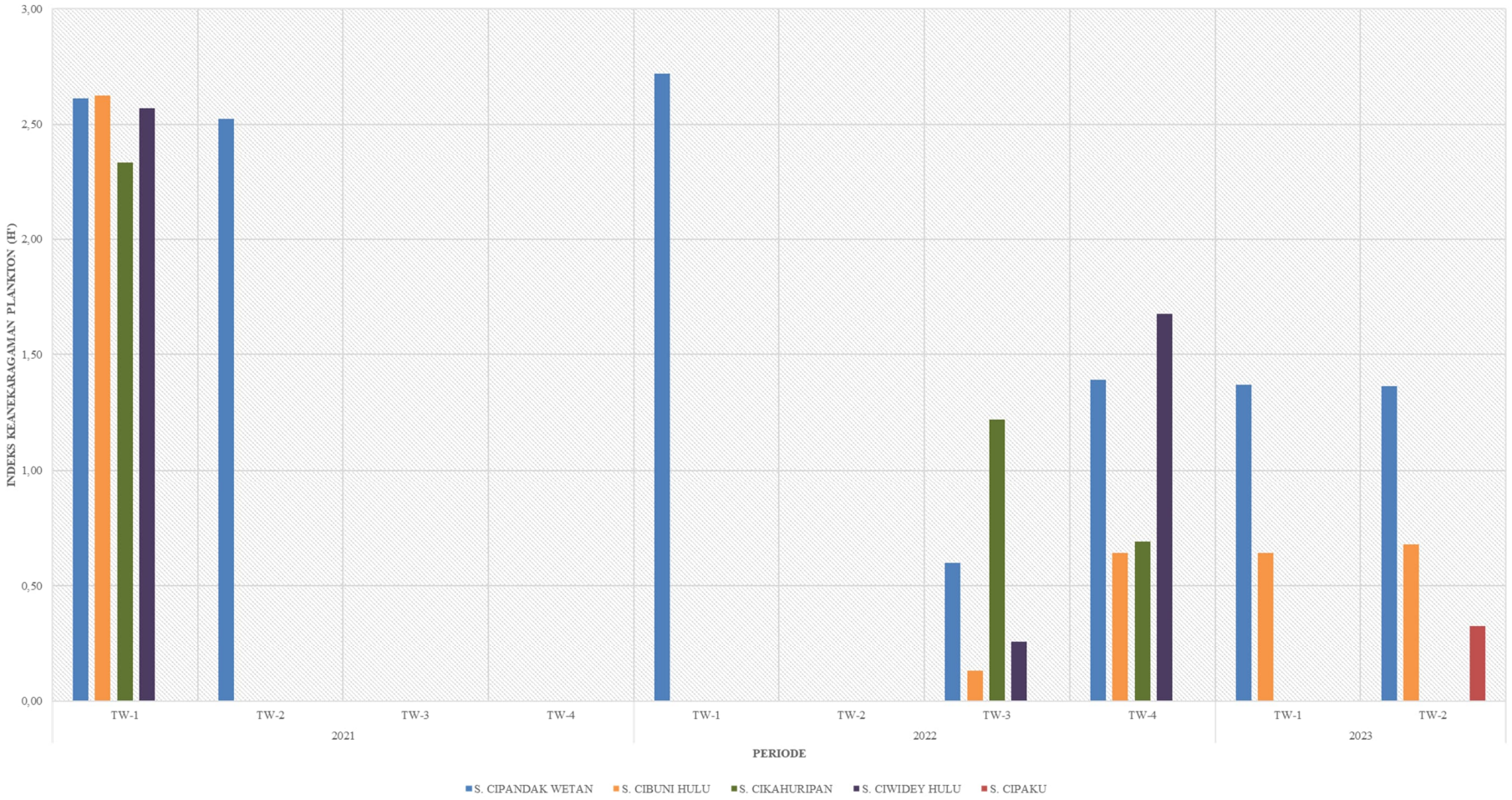


Figure 21 Trend of Plankton Species Diversity Index in Steam Field Development Activities and Patuha Unit 2 Power Plant Construction

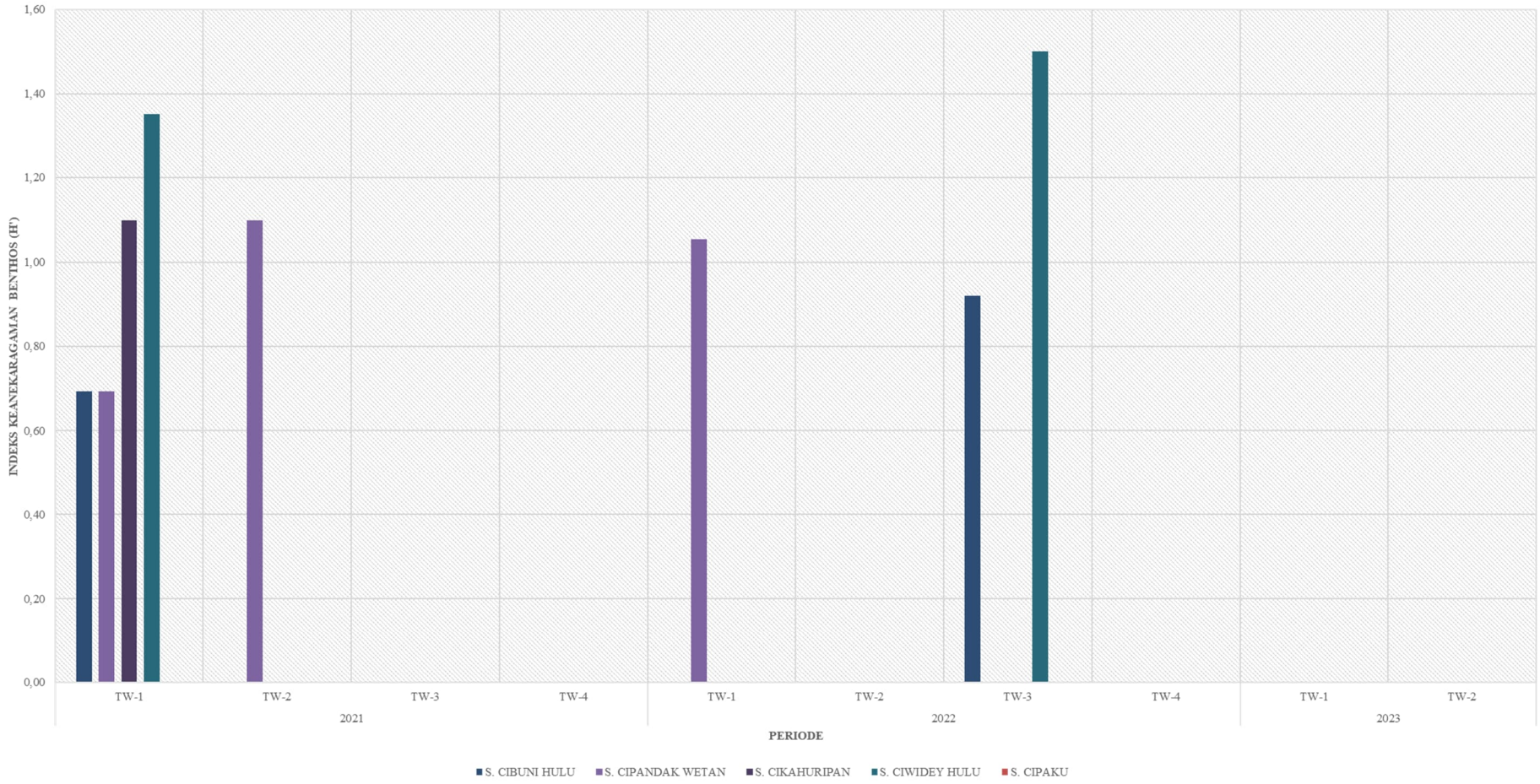


Figure 22 Benthos Type Diversity Index Trend in Steam Field Development Activities and Patuha Unit 2 Power Plant Construction