

TRIENNIAL 2024-2025 EXTERNAL ENVIRONMENTAL AUDIT



Executive Summary
August 2025



Prepared for:

PT FREEPORT INDONESIA The logo for PT Freeport Indonesia, featuring the company name in a bold, black, sans-serif font next to a red circular icon with a white 'C' shape inside.

EXECUTIVE SUMMARY

PT Freeport Indonesia (PTFI) operates a large copper and gold mine and concentrator in the Mimika District on Papua's southern coast. PTFI is a subsidiary of Freeport-McMoRan (FCX), which is one of the world's largest publicly traded copper mining companies headquartered in Phoenix, Arizona, USA. The government of Indonesia (GOI), through MIND ID, owns 51.24% of PTFI, and FCX owns 48.76% and manages PTFI pursuant to its shareholders agreement.

PTFI's IUPK includes an area of 99.46 square kilometres (km^2) at high elevations with an associated IUPK support area of 1,167 km^2 . These areas are characterized by extreme terrain, extending from the mining areas in the Highlands at 4,200 meters above sea level (masl), the concentrator at 3,000 masl, and to the Lowlands where the port and power plant facilities are located at sea level, on the coast, approximately 115 km to the south of the Highlands. The nearest townsites include the city of Timika which is located in the Lowlands and the town of Tembagapura which is located in the Highlands.

The mine operations began in the early 1970's with a production level of approximately 7,500 tonnes of ore per day from the open pit and expanded with the Grasberg Open Pit and as new underground reserves were identified to a nominal 230,000 tonnes of ore per day. Ore production at PTFI now only comes from its underground mines (Grasberg Block Cave (GBC), the Deep Mill Level Zone (DMLZ), and Big Gossan (BG)) after mining at the Grasberg open pit, which was the primary source of copper ore for nearly 30 years, concluded in 2020. Long term development activities will increase ore output with the addition of the Kucing Liar (KL) mine.

Ore from all mines is processed in the concentrating facilities (Concentrators #1 - #4) to produce the concentrates and tailings. Ore concentrates are transported from the concentrator by pipelines to the port where they are dried and stored for shipment, while tailings are transported in suspension by river to a 230 km^2 deposition and estuarine area in the Lowlands known as the Modified Ajkwa Deposition Area or ModADA.

In the past three years (2022–2024), underground ore production has steadily increased and is now approaching the planned production target, although it has not yet been fully achieved. This condition certainly requires tailing management to be kept at the same capacity as the production level when the Grasberg open pit mine is operating. Furthermore, the construction of SAG #3 and the new copper cleaner unit (Kasuang CuCL) has been successfully completed and is now fully operational. These facilities are expected to play a strategic role in anticipating and managing the challenges associated with the projected ore characteristics, particularly the higher sulfide content identified in the production plan.

The 2024-2025 External Environmental Audit is the tenth audit since 1996 which is conducted by PTFI as a commitment to undertake voluntary external environmental audits on a triennial basis, as stated in its 1997 GOI-approved Environmental Impact Analysis (AMDAL 300K). Through Article 48 of Law Number 32 of 2009 concerning Environmental Protection and Management and subsequent regulatory amendments in 2022 and 2023, the GOI encourages companies to conduct environmental audits to improve their environmental performance. This audit helps ensure that PTFI's operations comply with applicable environmental regulations and contribute to improving environmental quality, as stipulated in the Regulation of the Minister of Environment Number 3 of 2013 concerning Environmental Audits (Regulation of the Minister of Environment Number 3 of 2013). It also reviews the current position or status of PTFI's environmental management based on the company's policies, strategies, and its implementation as well as

environmental management performances as indicated by the monitoring results. Recommendations included in the 2021-2022 External Environmental Audit regarding duties to be met, environmental commitments, best practices, and future problems were also reviewed. In this external audit, the audit principals in ISO 19011:2018 Guidelines for Auditing Management Systems were implemented, with a focus on several strategic environmental issues including: Grasberg surface mine closure, underground mining operations, mill and concentrator operation, tailings management, waste management, climate change related issues, reclamation and biodiversity, and regulatory aspects.

During 2022-2024, PTFI received several government approvals—primarily updates or renewals of previously granted permits—related to environmental management, including tailings management. These approvals include the Tailings Management Roadmap Phase 2 for 2025-2030 (Minister of Environment and Forestry Decree No. 1528 of 2024), Environmental Impact Assessments to GOI requirements (AMDAL) related to the underground mines and planned supporting infrastructures development (Ministerial Decree No. 1069 of 2024 regarding the Amendment to the Decree of the Minister of Environment and Forestry Number SK.605/MENLHK/SETJEN/PLA.4/2023), as well as the AMDAL approval of the PLTGU development and its supporting facilities (Ministerial Decree No. 1501 of 2024). These provide a further foundation for PTFI's environmental management and monitoring practices, which were also reviewed in this audit.

Audit conclusions indicate that PTFI has maintained a consistent and proactive approach to fulfilling environmental management and monitoring responsibilities. PTFI is in compliance with all RKL-RPL provisions, in addition, PTFI has continually responded to various recommendations issued through scientific assessments and routine evaluations conducted by internal bodies and external oversight mechanisms such as the ISO certification processes. These actions underscore the company's ongoing commitment to regulatory compliance and environmental stewardship.

The 2021–2022 External Environmental Audit produced 59 recommendations across eight categories of Strategic Environmental Issues. As of the end of 2024, implementation of four of these recommendations remains in progress; including two recommendations related to tailings management and two recommendations related to reclamation and biodiversity. PTFI has taken steps to address these remaining recommendations; however, efforts are still ongoing and have been included in the current audit, which is comprehensive as to all new and ongoing recommendations.

The 2024-2025 audit resulted in a total of 52 recommendations - four of which are carried over from previous audit mentioned above - covering various aspects of operational and environmental management. Tailings management remains a key focus with fourteen recommendations, including two recommendations that were noted in the previous audit as ongoing studies to evaluate long-term stability or future ARD generation. The audit also identified four recommendations related to the Grasberg Closure Program, four concerning underground mining activities, and two focused on the mill and concentrator operations. While recognizing notable program improvements since the 2022 audit, particularly noteworthy for an operation of this scope and scale, waste management was again identified as an area where continued improvement is possible with twelve associated recommendations. Efforts related to reclamation and biodiversity led to eleven more recommendations, while climate change was addressed through two recommendations. Regarding the regulatory aspect, three recommendations were made to strengthen compliance with regulatory requirements. Altogether, the findings highlight the opportunity for continued improvement and monitoring action across multiple parts of the operation.

Grasberg Closure Program

Reclamation progress

PTFI has continued to make significant progress in detailed planning and implementation of surface mine closure including the Grasberg open pit infrastructure and overburden stockpiles. By the end of 2024, the reclamation progress at Grasberg area which includes the Wanagon Overburden Stockpiles (OBS), West OBS, and East OBS reached 572.41 hectares (ha). Due to the size, scale, and depositional characteristics of the Wanagon OBS, the 2024-2025 External Environmental Audit focused on the current status of the Wanagon OBS and progress there since the 2021 audit as well as surface water management. The Wanagon OBS closure plan is progressing steadily, with a strong commitment to thorough implementation. Slope regrading is being performed progressively to reduce erosion risks. Prioritizing the availability of resources and equipment is crucial to support effective implementation and to avoid any unnecessary rework that might be caused by erosion.

Overall, the implementation of the Grasberg mine closure program is progressing well in alignment with the reclamation plan and available resources, with satisfactory achievements. Reclamation targets in 2022, 2023, and 2024 were achieved or exceeded. The success of reclamation progress demonstrated at the West OBS and Upper Wanagon OBS should serve as a benchmark for effective reclamation and ecosystem recovery efforts at the East OBS (Carstensz Area).

West Wanagon Slope Stability

The Wanagon OBS is situated in steep mountainous terrain that experiences high rainfall conditions. These natural conditions can lead to high erosion and elevated total suspended solids (TSS) in the Wanagon watershed if stormwater and erosion are not diligently managed. In the 2024-2025 External Environmental Audit, geotechnical stability and geochemical controls were reviewed.

The audit had three main objectives: 1) to assess the status of findings from the 2021-2022 audit; 2) to analyze quantifiable environmental improvements; and 3) to provide updated recommendations (as needed) to address operational, hydrological, and geotechnical concerns. It was found that PTFI has successfully addressed all nine key findings identified in 2021-2022 audit. Actions taken included the completion and distribution of the Grasberg Mine Closure Drainage Plan to relevant departments, continued progress on the Wanagon West Slope Stabilization (WWSS) project, removal of sulfide-bearing material from the Kaimana Stockpile, and the ongoing reshaping and capping of exposed overburden areas with limestone to reduce acid rock drainage (ARD) potential.

Since the 2021-2022 audit, there has been ongoing and regular demonstratable and documented reduction in erosion and TSS levels from the Wanagon OBS as measured both at Banti and total sediment and associated metal load entering the ModADA. At the Banti monitoring station (#57), TSS levels have dropped from approximately 20 mg/L in 2022 to just 5 mg/L in 2025. This represents a continuation of a downward trend observed since 2017, when regrading and limestone cover programs were implemented more intensively. Between 2022 and 2024, more than 6.8 million tonnes of material have been placed for subgrading and cover, contributing to the stabilization of approximately 100 hectares of land.

The regrading of the upper benches of the Wanagon OBS has progressed well, contributing to improved geochemical conditions in the Modified Ajkwa Deposition Area (ModADA) and ensuring continued compliance with geochemical targets as stated in the applicable standard operating procedure (SOP). Regrading also helps reduce the loss rate of tailings storage capacity, eases

pressure on maintaining safe freeboard and levee stability, slows the emergence of areas requiring active ARD management, provides favorable material for final closure, and significantly decreases the amount of mineralized material entering the ModADA and estuary.

Despite these achievements, the audit also identified emerging risks. While the prediction of subsidence follows the results of the general strain analysis from GeoEngineering Division's Subsidence Transition Committee (STC), a key concern is the potential for early propagation of subsidence crack lines associated with underground block cave mining. As of the date of the audit visit, initial estimates of the block cave subsidence crack line propagation across the upper HEAT road are in 2030 while construction and maintenance sequencing of the Wanagon OBS are currently scheduled for completion in 2029. These cracks could reach the HEAT road—critical for closure operations—sooner than originally projected. PTFI is recommended to develop a detailed mitigation plan to address a situation where subsidence impacts are realized before Wanagon closure is completed. This plan could include construction of an alternate access road, stockpiling of heavy equipment and supplies or other mitigation strategies to ensure the mine closure schedule would not be adversely impacted by early loss of the HEAT road. Although the audit noted that the technical design and planning of the Lower Wanagon Overburden Stockpiles (LWOBS) considers subsidence trends and is updated as new models of the subsidence zone are updated, another area of concern is the Kaimana Dump Lower (KDL) drainage tunnel, which may be affected by future subsidence. PTFI is recommended to develop contingency plans if the KDL is impacted by subsidence sooner than projected.

The placement of the additional planned piezometers and maintenance of all installed piezometers in the Wanagon OBS should continue to remain a high priority. Any unusual increase (or decrease) in phreatic levels should be immediately reported to the PTFI design team.

PTFI should consider alternative methods to estimate discharge from the toe of the LWOBS (i.e. surface and groundwater). This data would be extremely useful to complete a system wide water balance for the Wanagon OBS.

Acid Rock Drainage/Acid Mine Drainage

Historically, the Grasberg Open Pit provided the majority of ore for processing, with pyrite concentrations averaging 7%. In contrast, future mining zones such as the Heavy Sulfide Zone and Kucing Liar exhibit pyrite concentrations of 52% and 26%, respectively. These mines contain significantly higher pyrite concentrations than previously mined areas, leading to a projected increase in pyrite feed to the processing plant as well as further to the tailings. This will require design and implementation of additional management strategies and techniques to manage environmental impacts.

PTFI has established a multi-department taskforce to monitor and address potential ARD generation. Short and long-term plans are routinely updated following analysis of the data collected by the taskforce. Sloping of stockpiles and LWOBS benches and the placement of limestone covers continues according to the SOP – GRS 8.1 – 03 Overburden Management on exposed overburden stockpiles. Continuous monitoring and adaptive water management strategies are essential to ensure that AMD-related risks remain within acceptable thresholds. Over the long term, proactive attention to this issue is critical to preserving both environmental quality and operational sustainability in the area.

Surface Water Management

The success of water management in Grasberg can be seen from the reduction of sediment load managed and monitored at each of OC-1 to OC-2 and DAM KM05. The reduction of sediment managed and monitored at OC-1 and OC-2 can decrease sediment load in the Banti River,

monitored at point #57, and will undoubtedly reduce the sediment load in ModADA, as also mentioned in WWSS section. The TSS levels at point #57 have significantly decreased from an average of 14,000 mg/L during 2007-2017 to below 200 mg/L. It is influenced by PTFI's successful management of the Wanagon surface water drainage system.

Underground Mining Operation

The subsidence model is updated every two years making it possible to obtain current and accurate information regarding the forecasted timing of potential damage to the existing facilities at Grasberg. This regular update ensures that any changes in operating conditions, material degradation, or environmental influences are captured and incorporated into predictive analyses. The outcomes of these updated models serve as an early warning, highlighting potential areas of concern before significant failures occur. This approach enhances operational efficiency and significantly improves risk management practices. Furthermore, having access to up-to-date forecasted damage timelines increases the awareness of all relevant stakeholders, including maintenance teams, safety officers, and management which allows for improved planning and prioritization of maintenance activities, allocation of resources, and implementation of preventive measures. Ultimately, the proactive strategy of regular model updates fosters a more resilient and reliable operational environment at the Grasberg site.

In the future, with the expansion of underground mining operations and the commencement of production at the KL mine, the subsidence zone is expected to enlarge. This expanding subsidence zone will indirectly serve as a conduit for surface runoff, particularly rainwater, to infiltrate and percolate into the underground mining areas. As such, the interaction between infiltrating rainwater and the surrounding host rock becomes a critical aspect that must be thoroughly investigated. This is especially important in assessing the potential for ARD formation and in determining the long-term quality of water entering the underground workings. Ensuring that the resulting underground mine water quality remains within acceptable environmental and operational limits is vital for the sustainability of underground mining activities, particularly in relation to subsidence progression at both GBC and DMLZ.

The underground pumping stations has undergone significant improvements, particularly in terms of their pumping capacity. These enhancements have enabled a more efficient handling of water volumes, thereby reducing the amount of water that flows along the ditches toward the AB monitoring points. By decreasing the water flow along these channels, the overall sediment load transported out of the underground mine can also be reduced along with frequent sediments removal from sediment traps.

However, the underground water from various underground mining operations is directed to the AB tunnels or pumped to the Amole Drift for use in the mill. Water exiting the AB tunnels is directed to sediment traps then subsequently discharged to surface waters which mix with the tailings discharged to the ModADA. The water quality measured at AB-1 and AB-2 showed relatively stable pH values throughout the measurements, in contrast to TSS, which generally remained below 4,000 mg/L, with notable spikes exceeding 10,000 mg/L, indicating increases in suspended particles.

Surface water and stormwater management strategies will continue to play a key role in preventing or minimizing risks and impacts to underground operations. These risks and impacts may be geotechnical (i.e. potential wet muck) or geochemical (AMD formation) in nature. Identification, design, implementation and monitoring of programs to prevent underground infiltration of surface waters will require constant review and revision. Source segregation, isolation, treatment and management evaluation will be critical to ensure present and future underground water discharges are in compliance with technical approval quality standards.

With the issuance of the technical approval for wastewater discharge—and the anticipated operational approval process in the near future—a thorough and continuous evaluation of wastewater management performance is crucial to ensure compliance with the upcoming effluent water quality standards based on technical approval. Any potential risks of non-compliance, such as increased load from KL Mine operations or the cessation of pumping activities in the Grasberg Pit Area, must be promptly communicated to all relevant divisions and proactively addressed to prevent any violations once the technical approval is officially enforced.

Mill and Concentrator

Significant development has occurred in the MP74 ore processing area since the 2021-2022 audit. Notable advancements include the completion of the Likupang Yard, SAG#3, Kasuang CuCl, and the addition of several embankments and surface drainage system to manage surface water; including storm water.

The ore stockpile capacity at MP74 is one million tonnes, divided between the MLA and the Amole stockpiles, with capacities of 250,000 tonnes and 750,000 tonnes respectively. These stockpiles support two processing lines: the C1-C2 system and the C3-C4 system. The implementation plan to integrate the C1-C2 and C3-C4 lines could provide an opportunity to regulate the CNV/MPA ratio in ore processing, helping to reduce a potential deficit CNV/MPA ratio in ModADA tailings management.

Following the commissioning of SAG#3 and the Kasuang CuCL, which began operations in December 2023 and October 2024 respectively, there is a potential for a reduction in tailings particle size. This condition may increase pressure on TSS levels at the compliance point in ModADA. Therefore, continuous review of the impact of finer tailings particle size on tailings management at ModADA—particularly regarding TSS values at the compliance point—should be continued.

Tailings Management

Management of the ModADA and adjacent Ajkwa River systems are continuously improving and Tailings River Management Project (TRMP) should continue to prioritize geotechnical and hydraulic conditions to manage the ModADA and bordering Ajkwa River systems effectively. Since the 2021-2022 audit, PTFI, and notably TRMP, have made substantial and demonstrable progress that has increased confidence and predictability in tailings management across the ModADA. Material testing, monitoring, inspection, and oversight should be completed tactically and rigorously for the ModADA and Ajkwa River systems to operate effectively. The ModADA and Ajkwa River systems are dynamic and will continue to require adjustments and adaptations to their design, construction, and operation.

Tailings management in the ModADA is guided by the Tailing Management Roadmap as stated in the Ministry of Environment and Forestry (KLHK) Decree No. SK.594/MENLHK/SETJEN/PLA.0/12/2018 and its amendment via Decree No. SK.101/MENLHK/SETJEN/PLA.0/1/2019. Tailings management activities mandated in the 2018-2024 PTFI Tailings Management Roadmap have been successfully implemented by PTFI, meeting the established targets. The trend of TSS reduction has achieved Roadmap TSS targets; indicating improvements in TSS management.

Following the formal approval in 2024 for completion of the obligations in this roadmap efforts focused on the development of Tailings Management Roadmap Phase-2 from 2025 to 2030 which has been approved by GOI through the SK/MENLHK No.1528 of 2024.

Tailings management activities conducted in 2018-2024 will be enhanced and further developed in the 2025-2030 Tailings Management Roadmap (Roadmap Phase 2), along with additional activities, including: a) enhancing retention through the construction of flow diversion structures as an alternative to cross levees; b) utilization of tailings to support national strategic projects; c) trial of reclamation island construction for enhanced tailings utilization; and d) online monitoring of tailings management roadmap implementation. Following the activities planned for the 2025-2030 Roadmap, the targeted TSS values using the predictive model at the 90th percentile is expected to be in the range of 10,000 to 15,000 mg/L.

PTFI has significantly advanced the design and increased construction of both spur dikes and geotubes designed to direct river flow away from the East and West levees. Thirteen recommendations from the 2021-2022 audit have been addressed, although two remain outstanding: 1) the test fill options involving a larger pioneer layer, geogrid, and uncompacted fill, which require benchmarking with empirical data—results are expected between early and mid-2025 and it should be given a high priority for completion; and 2) the geotechnical stability evaluation of the New West Levee (NWL), which is still in progress and anticipated to be completed in Q1-2025.

Regarding the key data collected, the geotechnical database for the overall ModADA system has been significantly expanded since the 2021-2022 External Environmental Audit, including forty-five new boreholes along both the West and East levees, to accurately determine embankment, calibrating Cone Penetration Tests (CPT) test results, and support PTFI's understanding of rate of rise (RoR) considerations in expanding the levee system. Management of the ModADA and Ajkwa River systems are continuously improving and ongoing close attention to geotechnical and hydraulic conditions should remain a high priority to TRMP.

Based on the 2024-2025 External Environmental Audit results, priority should be placed on completing the testfill at the East levee, as the results will provide critical insights into optimal construction methods, consolidation, saturation, and geogrid performance. Equally important is the establishment of reliable phreatic level monitoring through piezometers or hybrid systems, with data directly feeding into geotechnical models to refine design parameters and stability assessments.

Sustaining stability requires close attention to the Ajkwa River dynamics, particularly around the NWL, where detailed toe designs and proactive ARD risk management are essential. TRMP activities should continue to prioritize filling low areas to displace ponded water, complemented by spur dikes and geotubes that redirect flows and reduce pressure on levee embankments. Integration of LiDAR data into freeboard calculations and Failure Mode and Effects Analysis will strengthen predictive capabilities, while the use of drone technology offers real-time inspection efficiency, cost savings, and enhanced corroboration of instrumentation data.

A robust monitoring framework should be maintained and further institutionalized within TRMP SOPs, supported by fiber optic systems that ensure continuous, real-time levee performance assessment. Advancing data analytics tools is also recommended to shift from retrospective to predictive risk management. Additionally, it is recommended to incorporate sustained monitoring to safeguard Timika from potential pollutant migration.

PTFI is updating critical technologies and business processes to significantly improve data collection, management, and visualization strategies for monitoring programs that measure the potential impact of operations on the landscape. This includes the implementation of an enterprise-class data management system (Equlis), increasing the capacity of a centralized data management team, and going through the change management process with the business to train and roll over to the improved business processes and workflows.

Waste Management

Waste management has shown notable improvement since the 2021-2022 audit. There is increased awareness among all waste handlers—from generators to Waste Transfer Point (WTP) and THWS 32—along with more consistent and accurate tracking of waste transfers as well as the application of a Digital Working Space (DWS). Labelling and hazardous waste recording practices have improved compared to the previous external environmental audits in 2017 and 2022. The consistency of environmental inspections related to waste management and tracking the transfer process from each waste handler within PTFI through the chain of custody (CoC) system have also improved since the previous audits. Analysis of the improved tracking and inspection data can act as an early warning system, highlighting potential areas of concern before potential deficiencies occur. Consequently, this approach not only enhances operational efficiency but also significantly improves risk management practices.

Since the 2021-2022 audit, several internal and external developments have occurred at PTFI, including updates to environmental regulations, the issuance of additional environmental permits, and a decarbonization program aimed at transitioning from diesel-powered to electric heavy equipment. While these initiatives align with efforts to reduce greenhouse gas (GHG) emissions, they also introduce new challenges, particularly in the management of used lithium-based dry batteries, which are expected to increase due to the growing adoption of electric vehicles, buses, and locomotives.

Current waste management SOPs classify all batteries as corrosive, and disposal is managed through third-party providers. However, these providers are not currently licensed to handle lithium-containing batteries. Additionally, there is a lack of clarity and preparedness in handling, storage, and disposal processes for these emerging waste types, especially considering the size and volume of future lithium-based dry battery waste.

A comprehensive waste stream audit, conducted in October 2024 and which is currently being finalized, provided several recommendations for waste management improvement. Notably, issues related to lithium-based dry batteries were not covered in this audit. Observations also highlighted procedural lapses in the Management of Change (MoC) process and inconsistencies in spill management, such as lack of emergency drills and insufficient spill kits in key areas. Competency gaps were noted in spill response and leachate treatment operations in some cases.

The Environmental Management System (EMS), based on ISO 14001:2015, is in place across PTFI although it is not applicable in specific areas such as the army post in MP46 as the military is not included in the PTFI ISO certifications. However, at this location, improper waste disposal was observed and the audit team recognizes that waste management is compounded by security constraints.

Additional site visits in Highlands workshops and facilities identified labelling inconsistencies for hazardous materials and waste, deviating from Safety Data Sheet (SDS) standards. While these inconsistencies are mostly isolated, they highlight the opportunity for improved staff awareness and training.

Regarding non-hazardous waste, PTFI operates multiple sewage treatment plants (STPs) with effective technologies, such as activated sludge and oxidation ditch, ensuring effluent quality meets environmental standards and permit limits. Key facilities, including the New Portsite STP and MP68 STP indicate excellent performance, while MP38 STP requires optimization, particularly regarding flow rate stability and treatment efficiency further evaluation.

Solid waste is managed through landfills and the reduce, reuse, and recycle (3R) programs, though capacity constraints at several landfills necessitate long-term planning. MP38 Landfill requires further assessment of the effectiveness of leachate treatment and implement additional strategies, such as optimized biological treatment methods to enhance pollutant removal efficiency.

The 2024-2025 External Environmental Audit resulted in several recommendations for waste management. Regarding the hazardous waste, revising SOPs for handling used lithium batteries and including future waste streams in audits ensures proactive and compliant waste management. The Management of Change (MoC) process should be revisited, with particular attention to the adequacy of Phase 1 checklists. Emergency preparedness requires the implementation of scheduled spill response drills, conducted either as stand-alone exercises or integrated within broader emergency scenarios, accompanied by the consistent provision and routine inspection of spill kits in identified high-risk areas. Training remains a critical component; standard operating procedures (SOPs) and work instructions should explicitly incorporate environmental responsibilities. Furthermore, best practices in waste management, including the transport of waste to a centralized PTFI facility for final disposal, should be systematically communicated to all area-supervisory personnel, including third-party contractors, as part of onboarding and ongoing operational engagement across PTFI's work areas. Periodic evaluations of the effectiveness of environmental awareness training are also essential to ensure continuous improvement. Collectively, these measures strengthen operational resilience, reduce environmental risk exposure, and contribute to long-term organizational sustainability.

Climate Change

PTFI's annual GHG inventory has been conducted since 2007 and reported under FCX's GHG Inventory. GHG inventory data are verified to ISO 14064 Greenhouse Gases Parts 1 & 3 and against the Greenhouse Gas Protocol annually. For the periods assessed during the audit, all monitoring results meet the standard requirements of Government Regulation No. 22 of 2021 for Implementation of Environmental Protection and Management. Most recently, for 2023 to 2024, PTFI conducted a mandatory energy audit.

GHG emissions indicate a decreasing trend - 4.76 to 3.16 tons CO₂ equivalent per ton payable copper between 2018 and 2024 - which is enhanced by various decarbonization programs, such as operation of an electric train, operation of a 129 megawatt (MW) Dual Fuel Power Plant (DFPP), and optimization of equipment at the concentrating facility. PTFI is recommended to continue the efforts to reduce emissions from heavy equipment by evaluating several technologies, including the use of battery-powered heavy equipment and additives that can minimize the formation of carbon dioxide (CO₂).

While the current GHG inventory focuses on the main GHG emission sources, i.e. stationary and mobile combustion sources, a comprehensive GHG emission baseline requires the inclusion of potentially overlooked GHG emissions. These sources are recommended to be included in the upcoming GHG inventory to the extent feasible and economically practical.

Reclamation and Biodiversity

The reclamation and biodiversity program managed by PTFI encompasses ecosystems from sea level to over 4,200 masl. The site represents a complex environment making biodiversity management and reclamation uniquely challenging yet ecologically significant. Based on the review of the submitted RKL-RPL reports, the 2025 audit observed that PTFI has made significant efforts to comply with the applicable environmental regulations related to environmental management and monitoring (RKL and RPL). The results of environmental monitoring indicate

that environmental quality standards, as regulated by prevailing laws, and the annual environmental management targets have been met although the target for one year of mangrove rehabilitation was missed by a nominal amount.

Reclamation and Revegetation Activities

Reclamation activities at PTFI include the reclamation of disturbed post-mining sites in the Highland areas, and reclamation on tailings deposition at the double levees and other substrate in the Lowland and Ajkwa estuary areas. Since the 2022 external environmental audit, reclamation activities at disturbed sites have remained in compliance with the 2022-2026 Reclamation Plan which was approved by Ministry of Energy and Mineral Resources (KESDM) through the Director General of Mineral and Coal, KESDM Letter No. B-154/MB.07/DJB.T/2022. Progress toward meeting this plan is audited and confirmed annually by KESDM.

Observations during the 2025 audit indicate that PTFI has maintained a consistent and proactive approach to fulfilling environmental management and monitoring responsibilities, including compliance with all RKL-RPL provisions. In addition, PTFI has acted upon various recommendations issued through scientific assessments and routine evaluations conducted by internal bodies and external oversight mechanisms such as the ISO certification processes.

Reclamation in the alpine ecosystem of Grasberg is highly challenging due to extreme high-altitude conditions. The PTI Reclamation Team's commitment to continuous improvement is recognized as they refine techniques through experience and research. Beyond routine planting of native vegetation in newly reclaimed sites and maintaining past reclamation areas, the team conducts annual research and development to improve their practices.

Revegetation efforts have primarily focused on the native grass species *Deschampsia klossii*, which is propagated from natural populations and transplanted into reclaimed areas. Planting practices have evolved from 2 meter x 2 meter spacing to 1 meter x 1 meter spacing to accelerate vegetation cover. In addition, Bactosoil, a commercial organic fertilizer, is applied by hand and through hydroseeding to improve soil conditions and promote vegetation establishment. Over time, reclaimed areas have shown spontaneous colonization by mosses, lichens, and herbs, indicating that natural succession processes are also underway.

Reclamation has been conducted in accordance with the 5-year Reclamation Plan and activities have followed the procedures outlined in several standard documents. Reclamation targets for 2022–2024 were successfully met with a total of 117.5 ha reclaimed in the Wanagon and Kaimana areas. This brings the cumulative total of reclaimed areas in Grasberg to 572.40 ha for 2024. The current revegetation practice in Grasberg appears to have created environmental conditions that support natural succession—a process that will gradually increase ecosystem complexity in both biotic and abiotic components. The grassland and moss-dominated vegetation, established through both planting and natural diversification across reclaimed areas of varying age in Grasberg, provides food sources and habitats for wildlife. This is evidenced by the presence of birds, small mammals, and the New Guinea Singing Dog, a rare canine species found in the reclaimed areas.

Complementing these activities, PTFI has established composting and nursery facilities both at Grasberg and at MP21. These facilities support sustainable reclamation through compost production from food waste and propagation of native shrub species for enrichment planting. The nursery has recently been relocated to a warmer, lower elevation site to improve plant growth conditions. The use of air-layering (*cangkok*) and trials with other native grasses such as *Poa* sp. reflect ongoing innovation in revegetation techniques.

Monitoring of reclamation sites is conducted regularly using permanent 3 meter x 3 meter plots distributed across various OBS areas. Biodiversity indices such as species richness, Shannon

diversity, and evenness are recorded and compared with reference sites. However, the reporting format of these results has been largely static, and the audit recommends future reporting highlight trends over time-based on-site history, which would enhance the understanding of successional progress. There may also be an opportunity to analyze revegetation, based on individual monitoring site histories, to provide a clearer picture of reclamation performance over time and to provide a foundation for improving future reclamation methods and strategies.

Elsewhere, in the Ajkwa estuary, reclamation efforts have included mangrove planting using *Rhizophora mucronata* on tailings substrates, in line with technical approvals and commitments from RKL-RPL and the Ministry of Environment and Forestry. In 2023, 500.82 ha had been planted with mangrove seedlings, 97.0% of the 516.35 ha target included in the 2023 Pertek, while the audit team was informed anecdotally that the 2024 planting target of 500.12 ha was met although report is still being finalized. PTFI also introduced tailings retention infrastructure such as geotubes and E-groin fences to stabilize the estuary and support mangrove growth, although adjustments to designs were needed based on field performance.

Biodiversity and Natural Ecosystems

PTFI continues to show a strong commitment to reclamation, revegetation, and biodiversity programs through consistent monitoring, conservation, education, awareness, and research activities in both Highland and Lowland areas. Their biodiversity management and monitoring efforts are commendable and reflect a proactive environmental approach. Ongoing conservation initiatives and outreach programs are well-executed, with positive impacts. There is an opportunity to enhance the visibility and scientific engagement of the Natural Succession Discovery Park (NSDP), which has demonstrated that mature forest ecosystems can develop on areas containing significant tailings deposition without human intervention, to further strengthen biodiversity awareness and collaboration; particularly within the academic and research communities.

Biodiversity conservation efforts extend beyond vegetation. PTFI has supported species repatriation programs, established wildlife rehabilitation enclosures, and cultivated native orchids. The company works with numerous government and academic institutions, including Universitas Gadjah Mada, BBKSDA Papua, and Lorentz National Park. The MP21 facility which includes herbarium facilities that host an extensive collection of plant specimens, including those from unique sub-alpine and alpine vegetation in Papua, also serves as a living laboratory for monitoring succession and climate change impacts in alpine zones.

Recognizing the threat posed by climate change, PTFI has identified the role of intact, continuous vegetation corridors across elevations as critical for species migration and adaptation. Mangrove ecosystems are also being studied for their carbon sequestration potential, reinforcing the importance of maintaining ecosystem services.

Finally, while monitoring and operational SOPs are in place, the audit recommends updating key documents to reflect current practices, permit conditions, and best available science. Enhancing the accessibility and dissemination of biodiversity data—such as through scientific publications and collaboration with Indonesian herbaria—will also strengthen conservation outcomes.

Regulatory Compliance

Since 2020, Law Number 32 of 2009 concerning Environmental Protection and Management has been partially amended by Law Number 11 of 2020 concerning Job Creation and the Government Regulation in Lieu of Law Number 2 of 2022 concerning Job Creation into Law (which has been enacted into a law by Law Number 6 of 2023 regarding Enactment of the Government Relation in

Lieu of Law Number 2 of 2022 concerning Job Creation into a Law. The revision of the Environmental Protection and Management Law was followed by the issuance of Government Regulation Number 22 of 2021 concerning the Implementation of Environmental Protection and Management and several implementing regulations in the form of regulations and Decrees of the Minister of Environment and Forestry.

Evaluation of compliance with applicable environmental laws and regulations by PT FI is carried out through three stages, namely: 1) identifying and inventorying regulations and decisions related to mining and environmental protection, 2) reviewing various permits containing environmental management obligations that must be fulfilled by PT FI, 3) conducting field observations and discussing directly with stakeholders in the PT FI environment who are responsible for fulfilling environmental management obligations stated in the regulations and permits granted, as well as discussing with observers/representatives of the Ministry of Environment, the Central Papua Provincial Government and the Mimika Regency Government.

PTFI has demonstrated its commitment to environmental compliance through legal inventories, proper permit processing, and the implementation of internal standards and procedures. Regular performance reporting to authorities further reflects adherence to environmental regulations. However, challenges remain, particularly in the form of knowledge gaps and inconsistent understanding among implementers regarding new regulatory requirements. PTFI can develop an accessible regulatory information system as a reference for division/function within PTFI.

Manual reporting also poses risks of data discrepancies. To enhance compliance and efficiency, an integrated reporting system should be developed to ensure that compliance data and activities are well-documented and comprehensively reflect the compliance measures undertaken. In addition, PTFI must update its environmental management activities and implementation of SOPs in accordance with the new regulations and permits.

GLOSSARY OF TERMS, ACRONYMS, AND ABBREVIATIONS

1997 AMDAL 300K	1997 Environmental Impact Assessment (Mining expansion plan up to a capacity of 300,000 tons of ore per day)
3R	Reduce, Reuse, Recycle
AB-1	Compliance point for underground mine wastewater originating from GBC, BG, and KL
AB-2	Compliance point for underground mine wastewater originating from DMLZ
ADA	Ajkwia Deposition Area
AMDAL	<i>Analisis Mengenai Dampak Lingkungan</i> (Environmental Impact Assessment (procedure))
ANDAL	<i>Analisis Dampak Lingkungan</i> (Environmental Impact Analysis (document))
ANFO	Ammonium Nitrate/Fuel Oil
ARD	Acid Rock Drainage
Audit Team	2024-2025 External Environmental Audit Team (PT LAPI ITB)
BBKSDA	<i>Balai Besar Konservasi Sumber Daya Alam</i> (Conservation Centre Papua)
BG	Big Gossan
BOD	Biochemical Oxygen Demand
BRGM	<i>Badan Restorasi Gambut dan Mangrove</i> (Peat and Mangrove Restoration Agency)
BSAP	Biodiversity Strategic Action Plan
CD	Cargo Dock
CITES	Convention on International Trade in Endangered Species
CNV	Carbonate Neutralization Value
CoC	Chain of Custody
COD	Chemical Oxygen Demand
CoW	Contract of Work
CPT	Cone Penetration Tests
CuCL	Copper Cleaner
DELH	<i>Dokumen Evaluasi Lingkungan Hidup</i> (Environmental Management Evaluation Document)
DFPP	Dual Fuel Power Plant
DHI	Danish Hydraulic Institute
DMLZ	Deep Mill Level Zone
DOZ	Deep Ore Zone
DWS	Digital Working Space
DWP	Dewatering Plant
EIA	Environmental Impact Assessment
EMA	Environment Monitoring Access
EMS	Environmental Management System
EQuIS	Enterprise-class environmental data management system
FCX	Freeport-McMoRan
GBC	Block Cave; The largest underground mine currently
GHG	Greenhouse Gases
GOI	Government of Indonesia
GRS	Grasberg

HEAT Road	Heavy Equipment Access Trail Road; Main access road affected by subsidence
HMAF	Hazardous Material Authorization Form
IFS	Integrated Farming System
InSAR	Interferometric Synthetic Aperture Radar
IPAL	<i>Instalasi Pengolahan Air Limbah</i> (Domestic wastewater treatment plants)
IPPKH	Izin Pinjam Pakai Kawasan Hutan (<i>Forest Area Utilization Permit</i>)
ISO 14001	International Standard for Environmental Management System
ISO 14064	Standard for Greenhouse Gas Verification
ISO 19011	Guidelines for Auditing Management Systems
IUPK	<i>Izin Usaha Pertambangan Khusus</i> (Special Mining Business Permit)
K5	Kelapa Lima
KDL	Kaimana Dump Lower
KESDM	<i>Kementerian Energi dan Sumber Daya Mineral</i> (Ministry of Energy and Mineral Resources)
KL	Kucing Liar
KLHK	<i>Kementerian Lingkungan Hidup dan Kehutanan</i> (Ministry of Environment and Forestry)
LB3	<i>Limbah Bahan Berbahaya dan Beracun</i> (Hazardous Waste)
LEMASA	<i>Lembaga Musyawarah Adat Suku Amungme</i> (Amungme Tribal Council)
LEMASKO	<i>Lembaga Musyawarah Adat Suku Kamoro</i> (Kamoro Tribal Council)
LiDAR	Light Detection and Ranging
LNG	Liquefied Natural Gas
LOM	Life of Mine
LTP	Leachate Treatment Plant
LWOBS	Lower Wanagon Overburden Stockpile
MASW	Multichannel Analysis of Surface Waves
MEMR	Ministry of Energy and Mineral Resources
MIND ID	Mining Industry Indonesia
MLA	Mill Level Adit
MoC	Management of Change
ModADA	Modified Ajkwa Deposition Area
MOE	Ministry of Environment and Forestry
MOEF	Ministry of Environment and Forestry
MP	Mile Post
MPA	Maximum Potential Acidity
MPS	Mangrove Protection Structures
NAG	Net Acid Generation
NSDP	Natural Succession Discovery Park
NWL	New West Levee
OBS	Overburden Stockpile
OC	Outlet Channel
OHS	Overburden Handling System
OPL	Old Open Pit
OWL	Old West Levee
OWS	Oil Water Separator
P5	Pandan Lima
PERTEK	<i>Persetujuan Teknis</i> (Technical Approvals)
PLTD	<i>Pembangkit Listrik Tenaga Diesel</i> (Diesel Power Plants)
PLTMG	<i>Pembangkit Listrik Tenaga Mesin Gas</i> (Gas Engine Power Plants)

PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation
PP	<i>Peraturan Pemerintah</i> (Government Regulation)
PPLI	PT Prasadha Pamunah Limbah Industri
RAS	Return Activated Sludge
RC	Ridge Camp
REHAB DAS	<i>Rehabilitasi Daerah Aliran Sungai</i> (River Basin Rehabilitation)
RKL-RPL	<i>Rencana Pengelolaan Lingkungan - Rencana Pemantauan Lingkungan</i> (Environmental Management Plan - Environmental Monitoring Plan)
RoR	Rate of Rise
SAG	Semi-Autogenous Grinding
SBST	Strategic Business and Service Transportation
SDS	Safety Data Sheet
SK	<i>Surat Keputusan</i> (Decree)
SOP	Standard Operating Procedure
SPPLH	<i>Surat Pernyataan Kesanggupan Pengelolaan dan Pemantauan Lingkungan Hidup</i> (Statement of Ability to Manage and Monitor Environment)
SQRA	Semi-Quantitative Risk Assessment
STC	Subsidence Transition Committee
STP	Sewage Treatment Plant
SWM	Solid Waste Management
tCO2e	Tonnes CO ₂ equivalent
TDR	Time Domain Reflectometry
TEPM	TRMP Emergency Procedures Manual
THWS	Temporary Hazardous Waste Storage
TNI	<i>Tentara Nasional Indonesia</i> (Indonesian National Armed Forces)
TOE	Tonne of Oil Equivalent
TPS LB3	<i>Tempat Penyimpanan Sementara Limbah B3</i> (Temporary Storage Facility for Hazardous Waste)
TRMP	Tailings and River Management Project
TSP	Total Suspended Particulate (Air)
TSS	Total Suspended Solid (Water)
UG	Underground
UNESCO	United Nations Educational, Scientific and Cultural Organization
Wanagon OBS	Wanagon Overburden Stockpile
WSS	Water and Sewage System
WTP	Waste Transfer Point
WWSS	Wanagon West Slope Stabilization

INTRODUCTION

1.1. Background

PT Freeport Indonesia (PTFI) is a subsidiary of Freeport McMoRan (FCX) the world's largest publicly owned copper miner headquartered in Phoenix, Arizona, USA and MIND ID, an Indonesia's state-owned enterprise. The government of Indonesia (GOI), through MIND ID, owns 51% of PTFI, while FCX continues to be the operator of PTFI operations supported by corporate offices in Phoenix and New Orleans, USA, and from Jakarta, Indonesia.

PTFI operates a large copper and gold mine and concentrator in the Mimika District on the south coast of Papua, Indonesia. In late 2018, the 1991 Contract of Work (COW) with the GOI was converted to a new special mining license (*Izin Usaha Pertambangan Khusus or IUPK*), which grants PTFI mining rights through 2031 including a potential extension of mining rights through 2041. The project area covers an area of 1,267.29 square kilometres (km²) which consists of 99.46 km² of IUPK area and 1,167.83 km² of area for support facilities.

The project area is characterized by mountainous terrain, extending from the mining areas in the Highlands at 4,000 meters above sea level (masl), to the concentrator at 3,000 masl, and coastal terrain in the Lowlands where the port and power plant are located 85 kilometres (km) to the south of the mining area. PTFI provides all support and services including housing, medical and educational facilities, and other general services for 30,000 employees and contractors in the town sites at the Highlands and the Lowlands.

Operations began in the early 1970's with a production level of approximately 7,000 tonnes of ore per day and have expanded as new reserves were identified to a nominal 230,000 tonnes per day from an open pit and underground mines. Open pit operations ceased in 2020, and ore is currently being extracted from underground mines. Ore concentrates are transported from the concentrator by pipelines to the Port where they are dried and stored for shipment. Tailings are transported in suspension by river to a 230 km² deposition and estuarine area in the Lowlands.

Climate in the project area is characterized by cool temperatures in the Highlands and hot temperatures in the Lowlands with an average annual rainfall of approximately 5,000 millimetres (mm) although some areas receive up to 12,000 mm annually. The entire region of southern Papua exhibits one of the highest levels of biodiversity in Southeast Asia. The PTFI IUPK area is adjacent to the 2.5 million hectare (ha) Lorentz National Park which was designated a UNESCO World Heritage Site in 1999. Similar to the PTFI project area, the park encompasses a continuous track of land that extends from high mountainous to tropical marine environments, including extensive wetlands and mangrove forests near and along the coast.

In the 1997 AMDAL 300 K, PTFI voluntarily committed to conduct an external environmental audit of its copper and gold mining operation in Papua on a triennial basis. The first triennial audit was conducted in 1996 while the most recent triennial audit was conducted in 2021-2022. To conduct this tenth triennial audit for 2024-2025, PTFI appointed the technical experts at PT LAPI Institut Teknologi Bandung (ITB) in Bandung, West Java.

1.2. Objectives, Methodology and Scope

The objectives of the audit are to independently evaluate:

- The adequacy of PTFI's environmental management strategies in achieving the best environmental management practices that are feasible to implement on site.

- The compliance status with applicable national environmental laws, government (central, province and regency) regulations, or permits.
- The effectiveness of and continuous improvements to the environmental management system implemented on Site.

Several issues addressed by PTFI in the last few years were considered in this external environmental audit. These are:

- Since 2018, PTFI's majority owner is MIND ID, the GOI-owned mining holding company and the COW scheme was changed to an *Izin Usaha Pertambangan Khusus* (Special Mining Permit) valid until 2031 which includes a potential extension of mining rights through 2041.
- In 2018, the Ministry of Environment and Forestry issued Decree No. 594/MENLHK/SETJEN/PLA.O/12/2018 on the implementation of tailings management roadmap followed by an addendum Decree No. 101/MENLHK/SETJEN/PLA.O/1/2019. The resulting Phase-1 Roadmap was valid for five years; starting in 2019. Following the formal approval of completion of all obligations written in this roadmap in 2024, effort focused on the development of the Phase-2 Tailings Management Roadmap for 2025 to 2030 which was approved by the GOI through the SK MENLHK No. 1528 of 2024. The Phase-2 Roadmap aims to optimize and enhance activities from the previous roadmap that successfully retained tailings in the Modified Ajkwa Deposition Area (ModADA), such as optimizing tailings management in the ModADA and the Ajkwa Estuary areas, as well as increasing tailings utilization. The Phase-2 Roadmap includes plans for new activities to be implemented, monitoring facility development (continuous and online), and other supporting studies for optimization of tailings management.
- Following closure of the Grasberg open pit in late 2020, the primary source of copper ore in the area for almost 30 years, ore production at PTFI shifted production to the underground mines. The existing underground mines such as Big Gossan (BG), Deep Mill Level Zone (DMLZ) and Grasberg Block Cave (GBC) are the ore production backbone of PTFI while Kucing Liar (KL) is still under development. Production from KL will increase the pyrite content in the ore which will require management to mitigate the production of pyritic tailings.
- The process of AMDAL (Environmental Impact Assessment) related to the mines as well as planned supporting infrastructures development started in 2020 and was approved by the GOI through SK MENLHK No. SK.605/MENLHK/SETJEN/PLA.4/2023 and SK MENLHK No. 1069 of 2024.

The issuance of Law No. 11 in 2020 and its implementing government regulations and ministerial decrees has resulted in some significant changes to the environmental permitting scheme and standards that PTFI must follow (e.g. *Persetujuan Teknis* for wastewater and air emissions).

Both internally and externally important issues are the main considerations in this external environmental audit. The scope of the audit is to review the current position or status of PTFI's environmental management based on the company's policies, strategy and its implementation as well as environmental management performances as demonstrated by monitoring results. The audit method is based on ISO 19011:2018 Guidelines for Auditing Management Systems, with a focus on strategic environmental issues. This audit includes a review of the findings and recommendations of the 2021-2022 External Environmental Audit as well as PTFI's responses to these previous findings. Based on previous audits of PTFI's environmental management and the current condition of PTFI's operations as mentioned above, the strategic topics for evaluation in the 2024-2025 External Environmental Audit are:

- 1) Tailings Management
- 2) Grasberg Closure Program
- 3) Underground Mining Operation
- 4) Mill and Concentrator
- 5) Waste Management
- 6) Climate Change Issues
- 7) Reclamation and Biodiversity

This audit did not examine issues related to social, economic, and cultural aspects. The approach of this audit is summarized in Figure 0-1.

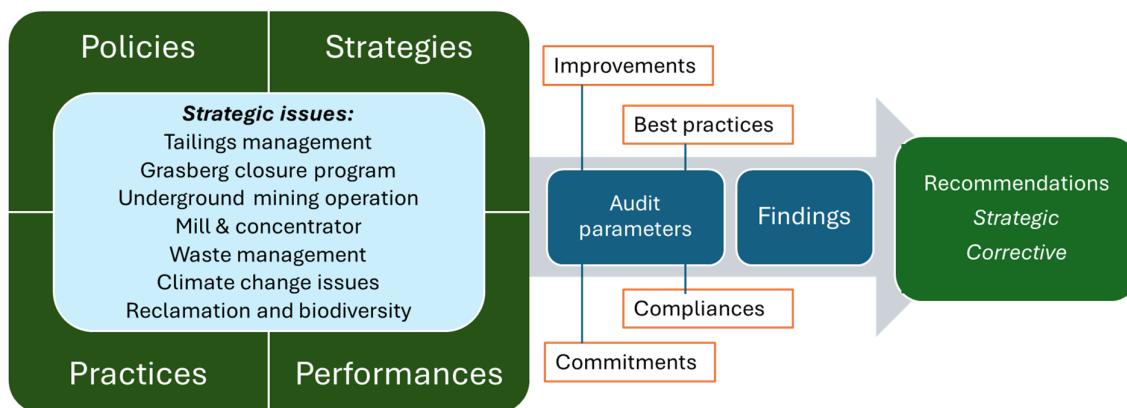


Figure 0-1 Audit methodology

1.3. Audit Team Qualifications

The structure of and technical experts on the audit team are shown in Figure 0-2.



Figure 0-2 Audit team structure

Roles and responsibilities of the individuals in the audit team are as follows:

- **Project Manager – Prof. Dr. Rudy Sayoga Gautama:** served as the overall Project Manager for the 2024-2025 External Environmental Audit. He is a professor in Mining Engineering at ITB and was an audit team member in the 2005 and 2008 External Environmental Audits as a mining expert with a focus in the fields of mine dewatering and control of acid rock drainage. He was the project manager in the 2011, 2014, 2017 and 2021-2022 External Environmental Audits. In the current audit, he also served in an active auditor in the same fields.
- **EMS & Registered IRCA Auditor – Randy Ismail** is a certified and experienced environmental auditor. He was responsible in developing the audit methodology and also conducted the audit evaluations of PTFI's EMS. Moreover, he has served as a team member on the 2017 and 2021-2022 External Environmental Audit.
- **Waste Management Expert – Dr. Ir. Katharina Oginawati, MS** is an associate professor in the Department of Environmental Engineering of ITB. She was responsible for the evaluation of waste and hazardous waste management in PTFI's project area.
- **Environmental Law and Regulation Expert – Dr. Nadia Astriani, SH, Msi** is a permanent lecturer at the Faculty of Law, Padjadjaran University. She is an expert in the field of Environmental Law, International Environmental Law, Natural Resource Law and State Administrative Law. She is also active as a researcher at the Center for Environmental Law and Spatial Planning (PSHLTR), Faculty of Law, Padjadjaran University as well as a part of a team of experts at the Citarum Watershed PPK Task Force. She was responsible for the evaluation of the applicable laws and regulations in Indonesia as well as those established by PTFI.
- **Biodiversity Expert – Prof. Endah Sulistyawati, S.Si., Ph.D** is a professor in ecology at the Faculty of Life Sciences and Technology of ITB. She was responsible for the evaluation of reclamation and biodiversity management on Site.
- **Underground Mining and Mining Environmental Expert – Dr. Ginting Jalu Kusuma** is a lecturer at the Department of Mining Engineering of ITB specializing in mining environment and geomechanics. He was responsible for the evaluation of underground mining operations and the associated environmental issues.
- **Geotechnical Expert - Alan Krause** is the former CEO of MWH and Stantec, a global leader in assessing engineering and environmental impacts and mitigation related to mining development. Mr. Krause served as the Project Manager for the External Environmental Audits in 1999, 2005 and 2008, and as a team member in the 2011, 2014, 2017 and 2021-2022 audits. He is highly familiar with and was responsible for the evaluation of geotechnical issues at the mine and ancillary facilities.
- **Biologist - Jim Webb** is currently the President Director for PT Hatfield Indonesia, an environmental and social consulting firm providing services to the mining and extractives sector in Indonesia. His areas of specialization include environmental safeguard instruments and audits, environmental and social impact assessments (ESIAs), cumulative effects assessments, and terrestrial ecosystem mapping. He was responsible for the evaluation of reclamation and biodiversity management on Site.

Observers

Three GOI personnel participated as observers in this audit:

1. Muhammad Haikal – Ministry of Environment, Republic of Indonesia
2. Yohanes Hanok Yose Reyaan – Environmental, Forestry, and Land Agency (DLHKP), Central Papua Province
3. Maria Yovita Menung Ike – Mimika Regency Office of Environment

1.4. Schedule

The overall schedule for preparing the 2024-2025 External Environmental Audit is shown in Table 0-1.

Table 0-1 2024-2025 External environmental audit schedule

No	Task Description	Timeline										
		Oct-24	Nov-24	Dec-24	Jan-25	Feb-25	Mar-25	Apr-25	May-25	Jun-25	Jul-25	
1	Opening Meeting											
2	Information Collection and Review											
3	Documentation and Approval of Audit Methodology											
4	Production and Approval of the Audit Plan											
5	Data Collection											
6	Site Inspection Audit											
7	Drafting of Audit Findings and Recommendation Workshop											
8	Preparation of Draft Audit Report and Participation Progress Meeting											
9	Resolution of Comment											
10	Preparation of Final Audit Report											
11	Submit Final Audit Report											

The site inspection was conducted from 5th to 13th February, 2025 and the detailed itinerary of the site inspection is appended to this report in Appendix D.

1.5. Audit Report Content

The preparation of this audit report was led by the Audit Project Manager. Each audit team member produced report content according to their respective expertise and fields of responsibility. Assessments of environmental practices were made by each respective audit team member according to their expertise/professional judgment, personal observations, discussions with PTFI personnel, experiences from previous audits, and evaluations from environmental management documents and relevant information.

Due to the nature of the audit process, the report cannot be said to be all-encompassing, although it provides a reliable and accurate report of the environmental performance of PTFI during the period since the 2021-2022 External Environmental Audit. It can be used by PTFI management and external stakeholders as an evaluation of performance and as a guide for the continuous improvement of sustainable environmental management practices.

The report is organized as follows:

- **Section 1** is an introduction setting out background, purpose of the audit, and a description of the audit team members.
- **Section 2** provides a general overview of the current status of operations and environmental monitoring programs.
- **Section 3** explains the review of regulatory aspects related to the strategic environmental issues assessed.
- **Section 4** presents audit results and findings divided into major areas according to the seven strategic environmental issues introduced in Section 1.1. Specifically, these are: tailings management, Grasberg mine closure program, underground mining operations,

mill and concentrator operations, waste management, climate change issues, and reclamation and biodiversity.

- **Section 5** is a summary of the audit team's conclusion and includes a summary table of key recommended actions detailed in Section 4.
- **Appendix A** provides related maps and figures.
- **Appendix B** contains a list of all documents provided in support of audit activities and/or evaluated by the audit team.
- **Appendix C** includes a list of the PTFI personnel who were contacted and interviewed during the audit process.

1.6. Acknowledgement

The Audit Team would like to express its sincere gratitude for the technical and logistical support provided by PTFI personnel during the on-site activities and throughout the auditing process. All personnel communicating at various organization levels were very forthcoming, direct, and responsive to the questions of, and inquiries made by, the audit team.

CONCLUSIONS AND RECOMMENDATIONS

1.7. Conclusions

PTFI has demonstrated its commitment to undertake voluntary external environmental audits on a triennial basis, as stated in its 1997 AMDAL 300K. The 2024-2025 External Environmental Audit is the tenth audit since 1996, and its purpose is to evaluate the environmental management and implementation in PTFI's IUPK area in comparison to the previous 2021-2022 External Environmental Audit as well as the management of new conditions as they might arise. Seven of PTFI's activities with critical environmental issues—tailings management, the Grasberg closure program, underground mining operations, mill and concentrator, waste management, reclamation and biodiversity, and climate change—were the focus of the audit. Analyses were carried out by analyzing changes in response to recommendations provided under the 2021-2022 External Environmental Audit and reviewing the duties to be met, environmental commitments, best practices, and future problems.

The Environmental Impact Assessment (AMDAL) related to the mines as well as planned supporting infrastructures development has been approved by the GOI through SK MENLHK No. 1069 of 2024 and SK MENLHK No. SK.605/MENLHK/SETJEN/PLA.4/2023AMDAL. Thus, PTFI's environmental management will refer to that document. For tailings management, PTFI also refers to the Tailings Management Roadmap as guided by the Minister of Environment and Forestry Decree No. 594 of 2018 and Decree No. 101 of 2019 regarding the PTFI's Tailings Management Roadmap that has been updated with the Minister of Environment and Forestry Decree No. 1528 of 2024.

Overall, there has been significant continuous improvement in environmental management within PTFI's mining areas compared to the findings of the 2021-2022 External Environmental Audit. The improvements reflect a serious effort by PTFI to address and implement the recommendations provided during the previous audit. In addition to these corrective actions, existing good practices have also been maintained and consistently managed and complied with the regulation. Key areas that demonstrate both improvement and consistent performance include tailing management, Grasberg closure program, waste management, reclamation and biodiversity and air quality monitoring as well as commitment to reduce the GHG emissions.

- PTFI is making strong progress in implementing the Grasberg mine closure program in alignment with the reclamation plan and resource availability, with notable achievements. The Wanagon OBS closure plan is advancing steadily, with a strong commitment to careful execution. This has been exemplified by the undertaking and degree of effort required to characterize and stabilize the Lower Wanagon toe. Slope regrading is being performed progressively to reduce erosion risks. Prioritizing the availability of resources and equipment is crucial to support smooth implementation and to avoid unnecessary rework caused by erosion.
- Management of the ModADA and adjoining Ajkwa River systems is continuously improving. TRMP should continue to prioritize special attention to geotechnical and hydraulic conditions in order to manage the ModADA and bordering Ajkwa River systems effectively. Since the 2021-2022 External Environmental Audit, PTFI, and notably TRMP, have made substantial, demonstrable progress that continue to increase confidence and predictability in tailings management across the ModADA. Material testing, monitoring, inspection, and oversight is completed tactically and rigorously in order for the ModADA and Ajkwa River systems to

operate well. The ModADA and Ajkwa River levee system is very dynamic and will continue to require adjustments and adaptations to its design, construction, and operation.

- In general, waste management has shown notable improvement. There is increased awareness among all waste handlers—from generators to WTP and THWS 32—along with more consistent and accurate tracking of waste transfers. Labeling and hazardous waste recording practices have improved, as well as the consistency of environmental inspections related to waste management.
- PTFI's annual GHG inventory has been conducted since 2007. These results are reported under FCX's GHG Inventory and show a decreasing trend of GHG intensity. This outstanding achievement on GHG emission intensity reduction is contributed by various decarbonization programs, such as operation of electric train, operation of a 129 MW DFPP and optimization at several equipment at Concentrating.
- PTFI continues to show a strong commitment to reclamation, revegetation, and biodiversity programs through consistent monitoring, conservation and mitigation, educational awareness, and research activities in both Highland and Lowland areas. Their biodiversity management and monitoring efforts are commendable and reflect a proactive environmental approach. Ongoing conservation initiatives and outreach programs are well-executed, with positive impacts. There is an opportunity to enhance the visibility and scientific engagement of the Natural Succession Discovery Park (NSDP), particularly within the academic and research communities, to further strengthen biodiversity awareness and collaboration.
- PTFI has demonstrated its commitment to environmental compliance through legal inventories, proper permit processing, and the implementation of internal standards and procedures. Regular performance reporting to authorities further reflects adherence to environmental regulations. However, challenges remain, particularly in the form of knowledge gaps and inconsistent understanding among implementers regarding new regulatory requirements. Manual reporting also poses risks of data discrepancies. To enhance compliance and efficiency, PTFI should establish a user-friendly regulatory information system and an integrated reporting system.

Overall, there have been improvements in environmental management in the PTFI mining area compared with the 2021-2022 External Environmental Audit and best practices were also maintained.

1.8. Recommendations

This audit formulated recommendations based on observations and reviews conducted throughout the audit. These recommendations discussed in previous chapters, in particular Chapter 4, aimed at improving and enhancing environmental management at PTFI's mining operations, have been compiled and summarized in Table 0-1.

Table 0-1 Summary of the recommendations for environmental issues

Environmental Issues	Recommendations
Tailing Management	<ol style="list-style-type: none"> 1. Experimental testfills planned, should be given high priority for completion. Two testfills are planned at the southern portion of the East levee where foundation conditions are considered tenuous. These testfills will provide important data to drive construction techniques (including RoR), consolidation rates, saturation levels and geogrid performance. Diligent efforts should be made by TRMP to preserve the operational integrity of each test pad, so data is reliable and useful for design, construction and operation of the levee system. 2. The measurement of phreatic surface levels in the levee embankments through standpipe piezometers have in the past been problematic due to 1) the levee crest traffic, 2) differential settlement that have sheared off vibrating wire piezometers and 3) levee raises that makes it difficult to “work around” water level instrumentation at the surface. It is recommended that TRMP develop a plan to measure water levels through traditional piezometers or hybrid systems which can provide accurate measurement of phreatic levels in the levee embankment. These data need to be feed into the geotechnical stability model for the ModADA. These piezometers will need to be carefully extended as further lifts are added to each levee to address freeboard requirements. Piezometer data collected should be correlated with foundation conditions and undisturbed, native groundwater levels to determine potential mounding conditions in the levee embankment and correlation of phreatic levels in the embankment in proximity to water adjacent or near the levee. 3. Foundation conditions to the south continue to be generally weaker owing to a number of factors. These southern areas contain peat lenses, which are influenced by tidal fluctuations, and will be highly sensitive to the RoR requirements due to inherently weak foundations. Geotechnical stability analyses suggest these sections are not liquefiable, but this largely depends on the soil parameters and assumptions used in the analyses. TRMP must continue to refine these data and adjust design parameters accordingly. It was apparent in the 2024-2025 Environmental Audit that this data collection and analysis is underway (see bullet below on testfill programs currently ongoing). 4. Consideration, evaluation and of the Ajkwa River remain very important to the overall performance of the ModADA. Detailed designs of the New West Levee (NWL) toe area will be required with subsequent lifts. Physical constraints of this area will become more challenging in the future as downstream expansion of the NWL is required. 5. TRMP should continue to strategically direct tailings materials into low areas of the ModADA with highest priority to infill and displace ponded water in contact with the levee embankment. This recommendation will result in improved tailings retention and levee embankment stability. (Reference Tailing Roadmap Section II – Handling of Material in ModADA, [5] The increase of tailings retention, [c] Filling of depressed areas. 6. The continued placement, operation, and maintenance of spur dikes and/or geotubes to strategically force the tailings river away from the levee embankment is highly supported. The spur dikes can be unarmored (i.e. without rip-rap protection) with periodic inspection and repair, when scour or erosion might occur. The spur dikes serve two primary purposes. First, they force the river away from the levee embankment and second, they create lower energy depositional environments immediately downstream of the spur dike structure. Use of Dolos (or other manufactured scour protection tools) in strategic areas versus

Environmental Issues	Recommendations
	<p>managing scour through widened crest widths or placement of sacrificial spur dikes should also remain as alternative scour protection methodology. This will require a tradeoff evaluation around effectiveness, cost, and availability. (Reference Tailing Roadmap Section II – Handling of Material in ModADA, [5] The increase of tailings retention, [b] Spur dikes and groins).</p> <p>7. The Ajkwa River Corridor remains an important element of the overall tailings management system. The corridor diverts the Ajkwa River from the ModADA (i.e. previously it was combined with the Otomona River) from the ModADA and provides a redundant level of protection to Timika through the New West Levee (NWL). Should a peak storm event exceed the design capacity of the ModADA, overflow would be captured in the corridor assuming the Ajkwa River watershed did not experience an identical peak storm event and was also in flood stage. While the NWL provides this additional protection to Timika, it also has technical issues that must be proactively addressed. Both the NWL and the Old West Levee (OWL) have specific sections constructed on top of tailings deposited prior to the segregation of the Ajkwa and Otomona Rivers. These underlying tailings were deposited in a dynamic, braided river environment resulting in pockets of tailings sediments underexposed in the Ajkwa River floodplain. From a physical geotechnical perspective, these tailings are potentially liquefiable when saturated. Under this saturated condition, significant seismic loads could destabilize the NWL as well as the OWL. In some locations these old exposed tailings are generating a visible ARD signal; synoptic water sampling above and below these locations show no discernable impact to surface water quality. It is recommended that PTFI continue to evaluate the geotechnical stability of the NWL and address potential ARD generation.</p> <p>8. With the completion of the Kwamki Lake discharge level lowering project at the end of Q4 2024, continued monitoring of the capture system's performance is essential to ensure that it functions as intended—specifically, as a hydraulic barrier to prevent the long-term spread of potential pollutants from ModADA to the city of Timika.</p> <p>9. Due to the dynamic nature of the ModADA and need for a reliable OFB target, LiDAR surveys are currently being done annually. The results of the LiDAR surveys should be incorporated into the OFB calculations on a regular basis and also be used to provide a database to update the Failure Mode and Effects Analysis. It should be PTFI's goal to have accurate survey data, at a minimum annually, and ideally on a 6-month basis (e.g., annual LiDAR with semi-annual infill surveys).</p> <p>10. Maintain the current levee monitoring program and frequencies (CQA, instrumentation, LIDAR, observations, seepage observation). TRMP continues to make great strides in this area over the years and the monitoring program should continue to be institutionalized and embedded in TRMP SOPs. Focus should be concentrated on the southern extensions of both the East and West levee sections. It is realistic to assume that in the south extension area, the acceptable RoR required to avoid deformation and differential settlement may not allow the placement of adequate levee fill material to meet freeboard design parameters. The test fill data will help assess this probability. Alternative designs or operating procedures are required to address specific situations where deformation can be managed sufficiently to preserve adequate freeboard.</p> <p>11. The fiber optics program was a wise investment by PTFI to monitor geotechnical performance of the combined levee system. The system will require continuous service to maintain this tool's reliability and accuracy.</p> <p>12. Drone technology should be exercised to its fullest to maintain real time operational inspection, reduce travel risk and costs and provide real time corroboration of instrumentation signals that may signal anomalous conditions.</p>

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		<p>13. Data collection by TRMP remains impressive and growing. The quality and reliability of the data is also improving. TRMP should continue to evaluate methods, software and approaches to interrogate data to transition from a lagging indicator (i.e. what has happened in the past) to a leading, predictive indicator of what is likely to happen in future.</p> <p>14. The release of Version 6 of the TRMP Emergency Procedures Manual (TEPM) since 2022 shows PTFI's commitment to continuous improvement in the daily management of the ModADA and specifically protocols that address emergency response actions. These periodic updates are a necessary requirement in the future.</p>
		<p>1. PTFI should confirm that all closure activities could be realistically supplied via the aerial tram alone and determine the limitations that will be imposed on highland reclamation activities by the early loss of the HEAT road. It is further recommended that PTFI develop a detailed mitigation plan to address a situation where subsidence impacts are realized before Wanagon closure is completed. This plan could include construction of an alternate access road, stockpiling of heavy equipment and supplies or other mitigation strategies to ensure the mine closure schedule would not be adversely impacted by early loss of the HEAT road.</p> <p>2. PTFI should develop contingency plan if the KDL is impacted by subsidence.</p> <p>3. The placement of the additional planned piezometers and maintenance of all installed piezometers in the Wanagon OBS should continue to remain a high priority. Any unusual increase (or decrease) in phreatic levels should be immediately reported to the design team.</p> <p>4. PTFI should consider alternative methods to estimate discharge from the toe of the LWOBS (i.e. surface and groundwater). This data would be extremely useful to complete a system wide water balance for the Wanagon OBS.</p>
Grasberg Closure Program	(Wanagon OBS)	
3. Underground Mining Operations		<p>1. The progression of subsidence—currently occurring in the Grasberg and DOM areas—is closely linked to surface access availability, infrastructure stability, and mine water management. Therefore, any updates or changes to existing subsidence predictions must be continuously communicated to the relevant divisions, and mitigation efforts should be prepared as early as possible. This is essential to ensure the availability of access and the stability of critical infrastructure required for the successful completion of the Grasberg post-mining program as well as the production-operation.</p> <p>2. Water balance analysis has been conducted for both open-pit and underground mines. The integration of water quality (geochemical load) analysis should be initiated for the underground mining operation, as the post-mining phase requires a sustainable and stable water quantity and quality, particularly in relation to subsidence progression at both GBC and DMLZ.</p> <p>3. Mine water management, for both surface and underground operations, has been implemented with a focus on ensuring a reliable water supply for mill operations via pumping at LPS, while also minimizing environmental impact. It is there for PTFI should maintain :</p> <ul style="list-style-type: none"> ▪ Efforts to separate water and solid particles as close as possible to the water-slurry sources underground need to be increased (e.g. increasing pumping capacity to the plant, series of mud pond/trap and UG ditch) to reduce sediment load need to be continued. ▪ Increase the frequency of sediments removal from traps to optimize design capacity need to be continued.

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		<p>4. With the issuance of the technical approval for wastewater discharge—and the anticipated operational approval process in the near future—a thorough and continuous evaluation of wastewater management performance is crucial to ensure compliance with the upcoming effluent water quality standards based on technical approval. Any potential risks of non-compliance, such as increased load from KL Mine operations or the cessation of pumping activities in the Grasberg Pit Area, must be promptly communicated to all relevant divisions and proactively addressed to prevent any violations once the technical approval is officially enforced.</p>
4. Mill and Concentrator		<ol style="list-style-type: none"> 1. Currently, MP74 Stockpile maximum capacity is 1 million ton (250,000 tonnes at MLA Stockpile and 750,000 tonnes at Amole Stockpile) to support overall concentrate mill process, including oreflow process. The implementation plan to integrate the C1-C2 and C3-C4 lines could provide an opportunity to regulate the CNV/MPA ratio in ore processing, helping to reduce the issue of deficit CNV/MPA ratio in ModADA tailings management. 2. Following the commissioning of SAG#3 and the Kasuang CuCL, which began operations in December 2023 and October 2024 respectively, there is a potential for a reduction in tailings particle size. This condition may increase pressure on Total Suspended Solids (TSS) levels at the compliance point in ModADA. Therefore, continuous review of the impact of finer tailings particle size on tailings management at ModADA—particularly regarding TSS values at the compliance point—must be maintained.
Waste Management	Hazardous Waste	<ol style="list-style-type: none"> 1. If the used dry battery is generated in PTFI in the near future, it is recommended to revise the SOP for handling of used dry batteries that contain lithium. The revised SOP should encompass correct labelling, storage and disposal to an authorized third-party including reassessment of the determined symbol where more than one symbol is used for one type of hazardous waste. PTFI also will determine how to influence Sandvik for management of storage and disposal in the future of these used dry batteries that contain lithium. 2. It is recommended to include future potential generated wastes e.g. used dry batteries and any anticipated future wastes will require inclusion in any upcoming waste stream audit. 3. PTFI needs to revisit the current MoC process specifically MoC review, to check the adequacy of the filled completed MoC checklist phase 1. 4. It is recommended to develop a schedule for spill emergency drills and undertake this drill either integrated with other emergency drills, e.g. fire or seismic or single scenario for spill emergency drill. 5. To provide emergency spill kit in relevant areas where the spill incident may occur and consistently conduct inspections for the spill kit equipment to ensure this equipment is ready to use. 6. To include training on relevant SOPs or WIs, (e.g. SOPs / WIs on spill emergency response, SOPs / WIs LTP operation) for persons whose tasks are significant to the environment aside from other relevant trainings as per specific aspects. 7. PTFI is recommended to socialize best practices with respect to waste management with TNI personnel during onboarding which includes their transportation of waste to a centralized PTFI location for disposal.

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		<p>8. Review the effectiveness of existing method on environmental awareness training to include training or briefing at working area during safety talks or environmental inspections. This approach will increase the knowledge and understanding of participants compared to conventional method in classroom (online or offline).</p> <p>9. Relevant waste generator needs to reassess the determined symbol where more than one symbols are used for one type of hazardous waste. This reassessment will refer to SDS or actual physical waste that being transferred and stored in the WTP.</p>
	Non-Hazardous Waste	<p>1. Optimization of wastewater treatment by further evaluation of MP38 STP, particularly regarding flow rate stability and treatment efficiency.</p> <p>2. Solid waste management at the MP73 landfill: <ul style="list-style-type: none"> ▪ Long-term planning for landfill capacity, given that several landfill facilities are nearing full capacity. ▪ Strengthening 3R programs to minimize the volume of waste sent to landfills. ▪ Continued monitoring to identify the potential environmental contamination. </p> <p>3. Leachate treatment; <ul style="list-style-type: none"> ▪ Further assessment of the effectiveness of leachate treatment at MP38, especially in reducing BOD levels. ▪ Implementing additional strategies, such as optimized aeration or advanced biological treatment methods, to enhance pollutant removal efficiency. </p>
Climate Change Issue		<p>1. Continue the efforts to reduce emissions and improve emission quality from heavy equipment by testing several technologies, including the use of battery-powered heavy equipment and additives that can minimize the formation of CO gas.</p> <p>2. To have a comprehensive GHG emission baseline, the overlooked GHG emissions are recommended to be included in the upcoming GHG inventory to the extent feasible and economically practical.</p>
Reclamation and Biodiversity (Biodiversity and Natural Ecosystem)		<p>1. In several areas at Grasberg where reclamation was initially conducted, vegetation has failed to establish on eroded slopes. Enhancement planting is recommended to ensure adequate vegetation cover on these eroded slopes to improve soil stability and to control erosion.</p> <p>2. As follow-up to the 2021-2022 External Environmental Audit recommendation to document post-mining reclamation success, PTFI is recommended to include soil fauna monitoring as part of the ongoing biodiversity monitoring program at Grasberg to demonstrate ecological processes of nutrient cycling and energy flow at post-mining reclamation sites.</p> <p>3. One of the objectives of Taman Kehati is to preserve high conservation values and Papuan biodiversity. It is recommended that indigenous flora species that are threatened or endangered – including those which have established on the tailings deposition at the MP21 research center - should be assessed for planting in this area once there is no risk of further deposition.</p> <p>4. A limited number of SOPs and MPs and reporting of the actions in these plans are either not consistently applied on-the-ground, accurately reflect permits and environmental approvals, or could be updated to include best practices. It is recommended to revise the SOPs and MPs listed in Table 4-8.</p>

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	<p>5. Monitoring mangrove survival rate is important to assess planting techniques and seedling success. It is recommended to review survival rate reporting procedures with the environmental team to ensure reporting aligns with MP-EM-RB-21 updated approved in December 2024.</p> <p>6. Habitats are changing from aquatic to terrestrial ecosystems in estuary. It is recommended that monitoring stations that were initial established for aquatic habitat – in particular EM270 – should be consulted with the MoE regarding the possibility of the relocation due to the expansion of mangrove ecosystems from the tailings deposition and planting.</p> <p>7. Monitoring in the MP40 to MP66 area (red zone) is required to meet environmental commitments and can provide valuable data on terrestrial ecosystems including flora and fauna diversity. However, access and security challenges restrict monitoring in this area. To overcome these challenges, it is recommended that alternative monitoring techniques such as remote sensing analysis be assessed for applicability.</p> <p>8. The current efforts in biodiversity conservation, outreach, and research are commendable. There is an opportunity to strengthen awareness of the Natural Succession Discovery Park (NSDP), especially within the scientific community. It is recommended that PTFI assess opportunities to share its herbarium collection with reputable Indonesian institutions to enhance scientific knowledge, foster collaborative research, and ensure the preservation of valuable plant specimens through distributed storage.</p> <p>9. PTFI has a strong commitment to biodiversity management and monitoring; as evidenced by the workshop held in December 2022 to develop an updated Biodiversity Action Plan based on expert advice. It is recommended that PTFI implement the Biodiversity Action Plan as it offers a clear five-year framework to strengthen monitoring, build capacity, and support scientific output.</p> <p>10. PTFI biodiversity monitoring is extensive, covering multiple ecosystems and taxa. However, challenges exist in timely species identification and data curation. To improve the reliability of data reporting, it is recommended that effective training and supervision in data collection best practices, species identification, and analysis be conducted with persons involved in biodiversity monitoring.</p> <p>11. As follow-up to the 2021-2022 External Environmental Audit recommendation on data analysis, a synthesis of existing reclamation monitoring data should be conducted to better understand the biological and physical phenomena of reclamation and adaptively improve reclamation practices.</p>
8. Regulatory Aspects	<p>1. PTFI can develop an accessible regulatory information system as a reference for division/function within PTFI.</p> <p>2. To enhance reporting efficiency, an integrated reporting system should be developed to ensure that compliance data and activities are well-documented and comprehensively reflect the compliance measures undertaken.</p> <p>3. PTFI must update its environmental management activities and implementation SOPs in accordance with the new regulations and permits.</p>