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## Environmental and Social Impact Assessment for PT Hutan Ketapang Industri, West Kalimantan, Indonesia

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*Prepared for:*

**PT Hutan Ketapang Industri**

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# EXECUTIVE SUMMARY

## Introduction and Context

PT Hutan Ketapang Industri (HKI) is an Indonesian plantation company located in West Kalimantan, Indonesia. HKI intends to convert their concession area from its existing state as a pulp timber plantation (although since only portions of the concession have been planted, it is considered a greenfield plantation project) to a rubber latex plantation (hereafter referred to as the “Project”). The Project received authorization for operations in their concession area in November 2011, and initiated planting in 2012.

HKI’s concession is comprised of two separate blocks: Kendawangan block (60,554 ha) and Air Hitam block (37,337 ha). The blocks are located in areas containing natural forests, secondary/degraded forest habitat, grasslands, peat swamp, dry scrubland, and seasonally wet shrubland. The blocks are also adjacent to several protected areas and nature reserves: Sungai Tengar - Sungai Pesaguan and Gunung Raya Protected Forests in the vicinity of Kendawangan Block; and Muara Kendawangan Nature Reserve and Sungai Jelai Protected Forest in the vicinity of Air Hitam Block.

Vegetation within the concession and the broader landscape has been degraded by logging, land clearing, and fire over decades. The broader landscape includes large areas of oil palm plantations, which are expected to continue to dominate in the region. The aggressive fire cycle now characteristic of the southern portion of the district of Ketapang has caused accelerated loss of natural forest, biodiversity, and livelihood opportunities for local people. Traditional farming methods have also resulted in degradation of natural forests and habitats. Despite this high level of disturbance, the HKI concession areas maintain a degree of ecological value, which is especially important within the context of the surrounding landscape, which tends to have lower ecological value. HKI is committed to conserving and enhancing the ecological value in and around the concession areas through sustainable forest management and through the proper management and mitigation of the operations environmental and social risks.

HKI has undertaken this Environmental and Social Impact Assessment (ESIA), consistent with international best practices, the International Finance Corporation’s Environmental and Social Performance Standards, and the Forest Stewardship Council (FSC) Forest Management Standards. In 2014, HKI successfully completed a national-standard environmental and social impact study (AMDAL), consistent with Indonesian environmental regulations.

Baseline studies for this ESIA were completed in collaboration with HKI and local communities. Baseline data used to develop the ESIA were derived from a combination of available sources, including the HKI addendum AMDAL report completed in 2014, the 10-year forest management plans (Rencana Kerja Usaha/RKU) completed in 2012 covering the 2008-2017 period, the draft RKU developed in 2017 covering the 2017-2026 period, background documents provided by HKI related to company operations, stakeholder engagement activities, and targeted field studies conducted by PT Hatfield Indonesia (PTHI) in Kendawangan Block and Air Hitam Block in 2016 and 2017, respectively.

The overall objective of this ESIA is to describe the predicted positive and negative effects of the Project, and outline measures to minimize, mitigate, and monitor potential impacts during the implementation phase of the Project.

## Project Description

**Project area:** Kendawangan Block is a 60,554 ha area located 60 km southeast of Ketapang, West Kalimantan (2°00'59" – 2°25'12" S; 110°12'56" – 110°33'03" E). There are four primary villages associated with the Kendawangan Block: Mekar Utama, Kedondong, Pangkalan Batu, and Sungai Jelayan. Topography is primarily flat: 85.9% is flat (<8% slope), 8.3% is gently sloping (slope 9-15%), 2.4% is undulating (slope 16-25%), and 3.4% is moderately steep (slope 26-40%). There are no steep (>40%) slopes in Kendawangan Block. Elevation ranges from 2 m to 100 m. Ecosystem types within Kendawangan Block consist of 53% wetlands and 47% drylands. The land cover types present in the area include secondary dryland forest, shrubs, swamps and swamp forests, as well as existing dryland agriculture and forestry plantation areas. There are no directly overlapping protected areas within the Kendawangan Block. However, there are two protected forests within close proximity (<3 km) to Kendawangan Block: Sungai Tengar-Pesaguan Protected Forest (4,647 ha), and Gunung Raya Protected Forest (15,209 ha). Access to the Kendawangan Block is from Ketapang District via a provincial road with medium quality. From Ketapang to the HKI Kendawangan Basecamp is approximately 4 hours travel by car.

Air Hitam Block is a 37,337 ha area located 100 km southeast of Ketapang, West Kalimantan, and 33 km southeast of the Kendawangan Block (2°33'03" – 2°46'44" S; 110°31'14" – 110°49'29" E). There are two primary villages associated with the Air Hitam Block: Air Hitam Besar and Air Hitam Hulu. The Air Hitam Block is primarily a flat landscape with 99% of the area classified as flat (<8% slope), and the remaining 1% classified as gently sloping (9-15% slope). There are no steep slopes in Air Hitam Block. Site elevation ranges between 0 m and 47 m. Ecosystem types within Air Hitam Block consist of 73% wetlands and 27% drylands. The land cover types present in the area include swamp shrub and swamp forests, dryland forests, as well as some existing plantation areas. There are no directly overlapping protected areas within the Air Hitam Block. However, there are two protected areas directly adjacent to Air Hitam Block: Muara Kendawangan Nature Reserve (175,000 ha), and Sungai Jelai Protected Forest (18,384 ha). Access to the Air Hitam Block is from Ketapang District via a provincial road with medium quality. From Ketapang to the HKI Air Hitam Basecamp is approximately 5 to 10 hours travel by car.

**Project scheduling and planning:** Given the cyclical nature of the Project, it is expected that the typical division in project activities between pre-construction, construction, operations, and post-construction phases, will occur concurrently, both spatially and temporally throughout the area, throughout the life of the Project. Once initial land clearing and planting are completed, the project will shift to harvesting and processing of the rubber latex and wood products. The activities assessed by this study include those activities related to the initial project infrastructure construction and operation, land clearing, planting, nursery development, and final tree harvesting. The main development and production plans are based on information from the RKU for 2017-2026.

**Spatial characteristics:** The HKI concession areas are located within production forest and limited production forest areas. The concession spatial plan divides the 97,891 ha concession area into areas for production, protection, and infrastructure development. The Project plans include 61,463 ha for plantation crops (62.8% of total area), 16,851 ha of protected areas (17.2%), 16,641 ha for community welfare plantations and other uses (17%), and 2,936 ha of infrastructure (3%). Production areas include the main plantation areas as well as community welfare plantations. Protected areas include ecologically high-value areas such as the buffer zones to Protected Forest areas, riparian areas, and protected peat ecosystem areas. Infrastructure areas include the areas designated for buildings and roads required for the Project.



**Forest management areas:** The Kendawangan Block covers 60,697 ha and is the Company plans to divide it into three functional areas: (1) effective area for production (~52,868 ha), (2) protected area (~6,014 ha), and (3) area for infrastructure (~1,816 ha). Within the effective area for production, ~42,848 ha is planned for the main plantation (71% of the Block area, 81% of the total effective area), and ~10,020 ha is planned for planting to support community welfare plantations (*Tanaman Kehidupan*) (16.5% of the Block area, 19% of the total effective area).

Air Hitam Block covers 37,194 ha and the Company also plans to divide it into the same three functional areas: (1) effective area for production (~25,237 ha), (2) protected area (~10,837 ha), and infrastructure (~1,120 ha). There is ~18,616 ha planned for the main plantation (50% of the Block area, 74% of the total effective area), and 6,622 ha planned for planting to support community welfare plantations (*Tanaman Kehidupan*) (18% of the Block area, 26% of the total effective area).

**Plantation area arrangement:** The HKI concession area is divided into 11 Estates for management of operational activities; 10 Estates in the Kendawangan Block and one Estate in the Air Hitam Block. The planned working area arrangement currently includes 18,616 ha for the main plantation area, 1,120 ha for infrastructure; 6,621 ha for community welfare; and 10,837 ha for protected areas.

**Project activities – construction:** Construction and associated land clearing is required for the expansion and construction of plantation infrastructure, including camps, drainage and irrigation channels, road networks, and water reservoirs. Construction will involve heavy equipment and vehicles for land clearing and landscaping, transportation of materials and workers, and construction of infrastructure and facilities.

**Project activities – land clearing and preparation:** Land cleared for plantation purposes, will involve a combination of manual, semi-mechanical (chainsaws), and mechanical (heavy equipment) means. Land preparation for the main plantation areas will be clear-cut with light or heavy equipment. Land preparation within community welfare plantation areas (*Tanaman Kehidupan*) has not yet been planned. However, it may not require clear-cutting, and could possibly be done manually or using semi-mechanical methods, which would limit the area of impact by only clearing areas for individual plants. Within shrub or herb-dominated areas, land clearing will also involve semi-mechanical and mechanical methods using chainsaws and bulldozers, or by cutting plants up to 15 cm from the soil surface. Shrub and herb-dominated areas will be identified and sprayed with herbicides (*glyphosate*) for weed-control purposes.

**Project activities – planting:** Planting activities include seedling distribution, cover-crop planting, lining, and spacing. Soil and water conservation and erosion prevention techniques will be applied prior to planting activities, including cover-crop planting and drainage channel construction.

**Project activities – maintenance:** On-going maintenance activities will focus on maintaining soil fertility, reducing competition between plantation species and unwanted plants (weeds), and preventing losses from pests and diseases. Maintenance activities of this nature will include manual trimming and spacing, fertilizing, plantation patching or replanting, weed removal, and pest management.

**Project activities – rubber latex harvesting:** Harvest of rubber latex is planned to begin in 2018/2019 within 153 ha of planted area. Rubber harvesting is expected to gradually increase to 61,950 tons of rubber latex by 2026/2027. Rubber latex will be tapped manually from each tree in 4-day intervals. Tapper production will be approximately 1 ha/day. At this rate of production, 100 ha of rubber trees will

require a full-time workforce of 25 tappers, and the workforce required to tap the entire rubber plantation by 2027 is projected to be 7,916 tappers.

**Project activities – processing and marketing:** Logs and unprocessed rubber latex will be sold to external buyers. In the future, HKI may develop its own processing facilities. The processing and marketing plan for timber and rubber latex is forthcoming, and will be developed in the near future.

**Project activities – decommissioning:** At this time, there is no firm timeframe for the life of the Project. The Project is expected to continue indefinitely as long as it is a viable operation. Therefore, there are no firm plans for Project decommissioning. However, post-operations plans were developed in the HKI addendum AMDAL, and included reforestation, asset management, workforce management, and community closure planning.

**Project infrastructure – roads:** There will be two types of roads constructed: main roads (10-m width), and branch roads (7-m width). Roads will be constructed of compacted gravel, using heavy equipment to clear land prior to road construction. Drainage channels will be constructed along all roads to ensure proper drainage. The RKU 2017-2026 included the construction of approximately 508 km of main roads, and an additional 1,080 km of branch roads. There are currently 745 km of existing roads.

**Project infrastructure – bridges and culverts:** Roads crossing streams or rivers will have a bridge installed of the appropriate size. The drainage network will be comprised of open-drainage channels (ditches). There are three types of drainage channels involved: field type (1-m width), collector type (2-2.5 m width), and disposal type (3-3.5 m width). Based on the revised RKU 2008-2017, there will be 784 bridges constructed.

**Project infrastructure – facilities:** The Project will require the construction of a variety of facilities and infrastructure, including buildings, roads, and nurseries. The planned facilities, as listed in the RKU 2017-2026, are spread across both Blocks, with a substantial number of facilities already in place, and include: offices, a training center, research center camps, power houses, nurseries, water storage, fuel storage, water treatment facilities, schools, guardhouses, log storage areas, and health facilities.

**Project infrastructure – nurseries:** Seedling provision for HKI involves two methods: growing from seed, and grafting. Seed supply for HKI was set in a standard operating procedure (SOP) of Nursery Rubber Plantation approved by the Director of Research and Development of Sampoerna Agro on March 16, 2012. The scope of the SOP covers the collection of seeds, selection of seeds, germination, planting, field selection, grafting, filling of polybags, grafting, planting in polybags, maintenance, and planting in fields with polybag seedlings. The projection of seedlings required for the rubber plantation is: first planting = 555 stems/ha, fill-in planting = 111 stems/ha, total seedlings required = 666 stems/ha. To meet the needs of the plantation areas, community welfare areas, and rehabilitation areas, HKI plans on developing four nursery facilities.

**Workforce requirements:** HKI's workforce will require the recruitment of workers from both local and non-local sources. There are currently 2,281 people working at HKI, including staff and casual workers. The Company plans to hire 15 technical staff that are required to have government-led training in specific fields including, forest planning, forest harvesting, forest maintenance, mapping, and latex inspection. The majority of the workforce will be casual labourers required to conduct rubber latex tapping once the plantation reaches maturity. Estimates using a total productive planted area of 33,221 ha would require a tapper workforce of up to 7,916 people.

**Company structure:** HKI's Head Office is located in Ketapang, Indonesia, with a site office in the Kendawangan Sub-district of Ketapang District. HKI's development organization consists of two levels: Head Office and Estate level. A General Manager is responsible for overseeing operations of each Estate. Each of the Estates is managed by an Estate Manager. Organization at site level includes the following divisions: Research and Development, Human Resources and Administration, Logistics, Planning, Harvesting, Environment, Corporate Social responsibility (CSR), Nursery, Infrastructure, and Assistance of Corporate Affair Service.

**Environmental management and monitoring:** The current environmental management and monitoring activities were developed in adherence to national standards under the 2014 AMDAL and described in the RKL, and RPL documents. Monitoring and evaluation are currently carried out on all operational activities, including management of production, and environmental and social monitoring, and specifically include: measurement and recording of all activities in the development of forest plantations; comparison between planned activities and actual completion of activities; evaluation of the collection and storage of data, methods of measurement, and results recording; periodic progress reports; and regular evaluations for performance improvement.

**Community empowerment:** Community empowerment related to the village community forest (PMDH) must provide opportunities for the community to improve their well-being (economic), independence, and increase awareness of environmental functions. The HKI community empowerment plan includes: improving community income: implementing community welfare plantation (*Tanaman Kehidupan*); increasing awareness: socialization of forestry practices, agriculture practices, health information, and related issues; capital assistance; and infrastructure capacity improvement, road rehabilitation, educational facilities, and other community-based infrastructure.

**Forest protection and security:** Forest protection and security includes activities that take place to prevent and limit damage to the area and forest products caused by human actions, animals, fires, natural disasters, pests, and diseases. There are three areas where forest protection and security are applied: Area, Plantation, and Biodiversity. The area protection and security objectives are to protect the concession area from unauthorized uses and encroachment, such as illegal logging and unauthorized cultivation. Routine patrols along the perimeter and consultations with the community in surrounding areas will be conducted. To protect the concession from fire, pests, and diseases, the company has established a unit to directly deal with forest fires, as well as develop a forest fire management system including infrastructure and equipment for preventing and fighting forest fires. Pest and disease control will be managed in a systematic and holistic approach by provision of trained workers, pest and diseases management systems, and providing the require equipment. Biodiversity protection measures include delineation of protected areas in both the field and on maps, routine patrols in protected areas, periodic monitoring of flora and fauna in protected forests, and visible signage indicating where protected areas are located.

**Labour and working conditions:** The workforce structure anticipated for HKI includes permanent and part-time employees, permanent daily workers, and temporary daily workers. The majority of the workforce will be permanent and temporary daily workers. Currently, the management of labor and working conditions is organized at the Estate level, which has created some inconsistencies in the implementation of the company-wide human resources policy, which has created a source of conflict with local workers. Generally these conflicts were regarding wages and the transparency of hiring practices for contractors, and how daily workers can become permanent staff.

**Pesticide use and management:** HKI currently implements SOPs that define procedures to manage the use of pesticides through various plantation activities (e.g., seedling preparation, planting and maintenance). These SOPs describe the type, amount, and time to apply pesticides. HKI does not currently have a Pesticide Management Plan (PMP) in place to provide a more comprehensive mechanism to handle procedures for the selection, procurement, storage, handling, and destruction of unwanted or out-of-date stocks, as recommended in the World Bank EHS Guidelines.

**Fertilizer use and management:** HKI currently implements activities and SOPs that define procedures to manage fertilizer use either directly, or indirectly. These include SOPs that directly involve use of fertilizers in land preparation and planting, as well as activities to indirectly affect fertilizer use by managing soil nutrients through composting, cover cropping, and other methods to preserve soil quality.

**Waste and wastewater management:** HKI implements an SOP to handle identification and management of both hazardous and non-hazardous wastes on site. HKI also has developed a procedure for waste composting of organic wastes. HKI also implements records keeping regarding non-hazardous wastes in a logbook. HKI's waste management includes plans to reduce, reuse, recycle and recover wastes to minimize impacts to the environment.

**Greenhouse gas and other emissions:** HKI adheres to regulations regarding no-burning land clearing. HKI also plans to conserve/restore up to 15,519 ha of protected areas that have been previously damaged or degraded, and will thereby significantly increase the carbon storage capacity of these degraded sites.

## Examination of Project Alternatives

Within the legal context of HKI's forest management permit, HKI is currently obligated to manage the concession area as a forest management estate. As such, only forest management options are available to HKI for the management of this land. Therefore, all other project alternatives involving other industrial uses are not considered viable alternatives to this project. We therefore considered two realistic and viable options available to HKI: (1) acacia and eucalyptus plantations for pulp or biomass production; and (2) rubber plantations for the production of rubber latex and timber

In the context of environmental and social effects, both of these forest management options present many similarities, including: both involve the conversion of land to fast-growing, exotic, tropical hardwoods; both involve planting of non-native tree species into the environment; stand structure, canopy height, understory habitat complexity, and species diversity are similar; biomass values of the standing forests are similar, therefore likely produce similar implications to carbon storage and greenhouse gas emissions; both will require similar operational infrastructures; both will require regular plantation maintenance and the application of fertilizers and herbicides; and, forest management rules, regulations, and legislation apply similarly to both options.

We identify two significant differences between the two alternatives: (1) Rotation schedules – Rotation age for acacia/eucalyptus plantations is 7-10 years, resulting in complete clearing of the forest and replanting every 7-10 years. For rubber plantations, this rotation is extended 32 years, resulting in more mature forest cover for longer time periods; and, (2) Latex tapping – contrary to acacia/eucalyptus plantations, rubber plantations involve the daily and continuous activity of rubber tapping. This non-timber forest product provides a regular and continuous source of employment income for local people.

Therefore, of the two viable and realistic alternatives available to HKI, pursuing the forest management alternative of rubber plantations for the production of rubber latex, likely represents fewer negative

environmental effects, and higher overall positive benefits to surrounding communities. On this basis, we believe the rubber plantation option to be a suitable project alternative in this case.

## Environmental Setting

**Biophysical conditions:** Ambient air quality measurements within Kendawangan and Air Hitam Blocks met all national standards. Noise levels within Kendawangan Block were below the 55 dBA 24-hr national threshold based on Ministry of Environment Decree No. 48/1996. Supplementary sampling to distinguish noise levels during day and night periods according to the World Bank EHS standards found that while average noise levels during the day were maintained below the day-time guideline (55 dBA during day-time) at both sampling points, average noise levels at night met the guideline (45 dBA during night-time), indicating that peak noise levels likely exceeded the guideline for periods during the night. During supplementary monitoring, it was identified that sources of noise in the communities were both human (, especially at night. Surface water quality sampled in three rivers within Kendawangan Block exhibited relatively low pH, high concentrations of total and fecal coliforms, and relatively high chemical oxygen demand (COD) levels. Overall water quality was classified as Class-C (polluted). No pesticides were detected. Water quality parameters sampled within Air Hitam Block indicated total suspended solids (TSS), COD, BOD, and phosphates exceeded national and/or international guidelines in 2014. However, these parameters did not exceed guidelines in subsequent sampling years. Overall water quality was classified as Class-C (polluted). No pesticides were detected.

Groundwater within Kendawangan and Air Hitam Block exhibited low pH, and high levels of coliform bacteria, which did not meet national regulations. Water color at one sample location also failed to meet the national regulation. Groundwater exhibited low levels of metals, and common herbicides and pesticides (i.e., Aldrin, Dieldrin). Volatile organic compounds (VOCs) were undetectable at both wells sampled. Sediments in rivers within Kendawangan Block had relatively high metals concentrations, and exceeded guidelines at some stations. Concentrations of PAHs, PCBs, and VOCs were undetectable, as were concentrations of common pesticides. All parameters measured for sediment within Air Hitam Block were below standard thresholds. Concentrations of PAHs, PCBs, and VOCs were undetectable, as were concentrations of common pesticides. The Kendawangan Block area contains three main rivers: the Pangkalan Batu River, the Jelayan River, and the Kendawangan River. Based on surveys completed for the 2014 AMDAL, the Kendawangan River is the largest river in the area with a width of 50 m, depth of 3 m, water height of 3 m, and average discharge of 27.25 m<sup>3</sup>/s; followed by the Pangkalan Batu River with a width of 150 m, depth of 7 m, water height of 7 m, and average discharge of 111.98 m<sup>3</sup>/s; and the Jelayan River with a width of 20 m, depth of 1.5 m, water height of 1.5 m, and average discharge of 8.64 m<sup>3</sup>/s. Within Air Hitam Block, one major river was surveyed: the Air Hitam Besar River with a width of 20 m, depth of 5 m, water height of 5 m, and average discharge of 25.58 m<sup>3</sup>/s.

Based on the 2014 AMDAL documentation, six soil types are present in the Kendawangan Block, and include: (1) Haplothord/Spodosol (19,529 ha); (2) Quartzipsamments (12,628 ha); (3) Haplohumults (9,472 ha); (4) Endoaquepts (4,398 ha); (5) Hapludox (1,317 ha); and, (6) Haplohemists (1 ha). Psamment soils were observed in samples taken in existing plantation areas. This soil texture is predominately coarse sand, and vulnerable to nutrient leaching. In the natural forest area, Dystrucept soils were observed. This soil type is not vulnerable to nutrient leaching but has a higher risk of soil erosion in areas with steeper slopes. Soil texture on this soil type is not vulnerable to nutrient leaching but has a low pH conditions. Haplothord or Spodosol soil types were observed within the block. These types of soils are identified as low-nutrient soils. Cation exchange capacity (CEC) was classified as low at all locations except at one sample location in natural forest. Similarly, organic content, total nitrogen,



potassium, and sodium levels were highest in natural forest sites, with areas in the rubber plantation having lower values. These results indicate that topsoil fertility in the concession areas of Kendawangan block is generally lower than that found in the surrounding natural forests. Within Air Hitam block, based on the 2016 HKI 5 Land Suitability Report, there are four soil types present: (1) Typic quartzsamsments (10,157 ha), (2) Typic dystropepts (11,297 ha), (3) Typic haplohemist (15,438 ha), and (4) Typic haplorthords (500.5 ha). Soil erosion hazard within Air Hitam block is dominated by very low erosion classification, indicating less than 15 ton/ha/year of soil losses. This result can be attributed to the topography of Air Hitam block which is dominated by flat terrain.

**Biological conditions:** There are no primary forests within the HKI concession areas. Within Kendawangan Block, the vast majority of land (91%) is classified as “modified habitat”, with “natural habitat” making up the remaining 9%. Three generic habitat types were recognized: cultivated plants, shrubs, and secondary forests. A total of 69 plant species were identified with two species identified as Critically Endangered by the IUCN: Red Balau (*Shorea balangeran*) and Light Red Meranti (*Shorea smithiana*). Within Air Hitam Block, modified habitats made up 36% of the block area, with the remaining 64% natural habitat areas. Flora surveys yielded 70 species of plants, with two nationally protected species: *Nepenthes ampullaria* and *Nepenthes mirabilis*; and, one Critically Endangered species: *Shorea balangeran*.

A total of 51 species of birds were recorded within Kendawangan Block, with 13 species protected by Government Regulation No. 7/1999, and one species was classified as Endangered (White-rumped woodpecker). Thirty-five species of herpetofauna were identified, with one species is listed as protected by Indonesian government regulation No. 7/1999: Bornean earless monitor (*Varanus borneensis*). A total of 21 mammal species were observed, of which two species are classified as Endangered (Proboscis monkey, Bornean white-bearded gibbon), and one species is classified as Critically Endangered (Sunda pangolin). Within Air Hitam Block 90 species of birds from 45 families were recorded, with 14 species protected by Indonesian Government Regulation No. 7/1999, and three species classified as Vulnerable (Greater green leafbird, Lesser adjutant, great slaty woodpecker). Seventeen species of herpetofauna were identified with one species protected under Government Regulation No. 7/1999, and one frog species listed by the IUCN as Near Threatened: Lesser Swamp Frog (*Limnonectes paramacrodon*). For mammals, nine species belonging to seven families were present, with one species classified as critically endangered: Orangutan (*Pongo pygmaeus wurmbii*), and one species listed as vulnerable: Sun Bear (*Helarctos malayanus*).

Based on Orangutan distribution mapping, there is high potential for Orangutan occurrence in the Air Hitam Block. During 2017 field surveys, we observed 11 arboreal nests identified as Orangutan nests. Based on these surveys, we can confidently confirm the presence of orangutans within the Air Hitam block.

Plankton samples collected with Kendawangan Block (Pangkalan Batu River, Jelayan River, and Kendawangan River), indicated that plankton communities contained six groups of algae, one protozoan, and 1 copepod. Diversity of plankton indicated that the rivers sampled were moderately to heavily polluted. Diversity of macroinvertebrates also indicated heavily polluted conditions. At least 17 species of fishes were found, with one classified by IUCN as Near Threatened (*Trycogaster leeri*), and one potentially classified as Endangered (*Sclerogages spp.*). As well, two species are protected by Indonesian regulations: *Notopetrus chitala*, and *Sclerogages spp.* Within Air Hitam, plankton samples taken within Air Hitam Besar River contain four groups of algae including Bacillariophyta, Charophyta, Chlorophyta and Euglenophyta. Species diversity indices indicated moderately polluted conditions.

Benthic macroinvertebrate diversity index also indicated a heavily polluted river. Baseline data results for nekton within Air Hitam Block were identical to those for Kendawangan Block.

**Socio-economic conditions:** Five villages were the focus of our socio-economic surveys in Kendawangan Block: Pangkalan Batu, Sugai Jelayan, Selimatan Jaya, Kedondong, Mekar Utama; and two as related to Air Hitam Block: Air Hitam Besar, and Air Hitam Hulu Village.

Kendawangan sub-district is 5,859 km<sup>2</sup> with a population of 34,768 people, resulting in a population density of 6 people/km<sup>2</sup>. Population growth rate during 2010 to 2014 within Kendawangan sub-district was 1.7%, with the largest combined proportion between 15 and 59 yrs. The number of households in Kendawangan sub-district in 2015 was 11,595, with the 7 villages covered by our surveys comprising 2,945 households. Total population in the Project area in 2015 was 15,468 people, consisting of 8,185 males and 7,468 females. Sex ratio in the study area was between 112 and 140. Communities come from various ethnic groups, including Dayak, Malay, Banjar, and Javanese. Our survey data indicated a distribution of Dayak with 57.1% and Malays with 31.4%, while Javanese consisted of 1.9%, and Banjar ethnics consisted of 0.9%. In Kendawangan Block, Dayaks play a significant role as village heads and local leaders. In Air Hitam Block settlements, Malay is the dominant ethnic group, and Dayaks tend to live away from the main villages.

Villages within Kendawangan Block provide basic and mid-level education, with only Mekar Utama village having high school facilities. The majority of the population had not completed elementary school. Within Air Hitam Besar and Air Hitam Hulu Villages, high school facilities exist.

Household income within the HKI concession was derived from two sectors: agricultural and non-agricultural. Agriculture sources amounted to 47%, and was the dominant contributor to total household income within Project-area communities. Monthly household income derived from agriculture was between IDR 300,000 (USD \$24) to IDR 2,750,000 (USD \$220) per month, with an estimated average income of IDR 1,013,000 (USD \$81) per month. Range in monthly income from the non-agricultural sector was IDR 300,000 (USD \$24) to IDR 3,000,000 (USD \$240) per month, with an estimated monthly average of IDR 665,500 (USD \$53) per month. Combined monthly income from the agricultural and non-agricultural sectors for households was estimated at IDR 1,678,500 (USD \$134).

Within Kendawangan Block, 47.1% of people were fulltime employees, followed by part-time employees at 19.1%. Labourers and traders made up 10.3% each. Farmers/agriculture-based occupations made up 7.4%. Civil servants were the smallest occupation group with 5.9%. In Air Hitam Bloc, employees made up 36.7%, followed by traders with 23.3%. Labour and farmer/agriculture-based occupations made up 13.3%, followed by part-time employees with 10.0%. Civil servants made up 3.3%.

The Project is within the working area of Kendawangan Community Health (or *Puskesmas* Kendawangan). Each village contains a government-built maternity clinic (*Polindes*), as well as a Supporting Community Health (*Puskesmas Pembantu*) provided in Mekar Utama and Selimatan Jaya. The most common health issue in Kendawangan Sub-district is upper-respiratory tract infection, accounting for 23.3% of the total health issues. Common cold/acute nasopharyngitis is the next most common health (15.2% of total cases), followed by dyspepsia/Indigestion (14.9%), fever (13.9%), and Gastroenteritis (9.4%). In 2014, there were 564 cases of clinical malaria, but malaria cases declined drastically in 2015, to 32 cases.

Within Kendawangan Block, the majority of people (64%) reported using rivers for sanitation (washing, bathing, toilets). This was followed by use of mountain water springs (18.7%), and well water for

washing and bathing (6.7%). Water from rainfall was rarely reported as being used (4.0%). The majority of people use toilets for defecation (69.3%). However, 17.3% reported using bush/forest areas, and 2.7% used rivers for defecation. Conversely, within Air Hitam Block, most respondents reported using well water for bathing, washing, and toilet (63.3%), with borehole water at 30.0%, and river water at 6.7%. Within Air Hitam, use of toilets occurred the majority of the time (73.3%).

In 2015, there were a total of 45 POSYANDU distributed among 19 villages in Kendawangan Sub-district. These healthcare facilities were complemented by 21 Village Health Centers and 11 Community Health Center Aides. Kendawangan Sub-district does not currently have a Maternity Hospital or Maternity Clinic. However, one midwife in each village is present and assisted by a traditional-midwife. There were 25 traditional-midwives in Kendawangan Sub-district. The number of doctors decreased from two in 2013 and 2014, to one in 2015. One dentist, but no specialist doctors are available within Kendawangan Sub-district.

Within Kendawangan Block, houses are largely made of wood, and constructed on stilts. They typically use metal roofing materials, and wood for the floor. The toilet, if there is a designated toilet area, is typically separate from the main house. Many houses in our field survey did not have toilets. Most of the villages surrounding Kendawangan Block are not serviced with electricity by PLN. To fulfill electricity needs, most people use a diesel generator for evening lighting and other services. Conversely, many houses in Air Hitam Block are permanent and semi-permanent modern houses, built from wood and cement, and include a toilet and kitchen inside the house. Most people of Air Hitam Besar Village are not serviced by PLN, and use diesel generators to obtain electricity.

Within Kendawangan Block, rivers accounted for 60% of respondents' fresh water source. Well water for drinking and cooking was reported by 6%, and piped mountain spring water by 18%. Bottled mineral water use was reported by 3%, and also PAM water by 8% of respondents. Very few people reported using borehole wells (1%) and rainfall catchment (3%). Within Air Hitam Block, well water was reported by 43% of respondents as their fresh water source. Bottled water was reported by 27% of respondents, borehole wells by 10%, and rainfall catchment by an additional 10%.

Ethnic groups within and around the HKI concession include Malay, Dayak, Java, Sunda, Batak, and Thionghoa. The large majority are Dayaks and Malays. Dominant religions are Muslim, Catholic, and Protestant. The Dayak within the HKI Project area are composed of sub-Dayak Kaharingan who live in Kendawangan. Dayak ethnic Kaharingan are subdivided into smaller Dayak Kendawangan sub-ethnics groups named: Air Durian, Air Upas, Batu Payung, Belaban, Membulu', Menggaling, Pelanjau, Sekakai, Sempadian and Air Hitam.

## Project Impact Scoping

**Scoping:** Scoping of this ESIA involved three components: (1) spatial extent of the ESIA, (2) temporal extent of the ESIA, and (3) scoping of potential impacts. We considered the spatial extent, as the concession boundaries covering both the Kendawangan and Air Hitam Blocks, transportation routes to and from the project, and surrounding areas affected by changes in air and water quality downwind or downstream of the project. We considered the temporal extent to be effects associated with all activities involved in the pre-construction, construction, and operations phases of the Project, as well as the hypothetical decommissioning phase. Scoping of potential Project-related impacts involved the systematic consideration of the potential impacts for all project-related activities to interact with biophysical, biological, and social-economic aspects of the environment. From an initial scoping to identify these potential Project-related impacts, all potential impacts were evaluated for their potential

to represent significant impacts. All potentially significant impacts were then carried forward and identified as those requiring assessment within this ESIA.

**Stakeholder engagement:** During the scoping phase, stakeholder engagement was conducted through consultations with heads of villages, local figures, women and youth groups, local NGOs, farmers, and local entrepreneurs. Initial public consultations were carried out during the 2014 AMDAL process, with supplementary engagements conducted for this ESIA. Topics covered during public consultations included: change of ownership, and HKI introduction; HKI's business plan; change in main crop type to rubber; main activities and the potential for impacts on the environment and public; rights and responsibilities of the company to the surrounding communities; community welfare, seed plants, and *Tanaman Kehidupan*; and corporate social responsibility plans.

**Impact assessment methodology:** The primary focus of this ESIA was the prediction, evaluation, and mitigation of impacts. All potential impacts were screened and assessed as to whether their potential impact was of sufficient magnitude to cause a significant impact. Where an impact was deemed to be so small as to be negligible (i.e., cannot be measured or detected, or will have no foreseeable effects), it was no longer considered for further evaluation. The focus of subsequent assessments was on predicting residual impacts – impacts that take into account mitigation or control measures that are part of the Project design. For positive impacts, mitigation was not required, but an assessment of potential enhancement opportunities was included. Level of significance considered the likelihood and magnitude of the environmental effect, its geographical scale, and duration in relation to the sensitivity of the key receptors and resources. Criteria for assessing the significance of impacts were based on a combination of: determination of magnitude and receptor sensitivity to determine severity, and then combining assessment of severity with the assessment of impact likelihood to assign an impact significance level.

## Biophysical Impact Assessment

**Air quality impacts from operation of heavy machinery:** Operation of heavy machinery and equipment during construction and operation phase, as well as land clearing and timber harvesting activities, are expected to cause impacts to air quality through the propagation of airborne particulates and dust. Based on the implementation of mitigation measures including semi-annual monitoring, implementation of speed limits, driver education, and proper vehicle maintenance, it is anticipated that residual Project-related impacts will be of Minor significance.

**Air quality impacts from fertilizer applications:** Potential airborne mobilization of fertilizer during planting, and maintenance activities as dust and particulates can have negative health impacts. Based on the implementation of mitigation measures including proper equipment maintenance, training, dust suppression, personal protective equipment, and public information dissemination, it is anticipated that residual Project-related impacts will be of Minor significance.

**Air quality impacts from herbicide and pesticide application:** Small toxic particles are discharged to the air during herbicides and pesticides spraying through a spray nozzle under pressure, posing a potential danger to workers and the public. Based on the implementation of mitigation measures including regular monitoring, personal protective equipment, proper equipment maintenance, worker training, and strict adherence to proper weather conditions, it is anticipated that residual Project-related impacts will be of Minor significance.

**Air quality impacts from waste management practices:** Implementation of waste management practices that involve burning waste, resulting in the emission of air borne particles, have the potential to impact air quality. Based on the implementation of mitigation measures including the implementation



of an existing waste-management program, proper handling of toxic wastes, and strict enforcement of a ban on illegal burning, it is anticipated that residual Project-related impacts will be of Minor significance.

**Noise impacts from operation of heavy machinery:** Ambient noise levels caused by operation of heavy machine and equipment during various activities, including construction, land clearing, and timber harvesting, could pose potential noise effects on workers and the public. Based on the implementation of mitigation measures including personal protective equipment, routine monitoring in villages, the use of lighter equipment when possible, public consultation, and proper scheduling of day/night activities, it is anticipated that residual Project-related impacts will be of Minor significance.

**Noise impacts from vehicles and traffic:** Mobilization of workers, equipment, and materials during Project construction and operation, resulting in increases in ambient noise levels in noise sensitive areas, represents potential negative noise impacts to communities. Based on the implementation of mitigation measures including strict implementation of speed limits, driver training, regular monitoring in villages, proper scheduling of day/night activities, it is anticipated that residual Project-related impacts will be of Minor significance.

**Surface and ground water quality impacts from changes to drainage regimes:** Modification of natural drainage regimes and changes in land cover types could potentially affect runoff patterns, and could also increase the likelihood and magnitude of flooding, ultimately impacting surface and ground water quality. Based on the implementation of mitigation measures including proper planning and construction of drainage structures, maintaining natural drainage patterns, retaining natural watershed characteristics, and maintaining wetlands and other hydrologic buffers, it is anticipated that residual Project-related impacts will be of Moderate significance. Implementation of best practices in construction and monitoring will mitigate the most serious impacts and provide the potential to improve drainage and flooding characteristics during more advanced stages of the operations phase.

**Surface and ground water quality impacts from changes to water availability:** A potentially high demand for water from numerous Project-related activities in addition to increases in domestic needs, could result in potentially negative changes in water quantity in watercourses in and around the Project area. Based on the implementation of mitigation measures including the implementation of a water management plan, regular monitoring, development of a drainage control infrastructure, and flood prevention management strategies, it is anticipated that residual Project-related impacts will be of Moderate significance. Improvements to community water infrastructure (e.g., wells, permanent water sources) will further reduce Project-related impacts.

**Surface and ground water quality impacts from soil erosion:** Project activities such as land clearing, timber harvesting, road construction, and plantation establishment could increase the risk of erosion, ultimately resulting in potential water quality impacts by elevating concentrations of suspended and dissolved solids, and other contaminants. Based on the implementation of mitigation measures including the maintenance of river buffers, proper road design and associated drainage structures, timing construction outside of heavy rain events, planting of cover crops, and regular monitoring, it is anticipated that residual Project-related impacts will be of Moderate significance. Implementation of a proper erosion reporting and management system will further reduce Project-related impacts.

**Surface and ground water quality impacts from chemical applications:** Application of fertilizers, herbicides, and pesticides could potentially impact water quality through improper application techniques, and through runoff and soil erosion issues. Based on the implementation of mitigation

measures including proper handling of chemicals, equipment maintenance, training, proper chemical application, proper scheduling of chemical applications, and regular monitoring, it is anticipated that residual Project-related impacts will be of Minor significance.

**Soil quality impacts from soil compaction:** Activities such as land preparation for roads, facilities, and plantations, as well as the use of heavy machinery, may result in potentially negative impacts on soil quality from soil compaction. Based on the implementation of mitigation measures including proper soil preparation for planting, use of light vehicles when possible, driver training, minimizing road construction, and proper vehicle maintenance, it is anticipated that residual Project-related impacts will be of Minor significance.

**Soil quality impacts from soil erosion:** Activities involved in land preparation, installation of road networks, infrastructure construction, heavy equipment operation, and modification of land cover may result in increased soil erosion and ultimately result in potential impacts on soil quality. Based on the implementation of mitigation measures including planting of cover crops, effective use of soil-erosion barriers, use of soil conservation techniques during construction, minimizing time lags between clearing and planting, use of reduced impact logging, and regular monitoring, it is anticipated that residual Project-related impacts will be of Moderate significance.

**Soil quality impacts from chemical applications:** Application of fertilizers, herbicides, and pesticides could potentially impact soil quality through chemical contamination. Based on the implementation of mitigation measures including proper handling of chemicals, equipment maintenance, training, proper dosage application, proper scheduling of chemical applications, and implementation of a concession-wide chemical application management plan, it is anticipated that residual Project-related impacts will be of Minor significance.

## **Biological Impact Assessment**

**Impacts on terrestrial flora from habitat loss:** Potential negative impacts on terrestrial flora within the project area may occur due to a variety of land clearing activities, road construction, facility construction, plantation establishment, timber harvesting, and herbicide application. Based on the implementation of mitigation measures including the avoidance and maintenance of high-conservation-value areas, identification and management of endangered species, and implementation of a flora management plan, it is anticipated that residual Project-related impacts will be of Minor significance.

**Impacts on terrestrial fauna from habitat loss:** Potential negative impacts on habitat for terrestrial fauna within the project area may occur due to a variety of land clearing activities, road construction, facility construction, plantation establishment, timber harvesting, and herbicide application. Based on the implementation of mitigation measures including the avoidance and maintenance of high-conservation-value areas, identification and management of endangered species, and implementation of a wildlife habitat management plan, it is anticipated that residual Project-related impacts will be of Minor significance.

**Impacts on terrestrial fauna from direct mortality:** Potential negative impacts to terrestrial fauna may occur from increases in direct mortality as a result of project-related activities such as vehicle collisions (animal road-kill) due to increased vehicle traffic, hunting and snaring of wildlife by local residents and project workers, and accidental poisoning from the application of pesticides. Based on the implementation of mitigation measures including improved sightability along roads, strict enforce of speed limits, an employee ban on hunting or killing of wildlife, strict enforcement of endangered species

laws, it is anticipated that residual Project-related impacts will be of Moderate significance. A public education and community involvement program could further reduce Project-related impacts.

**Impacts on terrestrial fauna from fragmentation and disruption of movement patterns:** Potential negative impacts on terrestrial fauna may occur as a result of fragmentation effects and disruption of movement patterns on terrestrial wildlife resulting from a loss in habitat connectivity from road construction and maintenance, facility construction and maintenance, and land clearing. Based on the implementation of mitigation measures including management and monitoring of high conservation value areas, minimizing the project footprint, avoiding wide dispersion of operational activities, retention of key linear habitat features, and preparation of a landscape connectivity plan, it is anticipated that residual Project-related impacts will be of Minor significance.

**Impacts on aquatic biota from changes in water quality from erosion:** Potential negative changes in water quality affecting aquatic biota, could potentially result from increased sedimentation and nutrient loading, and increased chemical concentrations. Based on the implementation of mitigation measures including regular monitoring, erosion mitigation and management, proper chemical management and application, and maintenance of natural buffers (e.g., wetlands), it is anticipated that residual Project-related impacts will be of Minor significance.

**Impacts on aquatic biota from land clearing:** Land clearing for buildings, roads, and plantation areas could potentially impact aquatic biota by directly removing aquatic habitat, or modifying, fragmenting, and isolating aquatic habitat to the extent it becomes unproductive. Based on the implementation of mitigation measures including retention of riparian-area setbacks (buffers), identification and management of critical aquatic habitat, restoration of natural sensitive habitat (e.g., peat swamps), and maintenance of aquatic habitat connectivity, it is anticipated that residual Project-related impacts will be of Minor significance.

**Impacts on aquatic biota from instream works:** The large number of required water crossings during the construction and operations phases of the Project, could result in impacts on aquatic biota due to the occurrence of instream works. Based on the implementation of mitigation measures including strict adherence to best management practices for instream works, proper sizing of drainage structures, scheduling of instream works during proper season and weather windows, strict implementation of company policies towards draining of wetlands, and regular monitoring, it is anticipated that residual Project-related impacts will be of Minor significance.

## **Socio-economic Impact Assessment**

**Impacts to employment opportunities:** During the Project's construction and operation phases, numerous employment opportunities will be created, which therefore represents potentially large positive impacts on local employment opportunities. Based on the implementation of mitigation measures including a local hiring policy, on-going local training, and public consultation, it is anticipated that residual Project-related impacts will be of Major positive significance.

**Impacts to business opportunities:** The Project will require numerous services from contractors and local businesses during both the construction and operation phases, such as seedling businesses, construction contractors, and other support businesses, resulting in potentially large positive impacts on local business opportunities. Based on the implementation of mitigation measures including a local business support policy, public consultation, and coordination with village heads, it is anticipated that residual Project-related impacts will be of Major positive significance.

**Impacts to community income:** Project-related activities have the potential to increase monthly household incomes, and therefore represent a potentially positive impact on community income. Based on the implementation of mitigation measures including implementation of a minimum wage, training and capacity building, and public involvement and education, it is anticipated that residual Project-related impacts will be of Major positive significance.

**Impacts to local workforce capacity:** The Project will result in the employment of a large local workforce, and therefore represents a potentially large impact on local workforce capacity. Based on the implementation of mitigation measures including the implementation of numerous training programs, and creation of fulltime permanent positions, it is anticipated that residual Project-related impacts will be of Moderate positive significance.

**Impacts to social conflicts:** Potential conflicts occurring during land clearing phases and in the course of forest area boundary arrangements related to land ownership disputes, could potentially result in impacts related to social conflicts. Based on the implementation of mitigation measures including the implementation of a social mapping study, improved communication among villages, establishment of a Community Relations Officer, and dedicated local staff, it is anticipated that residual Project-related impacts will be of Minor significance.

**Impacts to community facilities and infrastructure:** Project-related activities will include construction of community facilities and infrastructure such as health centers and schools, and therefore represents potentially positive impacts on community facilities and infrastructure. Based on the implementation of mitigation measures including a Corporate Social Responsibility program, with a focus on roads, clean water, lighting, places of worship, education and sports facilities, it is anticipated that residual Project-related impacts will be of Moderate positive significance.

**Impacts to disease prevalence from Project-related activities:** Project activities during construction and operation such as land clearing, heavy equipment operation, chemical spraying, and waste management could have effects on air and water quality that result in potential impacts on disease prevalence. Based on the implementation of mitigation measures including air quality management and mitigation (as described previously), water quality management and mitigation (as described previously), and increased public education, awareness and health care, it is anticipated that residual Project-related impacts will be of Minor significance.

**Impacts to disease prevalence from immigration of workers:** The Project will involve immigration of relatively large numbers of workers, potentially resulting in increases in communicable diseases such as tuberculosis, sexually transmitted diseases, malaria, and dengue fever. Based on the implementation of mitigation measures including employee health care benefits, public education and awareness, and increased health facilities and resources, it is anticipated that residual Project-related impacts will be of Minor significance.

**Impacts to community safety:** The Project will involve the use of heavy machinery, vehicles, industrial facilities, and related tools and equipment, and therefore poses potential risks to community safety through accidents and exposure to potentially dangerous industrial operations. Based on the implementation of mitigation measures including strict implementation of safety protocols, increased road and traffic safety, and public education and awareness, it is anticipated that residual Project-related impacts will be of Minor significance.



**Impacts on children from child labour:** The Project operates in an area with a high prevalence of children (under the age of 18) involved in the labour force. There are many factors that potentially contribute to a high baseline level of child labour in the area, which include the predominantly agrarian society, low education levels, and prevalence of oil palm plantations that promote the development of family run smallholdings that rely on support from family members to operate. The direct impact by the Project on this existing baseline is not considered to be significant, however proper management of the Company's workforce and subcontractors are required to ensure operations do not directly, or indirectly involve child labour.

**Impacts on shifting-cultivation farmers:** The Project will involve the conversion of open, cultivated land, to rubber plantation, and thereby have potentially negative impacts on the 8.5% of survey respondents who identify as shifting-cultivation farmers and use these areas as their primary source of income generation. Based on the implementation of mitigation measures including the implementation of community welfare plantations, creation of alternative employment opportunities, and boundary delineation, it is anticipated that residual Project-related impacts will be of Moderate significance.

**Impacts on cultural practices of indigenous peoples:** Project activities will involve land clearing, road construction, and plantation establishment in areas potentially identified by indigenous people (Dayak) as important traditional and cultural spaces, and therefore could have potentially negative impacts on cultural practices of indigenous people. Based on the implementation of mitigation measures including pre-construction consultation and engagement of Dayak communities, compensation programs for potential losses, and cultural support programs, it is anticipated that residual Project-related impacts will be of Minor significance.

**Impacts on cultural heritage:** Project activities will involve land clearing, road construction, and plantation establishment in areas potentially overlapping specific cultural sites (e.g., grave sites, ceremonial sites) identified by local communities, and therefore could have potentially negative impacts on cultural heritage. Based on the implementation of mitigation measures including maintenance of a cultural-site inventory, pre-construction public consultation and engagement, and implementation of cultural-site management protocols, it is anticipated that residual Project-related impacts will be of Minor significance.

**Impacts on worker health and safety:** The Project will involve the use of heavy machinery, vehicles, industrial facilities, and working with chemicals, related tools, and equipment, and therefore poses potential risks to workers through accidents and exposure to potentially dangerous industrial operations. Based on the implementation of mitigation measures including implementation of a rigorous health and safety program, employee training program, and regular monitoring and evaluation, it is anticipated that residual Project-related impacts will be of Moderate significance.

**Impacts from labour conflicts:** The project will involve the recruitment of large numbers of employees within various classifications including staff, non-staff, daily workers, and contractors, and therefore represents the potential for labour unrest and other negative impacts resulting from labour conflicts. Based on the implementation of mitigation measures including intensive communication and negotiation with labour groups and employees, in addition to consultation with local authorities in the case of conflict, it is anticipated that residual Project-related impacts will be of Moderate significance.

## **Carbon Storage and Greenhouse Gas Emissions**

For the purposes of this ESIA, our focus was on GHG emissions associated with Land Use, Land Use Change, and Forestry (LULUCF). Specifically, we focused on the positive or negative effects associated

with HKI's primary planned LULUCF activity: establishment of rubber tree (*Hevea brasiliensis*) plantations.

To predict overall effects on carbon stocks within the HKI concession area we compared carbon pools calculated for typical sites in West Kalimantan, with representative carbon pools calculated in rubber plantations. We based our assessment on predicted land cover changes, based on the following assumptions and logic: all land available to HKI will be targeted for conversion to rubber plantations, with the exception of land cover types targeted for retention to meet legal and conservation targets; cover types targeted for retention will include primary forest, peatlands, high-value forest; and, remaining cover types targeted for conversion to rubber plantation will include bare ground, agricultural land, shrub-dominated land, grass/herb-dominated land, and low-value forest:

Out of the 11 land cover types considered in this assessment, five will have no predicted effects on carbon pools, four will potentially result in increased carbon pools, and the two remaining cover types will result in either an increase or decrease depending on the circumstances. In this case, the five cover types with no predicted effects on carbon pools are attributable to an expectation that these cover types will be targeted for retention, due to their high legal and conservation importance. The four cover types resulting in increased carbon pools are attributable to non-forest land conversions to forested land. The remaining two land cover types – low-value, highly degraded peat and non-peat forests – may represent an overall increase or decrease given similar carbon pool estimates for degraded forest types in comparison to typical rubber plantations. On this basis, it is unlikely that Project-related activities within the HKI concession area will have significant negative effects on existing and future carbon pools, and are therefore unlikely to have significant negative effects on overall greenhouse gas emissions resulting from LULUCF factors.

The following mitigation and best management practices are recommended: (1) High-value, low-degraded forest sites, in particular peatland forests, should be retained to the greatest extent possible, (2) In meeting plantation area objectives, non-forested and highly degraded, low-value forest sites should be targeted for conversion as a priority over higher-value forested sites, to the greatest extent possible, and (3) Perform a more complete carbon stock and GHG emissions analysis when the required data and planning information becomes available.

### **Cumulative Impacts Assessment**

**Air quality and noise:** Project-related impacts on air quality are primarily driven by potential increases in dust and particulates in the air, especially around local villages. Any potential cumulative impacts will primarily be created during the construction and operation phases. The cumulative impacts of the Project on air quality and to noise levels are considered to be Moderate, as the Project's impacts will overlap with those of other, similar projects in the area and baseline conditions are currently approaching or exceeding thresholds. As the Project represents a production forestry operation within a landscape predicted to be dominated by oil palm agriculture in the future, HKI must manage and reduce air and noise impacts to the greatest extent possible through mitigation and best-management practices to avoid significant contributions to cumulative impacts on a regional basis.

**Surface and groundwater quality:** Project-related impacts on water quality are primarily driven by indirect exposure of water resources to chemicals from chemical laden dust and soils, as well direct exposure from application and subsequent run-off of chemical fertilizers and pesticides. Potential cumulative impacts will primarily be created during the construction and operation phases, and are considered to be Moderate, as the Project's impacts will overlap with those of other, similar projects in

the area, and existing baseline conditions are approaching or exceeding thresholds. Given the location of the Project area within local watersheds, the company can have a significant impact on water quality within the specific watersheds they operate, but limited leverage to affect cumulative impacts in watersheds where water quality is already heavily impacted before reaching the Project area. HKI must manage and reduce water quality impacts to the greatest extent possible through mitigation and best-management practices to avoid significant contributions to cumulative impacts on a regional basis.

**Hydrology and water quantity:** Project-related impacts on hydrology (surface water levels and flows) are primarily driven by modification of watershed characteristics and runoff regimes. The direct impacts are considered to be changes in drainage patterns from road infrastructure and diversion channels as well as increased risks of flooding and erosion due to increased runoff coefficients in cleared land. The cumulative impacts of the Project on hydrology and water quantity are considered to be Minor, as potential changes in hydrology are mostly localized, and mitigation measures will limit significant changes in large-scale watershed hydrology. The Project operates in the upper limits of some of the smaller watersheds, but will mostly contribute to cumulative impacts at middle and lower watershed levels. HKI will minimize its contributions to cumulative impacts of this nature by strict implementation of mitigation actions and best management practices concerning the conservation and modification of surface water flows.

**Terrestrial flora and fauna:** Project-related impacts on terrestrial flora and fauna are primarily related to issues of potential habitat loss from land conversion to plantations, potential increases in direct faunal mortality from increases in human interactions (e.g., hunting and vehicle collisions), and disruptions to faunal movement and fragmentation effects from land development (particularly road construction). Overall cumulative impacts of the Project on terrestrial flora and fauna are considered to be Minor, with the exception of potentially Moderate cumulative impacts on direct mortality effects on terrestrial fauna – largely associated with large anticipated increases in human presence, which could contribute significantly to regional direct mortality levels of terrestrial fauna through increased hunting pressure and vehicle collisions. HKI must effectively manage direct mortality effects on terrestrial fauna to the greatest extent possible through mitigation activities to minimize or avoid significant cumulative impacts on a regional basis.

**Employment opportunities and community income:** Project-related impacts on employment opportunities are the direct result of the company's substantial workforce requirements, with indirect impacts to community income levels. Overall the Project's cumulative impact to community employment opportunities and incomes is considered to be positive, and of Moderate significance. The company's leverage on cumulative impacts to employment and community income could be significant, if HKI is able to develop an effective relationship with local labour unions and communities to drive positive change in worker capacity and support worker rights. On this basis, HKI will contribute to positive cumulative impacts over the long-term by increasing employment opportunities and standards, and community income within the region.

**Business opportunities:** Project-related impacts on business opportunities for local communities were assessed as positive, and of Major significance as the Project would bring new business opportunities to the local area. Overall, the Project's cumulative impact on business opportunities is considered to be positive, and of Moderate significance. As the company operates in a region that is primarily developed and developing oil palm plantations, there is limited leverage for the company to improve their impact on business opportunities beyond their project boundaries. However, HKI will contribute to positive

cumulative impacts over the long-term by increasing business opportunities and capacity of local community to take advantage of developing business opportunities within the region.

**Community health:** The Project's use of migrant workers is expected to have negative impacts on the prevalence of communicable diseases in local communities. However, as HKI's workforce will likely only represent a small proportion of the total migrant workforce in the region, the cumulative impact of the Project on community health is considered to be Minor. Any cumulative effects on community health will be reduced by HKI's plan to build additional community health infrastructure. Worker education on communicable diseases is part of the mitigation activities recommended in the ESIA. The company therefore has some leverage in reducing the overall cumulative impact through improvements in local healthcare capacity, and education of workers and the community.

**Shifting-cultivation farmers:** The Project's plans to transfer most of the open, arable land in the concession areas to rubber plantations may create disproportional impacts to the livelihoods of shifting cultivation farmers in the area, including the local Dayak, who rely on access to arable land to clear and plant crops. However, overall cumulative impacts on shifting cultivation farmers is considered Minor, as the potential impacts to this group are low, relative to other activities in the region. As HKI is committed to managing an environmentally and socially sustainable forestry operation, cumulative impacts on shifting cultivation farmers will be minimized on a regional level through engagement, education, and employment.

**Indigenous people:** The Project operates in an area with identified Indigenous People's groups, collectively known as the Dayak. As the Dayak have customary rituals centered on cultivating forest areas, HKI's plans to transfer most of the land in the concession area to rubber plantation could potentially impact the Dayak's ability to maintain their cultural identity. However, the Project's cumulative impact is considered to be Minor, as the regulations governing operations of forestry companies and HKI's commitment to engaging with local indigenous groups represent a small impact compared to the much greater impact of other activities in the region. The ability of the company to influence the overall cumulative impact is potentially high, as it can provide a refuge for Dayak culture and act as a model in preservation of cultural heritage in the region.

## **Environmental and Social Management Plan (ESMP)**

The ESMP describes the overview of mitigation strategies and management plans that will be applied to eliminate or minimize potential negative impacts, enhance positive benefits, and monitor activities to track long-term performance related to environmental and social components. It provides a framework for addressing management issues and concerns. Detailed management plans and specific work instructions will be required as the project progresses.

**Environmental Management Plan (EMP):** ensures that all Project interactions with the physical and biological environment are managed effectively to minimize the Project's residual impacts on the environment. The EMP also includes opportunities to enhance environmental benefits through environmental programs.

**Social Management Plan (SMP):** ensures that all Project interactions with the community are managed effectively to minimize the Project's residual impact on local, regional and national community as well as cultural heritage while maximizing the potential benefits. As part of the SMP, a Labour and Health & Safety Management Plan will be provided, which ensures that the working conditions and activities engaged by the employees are conducted in a way that minimizes potential sources of hazards to the human health and safety.



***Roles and responsibilities:*** Implementation of the ESMP will require assigned responsibilities for identified staff, including the following identified positions: Project owner/management; Health, Safety, and Environment Manager; Environmental and Social Officer; Community Relations Officer; Auditing Supervisor; Health and Safety Officer; Health Supervisor; Safety Supervisor; Inspectors and Firefighting Personnel; and Contractors.