Annex 1 Impact Assessment Methodology

The significance of all potential impacts that would result from the proposed project is determined in order to assist managers.

Key issues identified during scoping require further studies to determine whether they are likely to occur and to assess how they will manifest themselves.

For key potential impacts identified by the scoping study, it will be necessary to determine the significance of each impact, based upon qualitative or quantitative assessment of the following attributes:

- magnitude
- geographical scale
- duration
- probability of occurrence

The resulting impact will be indicated by their significance class, which classes are defined as:

Table 1: Classes of impact significance

< Impact significance >
Major (significant) effect: effect expected to be permanent or continuous and non-reversible on a national scale and/or have international significance.
Moderate (significant) effect: long-term or continuous effect, but it is reversible and/or it has regional significance.
Minor (not significant) effect: effect confined to the local area and/or of short duration, and it is reversible.
Negligible (not significant) effect: effect not detectable.
Unknown effect: insufficient data available to assess the significance of the effect.

In addition, impacts have been classified as:

- Positive: indicating whether the impact will have a positive (beneficial) effect; or
- Negative: indicating whether the impact will have a negative (adverse) effect on the environment, including affected people.

The degree of detail will enable the determination of required mitigation and possible enhancement measures, respectively to prevent or reduce significant negative impacts and to promote any positive impacts already in the planning phase. The implementation of mitigation measures will reduce negative environmental impacts to an acceptable level as much as possible.

After implementation of mitigation/enhancement measures the significance of the impacts will again be determined.

The impact assessment methodology is described below.

The **significance** of an impact is defined as a combination of the **severity** of the impact occurring and the **probability** that the impact will occur. The significance of each identified impact will be rated according to the methodology set out below:

First the **intensity/magnitude/size**, **scale** and **duration** of the impact are determined according to below tables (see **Table 2**,

Table 3 & **Table 4**).

Table 2: Defining the intensity / magnitude / size of negative impacts

Rating	Description of Rating for		
	Natural environment	Socio-cultural	Health/safety
High	Irreversible damage to highly valued species, habitats or ecosystems	Irreparable damage to highly valued items of cultural significance, or social functions or processes are severely altered	Event resulting in loss of life, serious injuries or chronic illness; hospitalization required
Medium	Reversible damage to species, habitats or ecosystems	Repairable damage to items of cultural significance, or impairment of social functions and processes	Event resulting in moderate injuries or illness; may require hospitalization
Low	Limited damage to biological or physical environment	Low-level damage to cultural items, or social functions and processes are negligibly altered (nuisance)	Event resulting in annoyance, minor injuries or illness, not requiring hospitalization
Negligible	No relevant damage to biological or physical environment	No damage is done to cultural items and social functions and processes are not altered	Event is not experienced by receptors or only occasional minor annoyance

Table 3: Defining the intensity / magnitude / size of the positive impacts

Rating	Description of Rating for		
	Natural environment	**Socio-cultural**	**Health/safety**
High	Direct benefits to species, habitats and resources with significant opportunities for sustainability	Benefits to local community and beyond	Health and safety will be significantly improved
Medium	Moderate benefits to species, habitats and resources with some opportunities for sustainability	Benefits to many households or individuals	Health and safety will be improved
Low	Minor benefits to species, habitats and resources with possible opportunities for sustainability	Benefits to few households or individuals	Health and safety will be slightly improved

Table 4: Defining duration and scale of the impact

Rating	Definition of Rating
Duration– the time frame for which the impact will be experienced	
Short-term (ST)	Up to 2 months (construction time per zone)
Medium-term (MT)	2 to 10 months (total construction time)
Long-term (LT)	More than 10 months
Scale– the area in which the impact will be experienced	
Small (SS)	Localized spot – tower or substation location
Medium (MS)	Part of study area
Large (LS)	Study area or beyond

Then the severity **rating** of the impact is determined by combining the **magnitude** of the impact with **duration** and **scale** of the impact (see **Table 5**) as set out below.

Table 5: Determination of the Severity Rating of the impact

Magnitude	High	Medium	Low	Negligible
Duration and/or Scale				
LT-LS, LT-MS or MT-LS	High	High	Medium	Negligible
LT-SS, MT-MS, MT-SS, ST-MS or ST-LS	High	Medium	Low	Negligible
ST-SS	Medium	Low	Negligible	Negligible

The next step is to define the probability of an impact to occur, as defined below (see **Table 6**).

Table 6: Defining the probability of the impact

Probability– *the likelihood of the impact occurring*	
High	Sure to happen, or happens often
Medium	Could happen, and has happened in Suriname
Low	Possible, but only in extreme circumstances

Finally, the overall significance of the impact is determined as explained below (see **Table 7**).

Table 7: Determination of the overall significance of the impact

Severity	High	Medium	Low	Negligible
Probability				
High	Major	Moderate	Minor	Negligible
Medium	Major	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible

The overall impact assessment will be presented summarized using a table:

Project activity	Resources affected	Impact description	Likelihood	Characteristics and consequence	Impact significance	Mitigation measures	Residual impact

Annex 2

Field Orientation Report
for the
Addendum ESIA Energy Infrastructure Project Commewijne

Prepared for:

NV Energie Bedrijven Suriname

Paramaribo, May 2021

ILACO

ISO 9001: 2015 certified

Introduction
On the 4th of May 2021, the study area was visited by a team of ILACO and EBS. The team members of ILACO were R. Bong A Jan and M. Fortune. The team members of EBS were E. Kasban, A. Amattamsir and L. Wirjoinangoen.

The purpose of the site visit was to do an orientation of the project location and to verify the current conditions on-site.

The field orientation on the 4th of May included orientation at the following locations:

- Proposed location for the galvanized riser poles for the river cable at Ellen and at Johanna & Margareta;
- Existing distribution line at the right bank of the Commewijne River (from the river site);
- Location of current 12 kV single-circuit line at plantation Kroonenburg;
- Proposed location for the solar plant at Alliance.

Photos of some observations at the different locations is presented below.

<table>
<tr><th colspan="2">Location: Ellen</th></tr>
<tr><td> 
New distribution line will be placed on the right site of Bamistraat (see red arrow), towards the location of the rise pole at Ellen.</td><td> 
Proposed location of the rise pole (end of the Bamistraat). The cable will be placed underground toward the left site of the old jetty (see red arrow). Minimum Parwa vegetation will be disturbed by placing the cable underground. From the left side of the jetty, the cable will go on the river bed.</td></tr>
</table>

RGD Health centre, on east side at the end the Bamistraat

Street at the west side at the end of the Bamistraat. No houses observed near location of rise pole.

Street at the west side at the end of the Bamistraat. Several houses observed on the east side.

Old jetty, still used by some fisher boats. Cable will be placed on the left side.

Parwa vegetation left side of the jetty.

Location: Johanna & Margareta
 Proposed location towards rise pole at Johanna & Margareta, from area with less vegetation
 Proposed location rise pole at Johanna & Margareta and existing distribution line along the bike path. The existing distribution line will be demolished after the new line is placed.

From left to right: riverside- bike path- location rise pole at Johanna & Margareta

Location: Kroonenburg

A location were new distribution line needs to be placed more landwards .

Location at current 12 kV single-circuit line (red cable) at Plantation Kroonenburg

Location were the current net splits to the east and west plantations. East towards Alliance and Reijnsdorp and west towards Fredriksdorp and Johanna & Margareta.

Location: Alliance

Proposed location for solar plant at Alliance near old station of EBS Centrale. The old building will be demolished and an operators room will be build. This aspect was already described in the previous ESIA study for the Commewijne project (ILACO, 2019).

Annex 3 The bio-physical environment (ILACO, 2019)

Introduction

The current environment represents existing conditions including cumulative changes associated with past and present developments (e.g., forestry, agriculture, mining, transportation, residential and recreational development) and natural factors (e.g., fire). For assessment purposes, the baseline characterization represents as much as possible the conditions in 2019.

Climate

Most of Northern Suriname has a Tropical Rainforest Climate (Af climate in Köppen's classification; Amatali & Naipal 1999).
The average annual rainfall in the central part of northern Suriname predominantly ranges between 2,000 and 2,500 mm.
Like in most parts of Suriname, consistently high temperatures and a high humidity characterize the study area with the main variation being rainfall and the associated cloud cover. The mean annual air temperature at Paramaribo (Cultuurtuin) is 27.8 ºC, with a daily range of 9-13 ºC and an annual range of about 2 ºC.
The weather of Suriname is dictated mainly by the northeast and southeast trade wind system called the Inter-Tropical Convergence Zone ("ITCZ" zone also known as the "Equatorial Trough").
The ITCZ follows the sun in its movement to the north to about 15º latitude and to the south to about 10º latitude south of the Equator. The ITCZ passes over Suriname two times per year bringing heavy rainfall when it is overhead. This results in four seasons based upon rainfall distribution (Scherpenzeel 1977).

- Long Rainy Season End April-Mid August
- Long Dry Season Mid-August-Early December
- Short Rainy Season Early December-Early February
- Short Dry Season Early February-End April

Figure 1 shows the mean monthly rainfall for four selected stations across the project area over a longer period (data from www.meteosur.sr). The stations show annual totals between 2,172 and 2,512 mm.
Highest total average monthly rainfall is recorded during the months May, June and July, which are in the Long Rainy Season, and minimum values are found during the months September to November, which are in the Long Dry Season. All stations have the same seasonal distribution.

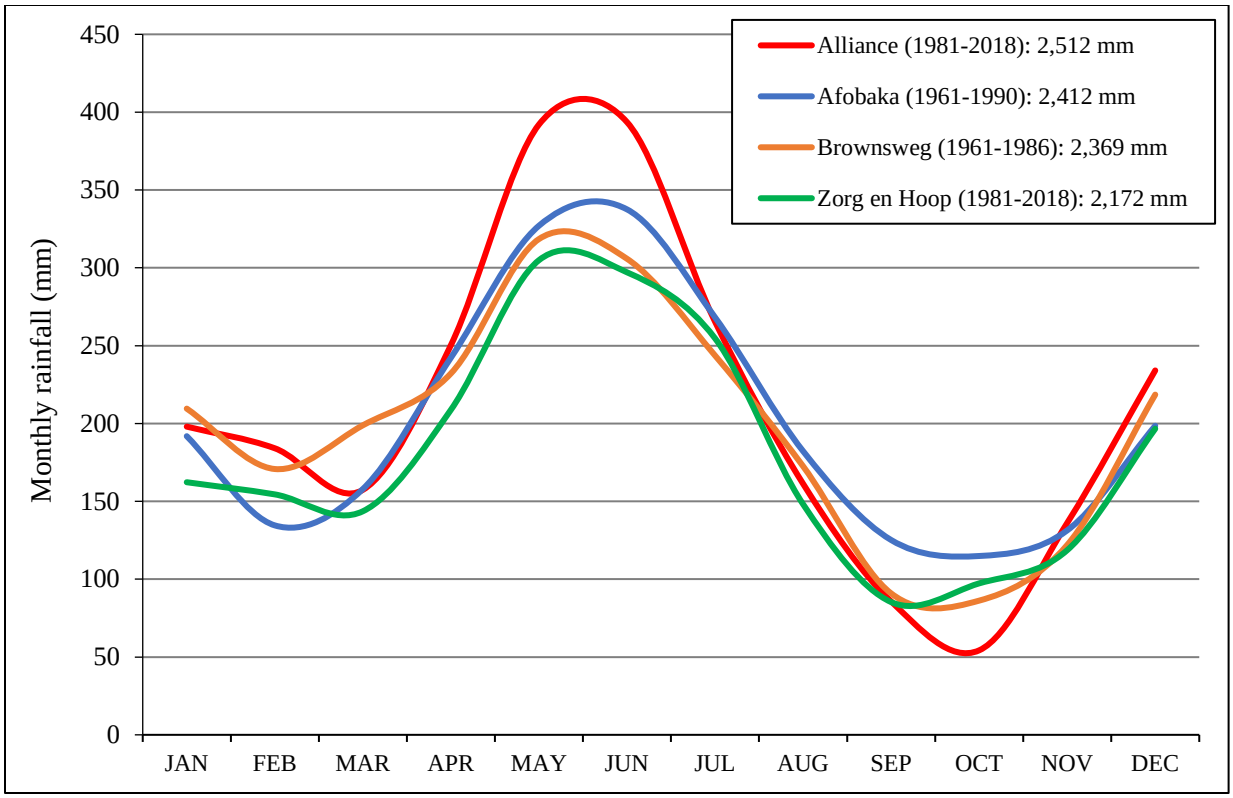

Figure 1: Long-term mean monthly and total annual precipitation for regional stations.

Northern Suriname has a northeast to southeast wind direction, with the first dominating in the February-April and the latter during the July-September period. The other months show directions mostly ranging between northeast and southeast. However, closer to the coast northeastern to eastern winds tend to dominate throughout the year.
Calm winds, i.e. winds with hourly average speeds less than 0.5 m/s, are very frequent. During the night and early morning, it is usually calm. During the day, the wind speed may increase to about 5 m/s, and in some seasons to 5-8 m/s, in particular in the February-April and the September-October periods. In the coastal zone, wind speeds are usually higher than further inland (Scherpenzeel 1977).
Wind speeds of 20-30 m/s have been occasionally recorded during thunderstorms, but only for a very short period (locally known as ‘sibibusi’). Suriname is free of hurricanes.

Air quality

Suriname does not have air quality monitoring stations, so no ambient air quality data are available. For the current study a qualitative description and assessment of ambient air quality is made, based on sources of air pollution and climatological conditions in the respective project areas.

The area in which the Powaka-Zanderij, the Koina Kondre and Brownsweg projects are found does not have significant air quality issues, because much of the landscape outside the roads is relatively natural and undisturbed. Sources of air pollution in the area is traffic along the roads and emissions from vehicles and equipment working at sand mines and wood landing areas along these roads, in particular the Afobakaweg. Emissions from road traffic and the working areas are expected to be relatively low, due to the rather low intensity. The main roads are paved, but also unpaved side roads are found. Traffic along these roads will generate dust during dry periods. However, traffic intensity along these roads is very low and dust is quickly

settling in the surrounding vegetation. Another source of air pollution are emissions from planes that land or depart from the international airport at Zanderij. But as a result of the dominating (north to south) eastern winds, these emissions are mostly blown away from the study area. And flight intensity is low. Finally, there is incidental and local generation of airborne particles and smoke as a result of burning of vegetation debris as part of the shifting cultivation. Such burning is usually done during the Long Dry Season. There are no industrial air pollution sources in the wider area.

In conclusion it can be stated that there are no major human-made influences on air quality and that air quality in this area is relatively good.

With respect to air quality, similar conditions and sources are present in the area of the Commewijne project. However, traffic intensity along the Oost-West Verbinding is higher than that of the roads in the previous area. But overall, also for the Commewijne study area it is concluded that there are no major human-made influences on air quality and that air quality in this area is relatively good.

Noise

Noise records taken along main roads in Suriname show that daytime LAeq levels range between 56.0 and 70.4 dBA (see **Table 1**). The variation in LAeq levels is mostly the result of traffic intensity and type of vehicle, but also speed and road type will play a role. Overall it can be concluded that all LAeq levels surpass the WHO/IFC daytime standard of 55 dBA for residential sites (IFC, 2007).

Table 1: Results of noise measurements along main roads in Suriname

Road	Daytime LAeq level (dBA)	Number of measurements	Source
Afobakaweg (rainy season)	63-68	3	ILACO 2017
Afobakaweg (dry season)	56-66	3	ILACO 2017
Martin Luther Kingweg	65-66	2	ILACO 2018
Wayamboweg	66-71	5	ILACO 2018
Winston Churchillweg	69-70	2	ILACO 2018

It should, however, be noted that measurements were typically done at a distance of 8-10 meter from the road, while most houses are farther away. These will thus be exposed to lower noise levels, depending upon their distance from the road.
The above noise levels are considered to be representative for the baseline levels in transects for most of the proposed transmission line projects. An exception will be formed by the Richelieu-Mariënburg line, which will run through a more rural area. Data for such areas are presented in **Table 2**.

Table 2: Results of daytime noise measurements in rural areas and communities in Suriname

Road	Daytime LAeq level (dBA)	number of measurements	Source
Powaka (small community)	43-44	1	ILACO 2017
Nieuw Nickerie (residential)	46-55	5	ILACO 2015
Ornamibo (rural)	51-53	2	ILACO 2018
Gangaram Pandayweg (rural)	48-55	2	ILACO 2018
Winston Churchillweg (rural)	52-56	2	ILACO 2018

From this table it is clear that noise levels in residential and rural areas and in small communities are much lower than along the main roads. The LAeq levels are almost always below the WHO/IFC daytime standard of 55 dBA for residential sites (IFC, 2007).

Such noise levels are considered to be representative for the daytime baseline levels in the areas where the solar plants and the substation will be constructed.

Land and soil

General

Four major geographical zones can be distinguished in Suriname (Noordam, 1993), which are reflected in **Figure 2**.

1. The Precambrian Guiana Shield area, commonly also known as the Interior, the Interior Uplands, or the Hill and Mountain Land.
2. The Zanderij Belt (also known as the Cover or Savanna landscape) formed on Late Tertiary braided river deposits. This belt forms an undulating to rolling lowland plateau, which is characterized by localized patches of savannah forest.
3. The Pleistocene Old Coastal Plain formed on sandy and clayey marine deposits. This plain is low-lying and flat to very gently undulating.
4. The Holocene Young Coastal Plain also formed on sandy and clayey marine deposits. This plain is flat to nearly flat and very low-lying. It is characterized by extensive wetlands.

Proposed projects are found within all four zones.

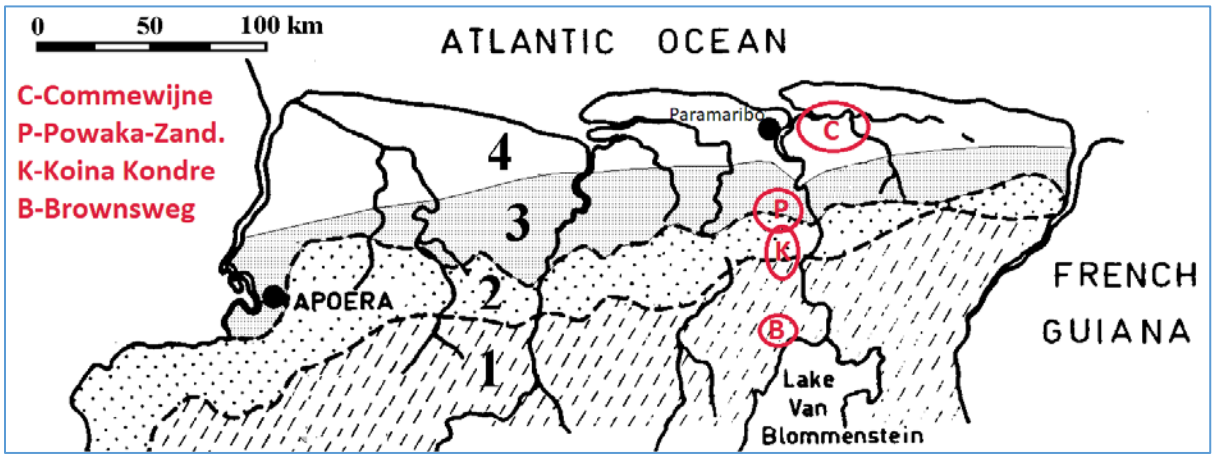

Figure 2: The four major physiographic regions of Northern Suriname

Description of the landscapes and their soils

The Young Coastal Plain is a flat and low-lying (0-4 m above mean sea-level) plain along the Atlantic Ocean. It is dominated by marine clay flats with the major part having elevations around 1.0 (± 0.5) m above mean sea-level. These areas are flooded in the rainy seasons, and often also part of the dry seasons, thus forming extensive swamps with peat formation. The heavy clay soils of the Young Coastal Plain are fertile, but they have moderate to poor physical properties, such as low permeability. Locally, the clay flats are alternating with east-west running sand, shell sand or shell ridges (former beaches), which are mostly up to 1-2 meter above the surrounding clay flats.

Parts of the coastal swamps have been developed into polders. In the Commewijne study area such development took place since the 17th century to form plantations for dryland cropping (sugarcane, cacao, coffee, cotton). The Polder Landscape is characterized by water management structures, such as sluices, dams and dikes, canals, ditches and a system of cambered beds and trenches. Plantation clays are usually completely ripened. Peperpot, La Paix, Richelieu, Mariënburg, Johanna Margaretha and Alliance are all old plantations. All planned project activities for the Commewijne project will occur within such old plantations, usually on clay soils, but along the Oost-West Verbinding also sandy ridges are found. Narrow ridges are crossed by the transmission line from Richelieu to Mariënburg.

The Powaka-Zanderij transmission line crosses the River Landscape. This landscape forms a narrow strip along all the Para River. Silting up has occurred till approximately 1 m above mean sea-level. The narrow silty clay levees are only inundated during spring tide. The heavy clay back swamps are inundated during part of the rainy season, and after spring tide at high river discharge levels. The properties of the soils of this landscape are similar to those of the marine clays.

The Old Coastal Plain forms a discontinuous belt of erosion remnants of a formerly continuous coastal plain at 4 -to 11 m above mean sea-level, separated by deep swampy gullies filled with early Holocene peat and clay (Veen 1970). The Powaka-Zanderij transmission line crosses the *Para or Old Sea Clay Landscape*. The Para Landscape is an almost level landscape at 4 to 7 m above mean sea-level. The landscape is characterized by almost flat, low plateaus, bounded by gullies. The soils of the plateaus comprise imperfectly to poorly drained silts to compact silty clays. Soil fertility is moderate to low, but the compact nature of the silty clays forms a major constraint and only soils with a silty to loamy topsoil have some potential for agricultural use. The soils of the swamp gullies are situated slightly above mean sea-level and filled with Early Holocene peat and soft clay.

Plantations are also found in the Para District, but these were mostly wood logging plantations and no water management system with ditches and canals is present. Excess water in this landscape drains from the higher land into the surrounding swamps. The road connecting the Afobakaweg with the JFK-Highway JFK- Highwayruns through the Hanover and Mawakabo plantations.

The Zanderij Belt is a gently rolling plateau landscape dipping to the north. Its elevation varies between 10 and 50 m. The landscape is characterized by white sands (podzols), and yellowish brown sands and loams. White sands dominate in the area of the Powaka-Zanderij and the Koina Kondre transmission lines. Most white sands here are excessively drained, but very locally imperfectly drained sands are found, due to the presence of a hardpan (>2 meter depth). The soils of the Zanderij Belt are poor to very poor (white sands).

The Brownsweg solar project is located within the Guiana Shield area, while also the southern tip of the Koina transmission line touches the Shield. This part of the Shield area is characterized as undulating and rolling lowland, with an elevation mostly between 25 and 50 meter above mean sea-level. The selected Brownsweg site is situated in a savanna within the Sabanpasi landscape.

The soils of the Precambrian basement are predominantly developed in the loose regolith that covers the underlying rock. The weathered parent material is already strongly leached and poor in nutrients, and thus the soils that develop from it are mostly poor as well. The physical characteristics of these soils are generally favorable, due to actively burrowing soil fauna and the non-swelling type of clay minerals. Drainage depends on position on the slope and soil texture: soils on higher positions are usually well drained. Imperfectly drained soils occur on plateaus in gently undulating landscapes and at the foot slopes of hills. The soils at the proposed site are characterized as *"Imperfectly drained loamy sand and clay, often gravelly"*.

Hydrology

The soils in the study areas in the Young and Old Coastal Plain are mostly imperfectly to poorly drained, with a shallow groundwater level during the rainy seasons. Smaller sections in the Old Coastal Plain are covered by swamps that are flooded during the rainy seasons. Drainage of the land in inhabited zones within the coastal plain occurs through a system of trenches, ditches and canals that carry excess water though sluices or by pumps to the main rivers in the area.

Transmission lines will be constructed along roads in the area. All roads in the coastal plain have roadside ditches at both sides for drainage of excess water from the road. In the Commewijne District these ditches drain into canals and ultimately to the Commewijne or the Suriname River.

In the Para District (Old Coastal Plain) the roadside ditches discharge directly into the Para River or into a nearby swamp area.

The soils in the concerned Zanderij Belt and Guiana Shield areas, are mostly well drained with deep (>1 meter) groundwater. Excess water is drained from the area by groundwater flow towards nearby creeks or swamp areas, and from there to a nearby river. Except for the area west of Brownsweg, which flows through the Mindrineti Creeks towards the Saramacca River, all discharged excess water from the projects in these zones ends up in the Suriname River.

The only major waterways in the project areas are the Para River (20-25 meter wide) that is crossed by the Powaka-Zanderij transmission line, and the Commewijne River (about 1 kilometer wide), below which an underwater cable will be installed. The Commewijne River is a tidal river with strong ebb and flood currents in its lower section where the project is found. The tidal range at its mouth is 1.9 meter.

Water quality

Being close to the Atlantic Ocean, the water quality of the Commewijne River near Mariënburg is strongly influenced by the intrusion of sea water into the river estuary. During high tide the river water is brackish and turbid. During ebb tide the salinity and suspended solids decrease due to dilution with fresh upstream river water.

The water of roadside ditches and canals in the inhabited sections of the Commewijne study area may to some extent be contaminated as a result of discharge of sewage, road and berm runoff water, and littering and waste disposal into the water. No systematic data are available, but – except for locally concentrated solid waste in the water - the degree of contamination is thought to be limited because highest inflow occurs during heavy rainfall events, when dilution and discharge is highest.

The Powaka-Zanderij transmission line will be built along a new road. This road is currently under construction and no houses are yet found here. But it is to be expected that building will start soon after opening of the road. In combination with the developing traffic streams, it is expected that water quality conditions will become similar to those in the Commewijne study area. However, overall contamination here is expected to be even less, because population density and activity levels will be lower.

The road sections with a transmission line that cross the Zanderij Belt are predominantly found on the watershed between the main creek catchments and no major creek are being crossed. No significant open water is found near the road, except for some shallow abandoned mine pits.

The proposed Brownsweg solar plant site is located about 1 kilometer to the west of the village. Many creeks in the surroundings of Brownsweg are already severely contaminated as a result of uncontrolled small-scale gold mining. Such creeks have a high turbidity, while some contamination with mercury is likely. Mines are present within 2 kilometer of the proposed solar plant site.

Vegetation

All transmission lines for this project will be constructed at the shoulders of roads. These shoulders are covered with a low grass and herbs vegetation (see **Photo 1**).

Photo 1: Low grass and herbs vegetation along the Afobakaweg

The proposed site for the Alliance solar plant (see **Photo 2**), as well as the proposed substation site at Mariënburg (see **Photo 3:**) and the riser pole sites for the underwater cable, are located in abandoned agricultural land with a low vegetation of mainly grasses and herbs, and scattered bushes and shrubs.

Photo 2: Alliance solar plant proposed site

Photo 3: Mariënburg substation proposed site

The Brownsweg solar plant is situated in a savanna area (see also below) of the Sabanpasi landscape (see **Photo 4**). Savannas do not naturally occur in the Tropical Rainforest Climate of Suriname. The savannas in Suriname are the result of regular burning of poor (xerophytic) vegetation types on soils with adverse conditions (like extremely poor soils, soils with strong alternation of dry and wet conditions and/or very compact soils). Fires are usually started by human, but also lightning is known to start bush fires.

Photo 4: Brownsweg solar plant proposed site

In conclusion it can be stated that no natural or old secondary vegetation is found within the footprint of the project.

Ecosystems

The ecosystems/habitats along the transmission line trajectories and around the solar plants could be affected by project activities. Therefore, the ecosystems till 100 meter from the project sites is described.

Commewijne project

The ecosystems map by Teunissen (1978) shows only *"Ecosystems of urban areas, farmland, livestock meadows, forest plantations, mining areas and abandoned fields"* for the Commewijne project study area. The abandoned fields in the study area refer to abandoned plantations. Forested sections are presented in **Figure 3**. Forest is still encountered along about half of the transmission line between Peperpot and Mariënburg. Most of this forest is found at the abandoned plantations Peperpot and Mariënburg. These plantations have been abandoned for about 20-25 years. Peperpot was a coffee and cocoa plantation and at Mariënburg sugarcane was cultivated. At both locations old secondary marsh forest is found on imperfectly to poorly drained clay soils. Marsh forest in Suriname is known as *"drasbos"*. Marsh forest is the climax forest on imperfectly drained soils which have a high water table in the rainy season and which do not desiccate during the dry season; and Swamp Forest is the climax forest on poorly and very poorly drained soils, almost permanently submerged, and with a water-saturated peat layer during dry seasons. The dominating species at Peperpot is Kofimama (*Erythrina glauca*), still with coffee and cocoa in the sub growth. Kofimama was used as a shade tree for the latter crops. At the other forested locations Mira Udu (*Ant tree; Virola surinamensis*), a pioneer species for this type of forest, is dominating.

At Alliance riverside mangrove forms the natural vegetation along the Matapica Creek. It is growing outside the dam that protects the plantation from flooding. Its closest point is at 50 meters from the proposed solar plant site.

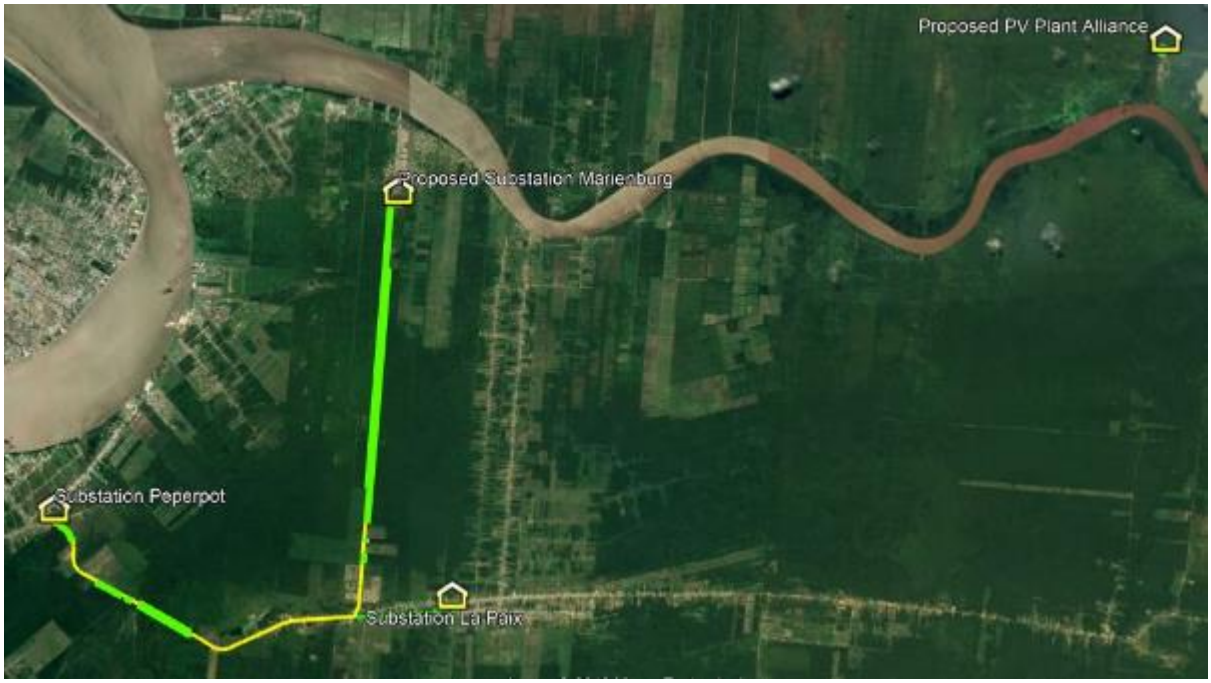

Figure 3: Forested stretches (green lines) along the transmission lines of the Commewijne project

Powaka-Zanderij transmission line

Part of the ecosystem map of Teunissen (1978) is shown in **Figure 4**.
Starting at the Powaka substation, the first 2.0 kilometer runs through the Zanderij Belt, with forest directly along the road corridor (units 56 and 60). For the legend is referred to **Table 3**. Forest is still present on recent Google imagery (September 4th 2018), but signs of sand mining can also be observed in this stretch.

From about kilometer 2, the transmission line runs for about 8.5 kilometer through the Old Coastal Plain. The higher parts of this plain are here covered by *"Mixed mesophytic dryland and marsh forest"* (unit 39). Based on information from Google (image September 4th 2018) it is concluded that within this stretch, a secondary type of this forest is also found on unit 66, *"Ecosystems of urban areas, farmland, livestock meadows, forest plantations, mining areas and abandoned fields"*. Shifting cultivation fields are present around the small community of Philipusshikwabana.

About 2.2 kilometer of the road connecting the Afobakaweg with the JFK-HighwayJFK- Highwaycrosses through swamps, of which about half is covered by swamp forest or swamp wood, and the remaining distance with open grass swamps (see **Table 4**). Swamp forest is the climax forest on poorly and very poorly drained soils, almost permanently submerged, and with a water-saturated peat layer during dry seasons.

The last 2.4 kilometer of the connection road runs again through the Zanderij Belt, with open savannas (unit 58) and dryland forest (unit 60). See **Table 3** for legend. Some shifting cultivation is observed in the forest zone.

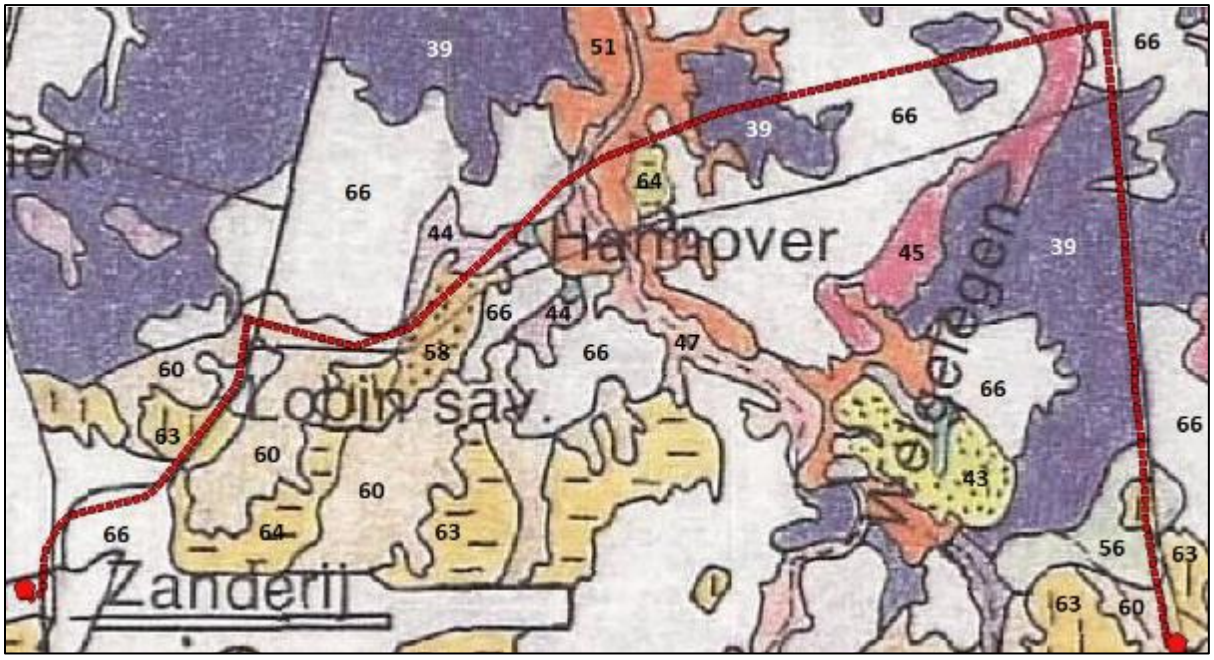

Figure 4: Ecosystem map for the Powaka – Zanderij transmission line (after Teunissen 1978); legend see Table 3

Table 3: Ecosystems of the plateaus and slopes of the Zanderij Belt (Teunissen 1978)

56.	Predominantly mixed mesophytic dryland forest, in W.Suriname locally dominated by *Aspidosperma excelsum, Mora gonggrijpii* or *Ocotea rodiaei*
58.	Dry brown sand savannas: short grass savannas with scattered gnarled treelets and bushes
60.	Predominantly mixed xerophytic dry- and marshland forest, locally dominated by *Eperua falcata, Dimorphandra conjugata* or *Swartzia bannia*

61.	Xerophytic dryland forest, dominated by *Dimorphandra conjugata*
62.	Xerophytic dryland- and marshland wood, locally dominated by *Dimorphandra conjugata*, *Swartzia bannia*, *Clusia fockeana* a.o.
63.	Dry white sand savannas of Cassipora type: short grass savannas with scattered scrub and bushes
64.	Marshy white sand savannas of Zanderij type: short grass savannas with scattered scrub and *Mauritia flexuosa*-palm galleries

Table 4: Ecosystems of the swamps of the Old Coastal Plain (Teunissen 1978)

44.	Hydrophytic swamp forest with Virola surinamensis, Symphonia globulifera (and Euterpe oleracea)
45.	Hydrophytic swamp wood, dominated by *Pterocarpus officinalis*
47.	Xerophytic swamp forest and wood, with *Crudia glaberrima* and *Macrolobium acaciifolium*
51.	Grass swamps, mostly dominated by Lagenocarpus guianensis / Rhynchospora gigantea or Eleocharis interstincta; also fern swamps, dominated by Blechnum indicum

The last 3 kilometers of the Powaka-Zanderij transmission line runs along the JFK- Highway towards Zanderij. Natural ecosystems are indicated in **Figure 4**, but most has been cleared over the past 40 years to make room for community development (Google image September 4th, 2018).

Koina Kondre transmission line

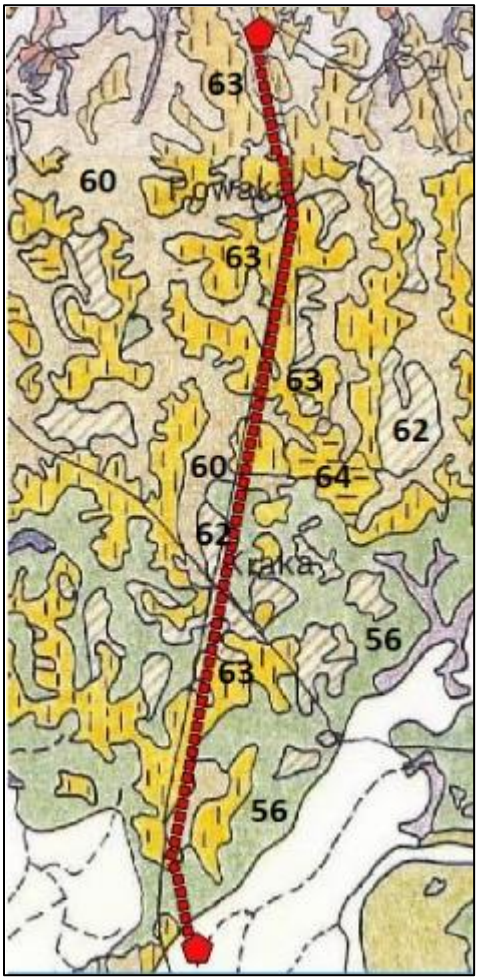

Figure 5: Ecosystem map for the Koina Kondre transmission line (Teunissen 1978)

Except for the last 500 meter, the Koina Kondre transmission line runs through the Zanderij Belt. The great majority of ecosystems comprises of dry savannas (unit 63), with minor sections crossing dryland forest (unit 56) or savanna forest (unit 62) (see **Figure 5**). Dryland forest is the climax forest on well to moderately well-drained soils, as well as on imperfectly drained slope soils. Soils are never saturated during rainy seasons and never desiccate during dry seasons. Savanna Forest (xerophytic forest, associated with the presence of savannas) is the climax forest on excessively drained or impermeable soils which desiccate during dry seasons. In the section from the Powaka substation to Kraka many sand mines have been established to mine the white sand that is used as fill sand. Abandoned mines are characterized by a criss- cross landscape with sand heaps, dams and shallow ponds.

In the section between Kraka and Koina Kondre many houses have been built with shifting cultivation fields nearby (Google image September 4th, 2018).

5.1.9.4 Brownsweg solar plant

There are no existing ecosystem maps for the Brownsweg area. Therefore, the ecosystems were determined from Google interpretation and a field check.

The site is located in an open savanna with scattered shrubs and Morisi *(Mauritia flexuosa)* palms along wet zones, including a smaller area with a low to moderately high savanna forest.

Conclusion

With the exception of the *"Dry brown sand savannas: short grass savannas with scattered gnarled treelets and bushes"* (unit 58) all of above discussed ecosystems are very common in northern Suriname. The savanna of unit 58, known as the Lobin Savanna, has only three counterpart areas in Suriname, covering a combined area of 30 sq. km. One site with this ecosystem is protected in the Coesewijne Nature Reserve (see below: protected areas). The Lobin Savanna is already under pressure by human activities, like agriculture, cattle grazing and rally events. Also all other above described ecosystems are present in one or more of the established lowland or upland nature reserves.

Wildlife

Terrestrial and amphibian animals

The fauna in the project area is expected to be typical for man-made and man-affected ecosystems, with animal species that are adapted to/tolerating, or able to cope with the presence of men in general, forest clearing, bush fires (habitat destruction), noise, road kills, hunting and fishing pressure, and trapping.

Many of the larger terrestrial mammals are hunted throughout Suriname (such as monkeys, tapir, deer, peccaries and large rodents). In northern Suriname, hunting, as well as live animal collecting, typically occurs along important access routes, such as all-weather roads, rivers and larger streams. The more densely populated and urbanized areas tend to lack large mammals, due to past and current hunting and current scarcity of suitable habitats.

But as soon as some degree of protection is in place, many animals can be observed. For instance, at the Peperpot Nature Park (see below: Protected areas) in addition to many birds (see below: Birds), visitors can encounter monkeys (common squirrel monkey and brown capuchin), the giant anteater and the common tegu, while trapping cameras have captured jaguars, ocelots and a puma. In addition, observations comprise agoutis, deer and tapirs.

Animals that are commonly encountered near inhabited zones are several species of reptiles (snakes, lizards, toads, frogs and caimans), sloths and opossums.

The focus will here be on large terrestrial mammals that are endangered, threatened, or vulnerable (listed as such by IUCN and/or listed on CITES Appendix I). Such mammals should be considered most vulnerable, and impacts of the project on their populations should be voided, prevented or compensated for.

For Suriname, 192 mammals are known (Lim et al. 2005), of which 37 can be considered large terrestrial mammals (average live body mass of at least 2 kg).

Species of concern are those large terrestrial mammals known to occur in the area likely to be affected by the project that are considered endangered, threatened, or vulnerable by IUCN (see IUCN Red List) or are listed on CITES Appendix 1. These species are shortlisted in **Table 5**, which also provides details on their IUCN and CITES status.

Table 5: Endangered, threatened and vulnerable large terrestrial animals that are known to occur in the wider area that will possibly be affected by the project (based on IUCN and CITES listing).

Scientific name	English vernacular name	IUCN	CITES

Lontra longicaudis enudris	Neotropical (Guiana) Otter	NT - Near Threatened	Appendix I
Panthera onca	Jaguar	NT – Near Threatened	Appendix I
Leopardus tigrinus	Oncilla	VU – Vulnerable	Appendix I
Tapirus terrestris	Lowland Tapir	VU – Vulnerable	Appendix I
Ateles paniscus	Guiana Spider Monkey	VU – Vulnerable	Appendix II
Myrmecophaga tridactyla	Giant Anteater	VU - Vulnerable	Appendix II
Leopardus pardalis	Ocelot	LC – Least Concern	Appendix I
Caiman crocodilus	Spectacled caiman	LC - Least Concern	Appendix II
Cebus apella	Brown Capuchin		Appendix II
Tupinambis nigropunctatus	Common Tegu		Appendix II

It should be noted that there is not necessarily a considerable threat to the survival of these species in Suriname. Quite to the contrary, most of them face only limited threats in Suriname and neighboring Guiana Shield territories, fundamentally because of low overall human population size. However, in the coastal zone of Suriname, especially in areas that are converted and have high human population densities, species are under some pressure.

Birds

By the end of April 2018, the total number of species of birds for Suriname is standing at 752 (http://www.surinamebirds.nl/, accessed July 6, 2019). According to BirdLife International (2019) there are 587 land birds, 19 sea birds and 106 water birds. About 50 species are endemic to the Guiana Shield, but none to Suriname. There are 202 migratory species of birds.

Two species in Suriname are endangered according to the IUCN Redlist. These species are not encountered in manmade areas. Another 9 species are listed as vulnerable, but these species are usually found outside of manmade zones, while some are still common in Suriname. Some may enter manmade zones, but are not depending upon this.

Birdwatcher's hotspots in the study area are the Peperpot Nature Park (see below: Protected areas) with 305 spotted bird species and the Hanover (or Lobin) Savanna. The connection road between the Afobakaweg-JFK-Highway under construction crosses this savanna area and will already have some impact to bird life in the area.

The estuarine zone (mudflats, mangroves and lagoons) along the Surinamese coast may be considered as one of the principal South American wintering grounds for southern and northern migratory shorebirds. The southern boundary of the estuarine zone in Commewijne is at least 7 kilometers away from the nearest transmission line to be constructed. During the spring, the migratory birds remigrate to their breeding grounds, and by the end of the summer they return, later followed by their young, to Suriname.

Numbers of shorebirds vary greatly throughout the year, with peak numbers during the southbound (July–November) and northbound (February–May) migration periods. Many species, however, are also present in relatively high numbers during the northern winter and summer periods. Some migratory paths may cross with projected transmission lines, but flying height of the migratory birds is far above the surface.

Conclusion

Given the location of the transmission routes, the solar plants and the substation site in inhabited zones, along main roads and/or in zones with active land use, no threatened, endangered, or vulnerable plant or

animal species are to be expected within or adjacent to the project area. An exception could be there for an occasional jaguar, for which it is known that they venture into rural areas every now and then.

Protected areas

Since 1966 fifteen protected areas have been established in Suriname, in total covering approx.13% of the land surface of Suriname. The protected areas comprise 11 Nature Reserves (NR's) and 4 Multiple-use Management Areas (MUMA's). In addition, there is also a Nature Park (Brownsberg) (seeTable 15). In the Interior Uplands large areas with tropical rainforest and some savanna areas have been reserved as nature reserves or park. In the Young and Old Coastal Plain protected areas cover an area of over 2,500 sq. km.

Along the coast the main purpose of these nature reserves is to protect the enormous numbers of migratory and resident waterfowl, and to protect the major sea turtle nesting beaches. Elsewhere in the Coastal Plain the conservation of special ecosystems and vulnerable species is the main motive for protection. As it was recognized that protection of a small part of the coast was not adequate to meet the overall goals, the concept of "Multiple Use Management Areas" (MUMA's) has been adopted. MUMA's are defined as areas where special management by or on behalf of the Government is needed for a rational use of the natural resources, which includes the protection of vulnerable ecosystems and species.

Figure 6 presents an overview of all protected areas in Suriname.

Alliance is situated within the MUMA zone, but MUMA's officially cover only free domain land, and domain land that has been issued after this Ministerial order came into effect (2002 for North Commewijne-Marowijne MUMA). That means that domain land that had been issued before this Ministerial Order came into effect, is not a part of the MUMA. The latter applies also for Alliance and all other plantations along the right bank of the Commewijne River.

The Peperpot Nature Park is a privately owned nature park (not shown in below figure) under the management of the Peperpot Nature Forest Foundation.

In the north it bounds to the Oost-West Verbinding, separated from it by a 200-meter-wide buffer zone and a canal.
The park is accessible along a trail in the center of the park, with its northern entrance next to the Peperpot substation. Apart from tourism it is important for nature education, while also nature research is supported. None of the proposed project activities will take place within the boundaries of a protected area.

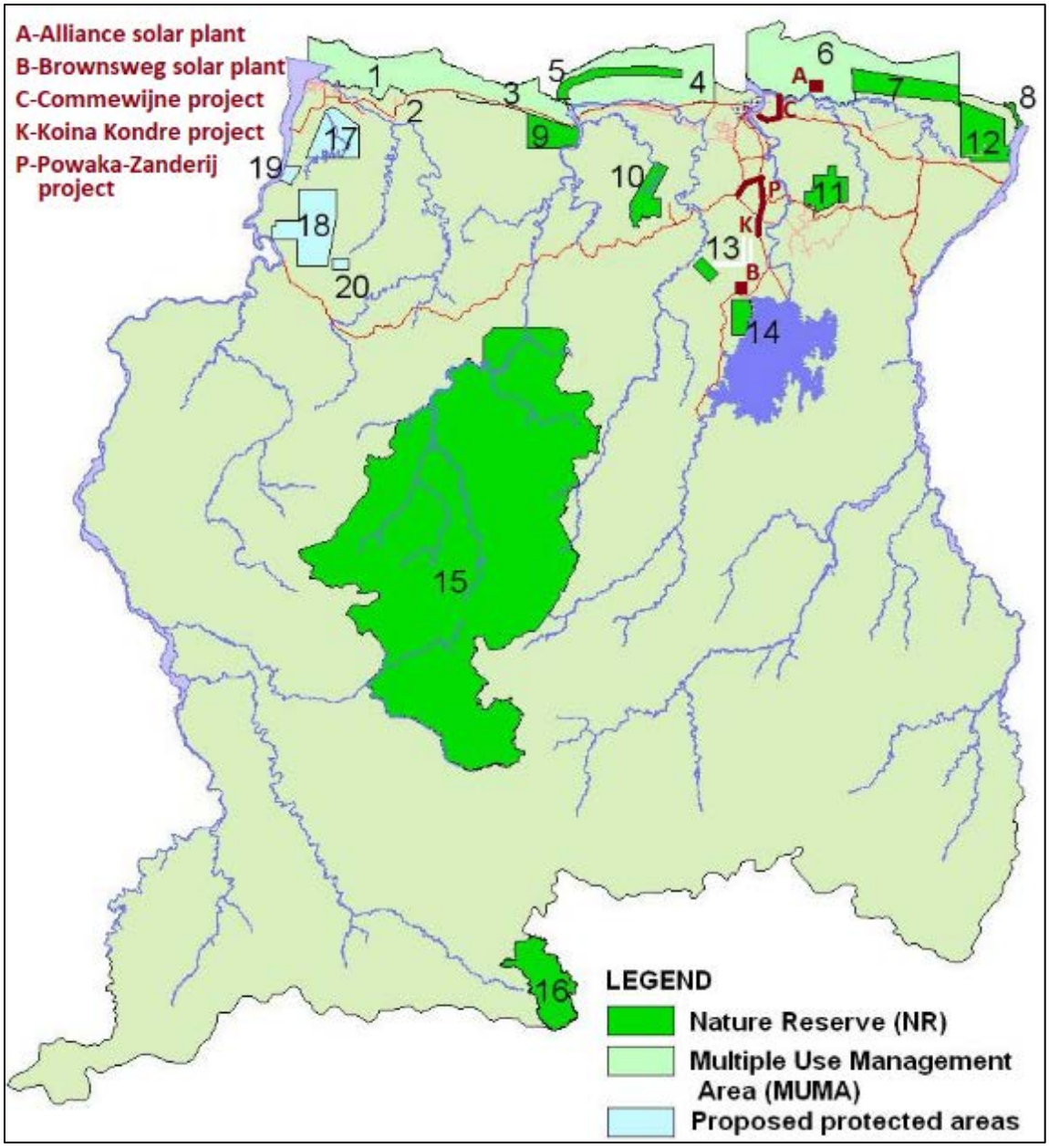

Figure 6: Protected areas in Suriname

Table 6: Protected areas in Suriname

	Name Protected Area	Area in sq. km		Name Protected Area	Area in sq. km
1	Bigi Pan MUMA	67 9	9	Peruvia NR	310
2	Hertenrits NR	1	10	Boven-Coesewijne NR	270
3	North Coronie MUMA	272	11	Copi NR	280
4	North Saramacca MUMA	884	12	Wanekreek NR	450
5	Coppenamemonding NR	120	13	Brinckheuvel NR	60
6	North Commewijne-Marowijne MUMA	615	14	Brownsberg Nature Park	120
7	Wia-Wia NR	360	15	Central Suriname NR	15,920
8	Galibi NR	4 0	16	Sipaliwini NR	1,000

Annex 4 Minutes of Meetings

Minutes of Meeting

Project:	Addendum ESIA Energy Infrastructural Project Commewijne
Project Code:	IS-386
Onderwerp:	Kick-off meeting
Aanwezig:	**ILACO:** Koenjbiharie S (SK)/ Fortune M (MF)/ Heemskerk M (MH)/Bong A Jan R (RB) **EBS:** Graanoogst F (FG)/Kasban E (EK)
Locatie:	Online via Teams
Datum:	23/04/2021
Tijdstip:	13.20-13.45
Opgesteld door:	Koenjbiharie S

Onderwerp	**Discussie/opmerkingen**
Agenda	- Introductie - Planning - Acties/Follow up - Wat ter tafel komt
Introductie	SK start de meeting om 13.20 en introduceert het ILACO team. **Notitie:** Dirk Noordam is ook onderdeel van het team, maar kon niet aanwezig zijn; hij zal na de meeting geïnformeerd worden over de afspraken en planning. De studie betreft een ESA en is een aanvulling op het Commewijne onderdeel vanwege de scope wijziging. De belangrijkste wijzigingen betreffen: - Vervanging van de 33KV lijn met een 12KV lijn - Cancelen van substation Mariënburg - Introductie van een alternatieve route van de 12KV lijn in het ROC gebied (overkant van de rivier).
Planning	Het contract is getekend op 14 april 2021. De planning is opgesteld op basis van gemaakte afspraken. Het project heeft een uitvoeringstijd van ongeveer 3 maanden. We zitten nu in de voorbereidingstijd en daarbij zijn de volgende acties cruciaal: - Aanleveren van een complete project omschrijving en justification. - Informeren van de stakeholders. De DC is hierbij een key stakeholder. - Gezamenlijke oriëntatiebezoek (EBS/ILACO) Ad. 1: Het traject van de alternatieve route is erg belangrijk. EK: de route zal zoveel mogelijk door openbaar terrein lopen; bij een gedeelte van 4-5 km is er meer zwampgebied. Het is mogelijk dat het op enkele plekken door prive terrein gaat. MH: is de status van de gronden bekend? Belangrijk om te weten op welke plekken de kabel via prive terrein loopt. Ook belangrijk om te weten waar er land is waar er mensen een claim op kunnen maken vb. Plantage besturen, plantage eigenaren, boeren. Dit zal in het veld ook worden besproken met o.a. plantage bestuur en de boeren. Ad. 2: FG: de stakeholders zijn nog niet geïnformeerd. Er wordt voorgesteld om de DC gezamenlijk te benaderen. MH: Akkoord. Na ontvangst van de project omschrijving zal de datum voor deze meeting nader worden bepaald. Ad. 3: Er wordt voorgesteld om het trace samen met de EBS langs te lopen in de eerste week van mei.

	De planning voor de uitvoering is o.a. afhankelijk van de projectomschrijving. Verder moeten wij rekening houden met de COVID-19 updates. De planning zal zo nodig worden bijgesteld.
Acties/Follow-up	- ILACO deelt de planning samen met de minutes of meeting uiterlijk 26 april. - ILACO levert template aan uiterlijk 26 april. - EBS levert projectomschrijving aan, inclusief justification en stakeholder contactinfo (voor veldwerk), uiterlijk 30 april. - Na intern overleg komt ILACO met een voorsteldatum voor meeting met de DC, uiterlijk 30 april. - EBS zorgt voor boottransport. Planning voor veldbezoeken liefst 2-3 dagen van te voren doorgeven aan EK zodat boottransport kan worden geregeld.

Minutes of Meeting

Project: Environmental and Social Impact Assessment of Energy Infrastructure Projects
Project Code: IS-386
Subject: Meeting with DC Commewijne, ILACO and EBS
Purpose of the Meeting: Informing the DC about the proposed project
Attendance: District Commissioner Commewijne: DC M. Radjab/ M. Sewpersad (minutes secretary)
ILACO: Bong A Jan, R. /Fortune, M.
EBS: Kasban. E. / Amattamsir, A. / Wirjoinangoen L.
Location: Districtscommissariaat Commewijne, Nieuw-Amsterdam
Date: 04/May/2021
Compiled by: Fortune, M.

Subject	**Discussion/Remarks**
Agenda	- Introduction & project information - Discussion - Follow up
Introduction & project information	The meeting was opened by the DC of Commewijne, followed by a short introduction. Mr. E. Kasban, project manager of the project in Commewijne, explained the proposed project and the role of ILACO within the project, namely the execution of an Environmental and Social Impact Assessment. The Commewijne project is part of the IDB Infrastructural Projects. The purpose of the Commewijne project is to improve the energy supply to the Right Bank of the Commewijne River (ROC). Currently there is one single line from plantation MonTresor to Kroonenburg. In case of a failure in this transmission line, the whole right bank of the Commewijne River will be devoid of electricity. Within this project the distribution grid from plantation Richelieu will be extended through Mariënburg to Ellen (near the local Medical center). From there, a river cable will be placed across the river (underwater) toward Johanna & Margaretha. The whole network from Johanna & Margareta till Reijnsdorp will be changed. Sections along the river that flood during springtide, will be replaced by a new distribution line that is located more northwards. In Alliance a 200-kilowatt Solar plant will be constructed as an additional system for more efficiency and less use of fuel. There are 2 options for river cable placement, namely by drilling (which is more expensive) or by using weights placed on the cable at different distances. The project planning entails finalizing all documentation by August 2021 and start the construction activities in 2022, which will have a duration of 3 years. The construction phase is divided in 3 lots: 1. Extend distribution grid from Richelieu to Mariënburg 2. Placement of the river cable 3. Making the connections in the ROC
Discussion	The DC had the following remarks/ input regarding the project: • EBS should involve the Ministry of ROGB in case the roads will be widened. Mr. Kasban explained that it's more related to the roadsides and that the EBS

	has already sent a request to the Ministry of Public Works. They are still awaiting their response. • The DC inquired whether the distribution line would be placed underground or aboveground, because he was concerned about the high rate of accidents involving collisions with EBS poles. Mr. Kasban explained the infrastructure would be situated aboveground, because it would be too costly to implement an underground network. • The DC will not be able to provide support with clearing the area of Mariënburg where the distribution line is projected, due to limited resources (e.g., equipment). The Commissioner's Office only managed to clear a section of the area (circa 3km onwards from Richelieu), but the remainder still needs to be done. • Regarding the network at the ROC area, he suggested the EBS to work together with Mr. Sebastian "Bas" Spek, as he is currently working on the rehabilitation of the bike path that connects several plantations located in the ROC. The plantations are private property; you will have to contact the owners for further inquiries. Get in touch with Mr. Spek; he can provide additional information. • The following persons can also be contacted for additional input/ support: o Mr. Zalman, Sirano, regarding tourism activities at Fredriksdorp o Mr. Van Alen in relation to activities at Rust en Werk o Mr. Sebastian "Bas" Spek can also give additional information regarding other stakeholders to be involved The DC mentioned some other planned projects in the district of Commewijne are: • Shore base facilities at Belwaarde and at Voorburg (on account of Offshore developments) • Project of SWM at La Liberte (near Peperpot) • Hydrogen project The DC expects that due to abovementioned projects approximately 3000 jobs will be created in Commewijne; it is anticipated that about 100-200 persons will have a job by next year. Mr. Kasban also mentioned a project involving a weather station that will take wind measurements in order to create a wind map of the coastal area. The purpose is to monitor the potential for wind energy. <u>Questions</u> ***Location River cable*** • Mw. Bong A Jan: Is there much river traffic near the proposed location of the river cable? • DC Radjab: There is not much traffic. Only the small ferry boats. • Mw. Bong A Jan: Are there fishing activities in this area? • DC Radjab: There are no big fishing activities in that area. Only individual fishing (sport fishing). ***Policy plans of the Government*** • Mw. Bong A Jan: What are the policy plans of the government for the project area of EBS.

	• DC Radjab: Only for the Mariënburg area there may be some activities in the coming years. Land has been allocated in that area, so there will be housing development projects and business creation.
Follow up	ILACO will contact the DC if additional information is required e.g. District Plan.