REPORT

Mirny (Kazakhstan) 1GW Wind Farm Project

ESIA Report Chapter 03 - Impact Assessment Methodology

Submitted to:

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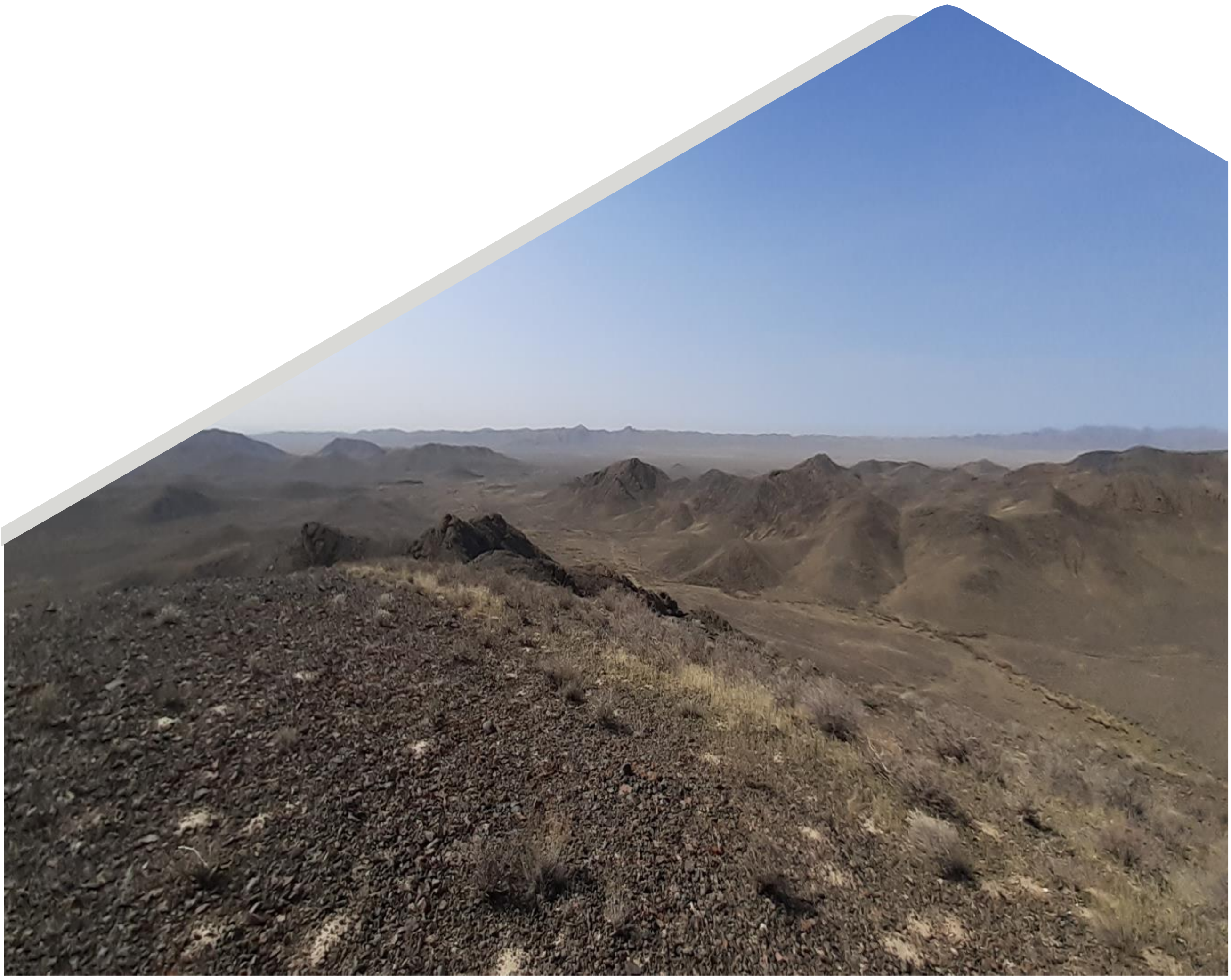

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3.0 IMPACT ASSESSMENT METHODOLOGY

3.1 Introduction

This section presents the methodology for the Environmental and Social Impact Assessment ("ESIA") developed considering national and international standards and requirements illustrated in Chapter 03 - Legal Requirements of the Environmental and Social Baseline Study ("ESBS") report (ref. doc. **24685792-002-R-Rev 0_ESBS**).

The following figure summarizes the phases of the ESIA report, and the methodology described in this document.

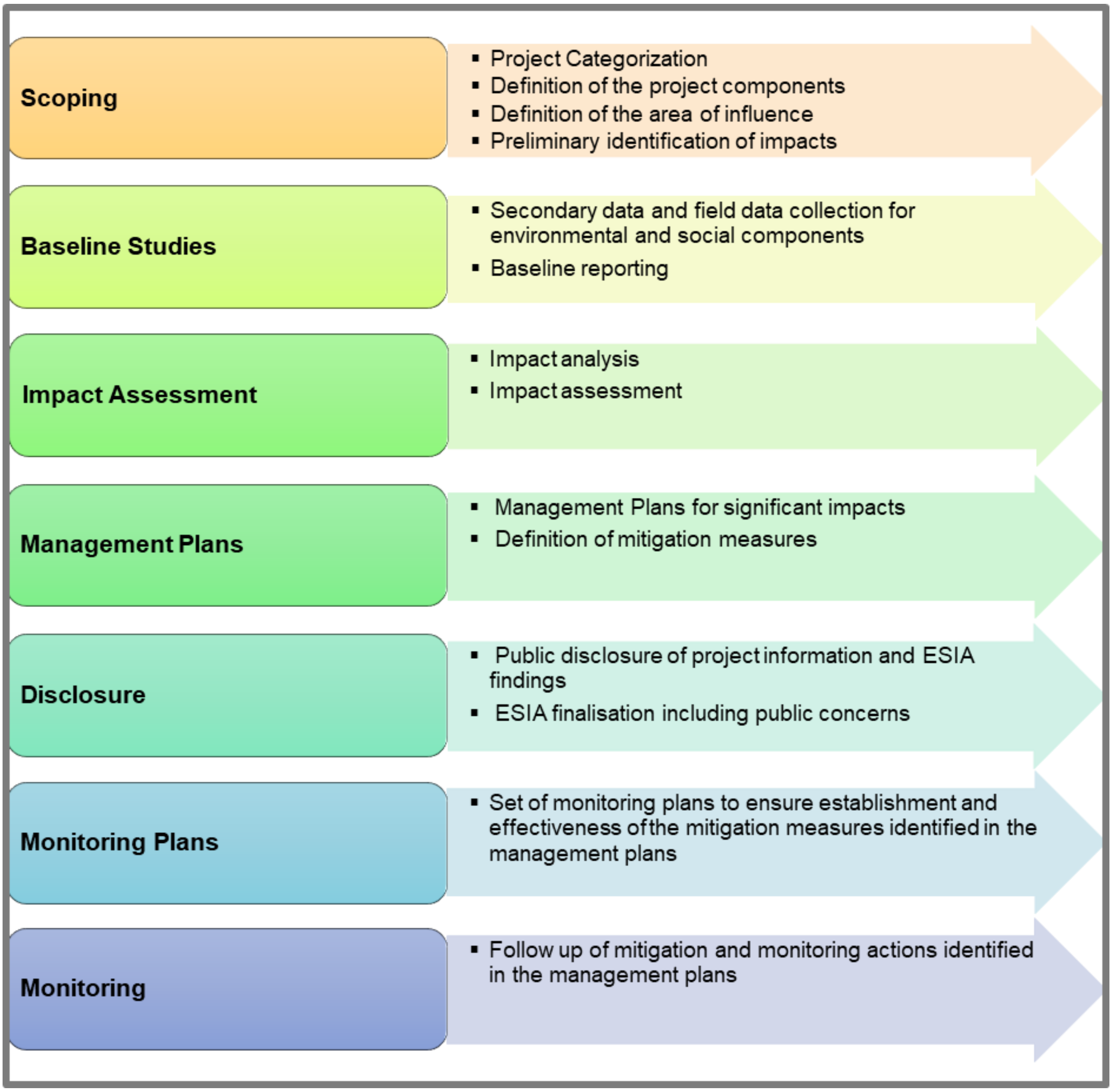

Figure 1: Phases of ESIA process.

The general methodology adopted by WSP for ESIA studies has been designed to be analytical and transparent and to allow for a semi-quantitative analysis of the impacts on the various environmental and social components. This methodology is based under the assumption that projects can generate both negative and positive impacts whose magnitude that can be evaluated considering the different characteristics of the project activities and of the environmental and social context.

This methodology is based on three main analytical phases, as described below:

- **Phase 1: Identification of Project Actions and Impact Factors:**
  a. **Project actions:** activities directly or indirectly related to the Project that can interfere with the context, generating environmental or social pressures; and
  b. **Impact factors**: direct or indirect interferences generated by the Project actions on the context and able to influence the state or quality of one or more environmental and social components.
- **Phase 2: Identification of Environmental and Social Components and Sensitivity level allocation:**
  c. **Identification of the components potentially subject to interference**: using a specific cross-refence matrix between the impact factors and the Project actions, it is the process identifying the components potentially subject to impacts in each phase of the Project (for example: construction, operation; decommissioning); and
  d. **Sensitivity of the component:** sum of the conditions characterizing the current quality and/or the dynamics of a specific environmental and social component and/or of its resources.
- **Phase 3: Impact Assessment:**
  e. **Impacts:** changes suffered by the environmental and/or social quality status due to the effects caused by the impact factors on the environmental or social components; and
  f. **Mitigation measures:** actions adopted to mitigate negative impacts or to maximize the effects of positive impacts on the environmental and social components.

The three phases are illustrated in Figure 2 and described in the following paragraphs.

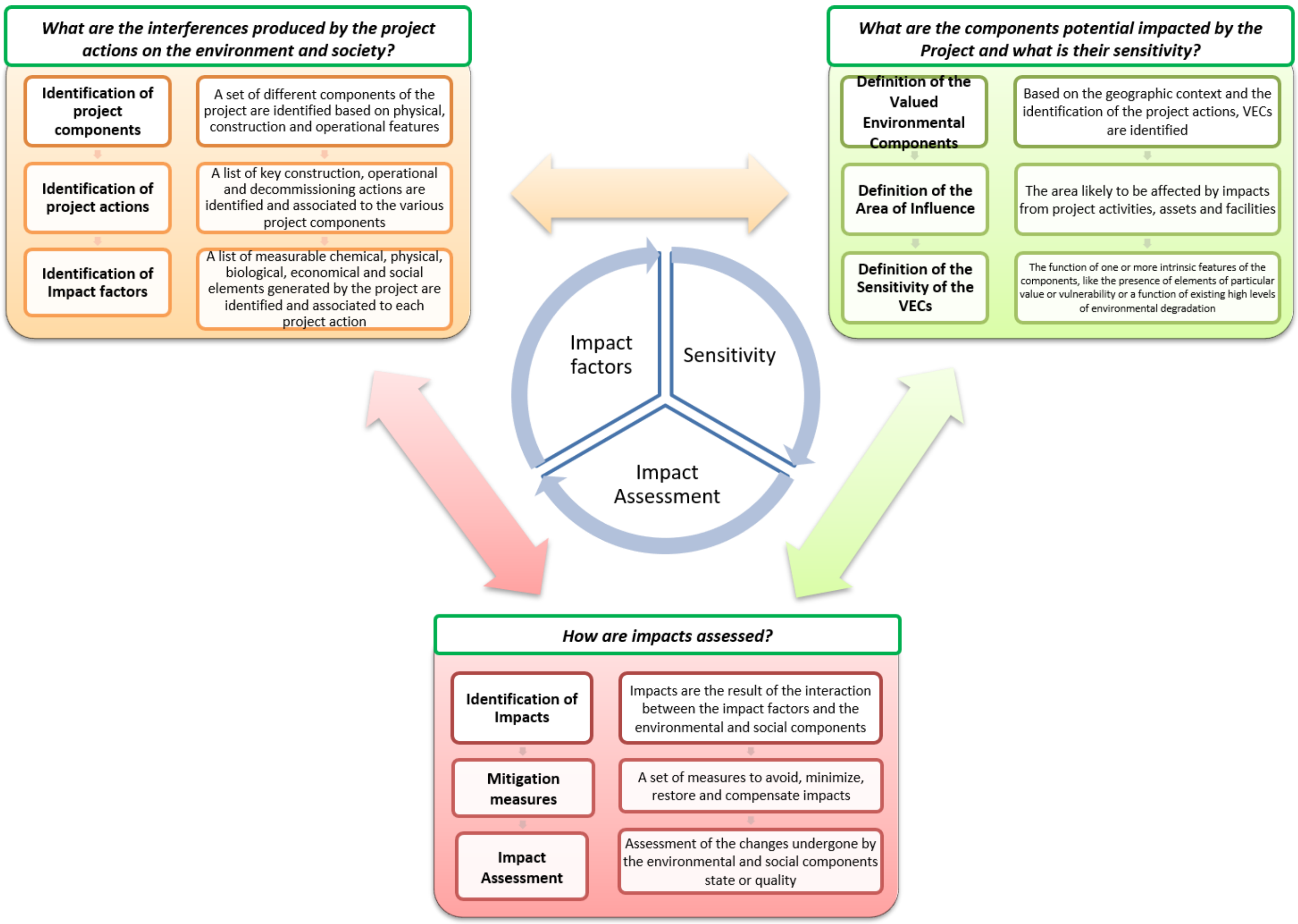

Figure 2: Impact Assessment Methodology - Analytical Phases

3.2 Phase 1: Identification of Project Actions and Impact Factors

3.2.1 Project Actions Identification

Project actions are activities directly or indirectly related to the Project which can interfere with the natural or social environment as primary generative elements of environmental or social pressures, defined in the context of this methodology as impact factors. The actions are identified for the whole Project's lifecycle (construction and operation).

The Project actions have been identified based on the activities foreseen by the Project and described in Chapter 02 – Project Description of the ESBS report (ref. doc. **24685792-002-R-Rev 0_ESBS**). The following Table 1 lists the Project actions for each phase.

Table 1: Project actions.

	Construction Phase
1	Mobilization of workers, machinery and equipment
2	Preparation of construction areas (WTGs, OHTL and roads) consisting of fencing, vegetation clearance, topsoil stripping and levelling
3	Installation of the Construction Camp and of the related services, utilities and structures

4	Project site sumps and trenches excavation and backfilling
5	Construction of crane pads and of WTGs foundations
6	Construction of Battery Energy Storage System (“BESS”) foundations
7	Installation of WTGs
8	Installation of BESS
9	WTGs and BESS Cabling and wiring
10	OHTL steel transmission towers’ installation surfaces’ excavation and backfilling and paving preparation
11	OHTL steel transmission towers’ parts assembling and welding
12	OHTL steel transmission towers’ erection
13	OHTL steel transmission towers’ wiring and cabling
14	Substations construction
15	Roads’ construction
16	Roads’ renovation
	Operation Phase
17	Periodical maintenance and control operations and activities
18	Security management and control
19	Cleaning activities
20	Daily activities such as power plant performance monitoring, operations control, alarm systems respond operations, and maintenance and control operations scheduling
	Decommissioning Phase
21	Dismantling and removal of the WTGs and associated infrastructure
22	Waste management
23	Land restoration

3.2.2 Impact Factors Identification

Project actions can determine **impact factors** on each component, intended as potential interferences that can influence, both positively or negatively, directly or indirectly, the environmental and/or social quality in the area of influence of the Project. The impact factors identified for the Project are listed:

- Removal/degradation of soil and vegetation;
- Change in the local morphology and topography;
- Change in the local hydrology and surface water quality;
- Change in the local hydrogeology and groundwater quality;

- Emission of greenhouse gases;
- Emission of dust and particulate matter;
- Emission of gaseous pollutants;
- Emission of noise and vibrations;
- Emission of light;
- Emission of shadow flicker;
- Presence of new buildings/infrastructures;
- Land occupation;
- Presence of artefacts and artificial works;
- Demand for solid waste treatment/disposal;
- Demand for liquid waste and wastewater treatment/disposal;
- Energy demand (fuel and electricity);
- Water demand;
- Workers' influx;
- Demand for security management;
- Demand for workforce;
- Demand for goods, materials and services (supply chain);
- Increase of traffic;
- Improvement of road network;
- Interference with existent roads/infrastructures/services;
- Introduction and spreading of invasive alien species;
- Creation of synergies with local educational institutions;
- Damage of cultural resources; and
- Provision of electricity to the national grid.

Accident or unplanned events (such as accidental spills/releases of oil/fuel from vehicles, fire, etc) are not considered as impact factors because the potential pollution of environmental components deriving from such events cannot be associated with routinary Project activities and are instead due to events that are not predictable and should not occur. This ESIA study addresses the accidents and unplanned events in the dedicated Chapter 11.

Following the identification of the impact factors generated by the Project, a Project actions – impact factors matrix is prepared (Table 2). For each impact factor, the correlation with the Project actions is shown on a different column at the left. Similarly, the related connection with the Valued Environmental and Social Component(s) is highlighted in the matrix on the right .

Table 2: Matrix Actions x Impact Factors x E&S Components.

Actions n°	Impact Factor	VESCs (Components)		
		Physical	Biological	Social
2, 3, 4, 5, 6, 10, 14, 15, 20, 21	Removal/degradation of soil and vegetation	▪ Soil	▪ Flora & Habitats ▪ Fauna	▪ Ecosystem Services ▪ Landscape and visual quality
2, 4, 10, 14	Change in the local morphology and topography	▪ Geomorphology and Topography	▪ Birds ▪ Flora & Habitats ▪ Fauna	▪ Landscape and visual quality
1, 2, 3, 4, 10, 14, 20, 21, 22	Change in the local hydrology and surface water quality	▪ Surface Water	▪ Flora & Habitats ▪ Fauna	▪ Ecosystem Services
2, 3, 4, 5, 6, 16, 20	Change in the local hydrogeology and groundwater quality	▪ Groundwater	-	▪ Ecosystem Services
1, 2, 3, 4, 5, 6, 7, 8, 10, 14, 15, 16, 20, 21	Emission of GHGs	▪ Air Quality	-	-
1, 2, 3, 4, 5, 6, 10, 14, 15, 16, 20	Emission of dust and particulate matter	▪ Air Quality	▪ Flora & Habitats ▪ Fauna	▪ Community, Health, Safety and Security
1, 2, 3, 4, 5, 6, 10, 14, 15, 20, 21	Emission of gaseous pollutants	▪ Air Quality	-	▪ Community, Health, Safety and Security
1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 14, 15, 16, 21	Emission of noise and vibrations	▪ Noise and Vibrations	▪ Flora & Habitats ▪ Fauna	▪ Community, Health, Safety and Security
16	Emission of shadow flicker	▪ Shadow Flicker	▪ Birds ▪ Fauna	▪ Community, Health, Safety and Security
1, 3, 16, 17, 19	Emission of light	-	▪ Birds ▪ Fauna	▪ Landscape and Visual Aspects
3, 7, 8, 9, 12, 13, 14	Presence of new buildings/infrastructures, visual impact	▪ Soil ▪ Surface Water	-	▪ Landscape and Visual Aspects
2, 3, 7, 8, 12, 13, 14	Land occupation	-	▪ Flora & Habitats	▪ Land use
16, 17, 18, 19	Presence of artefacts and artificial works	-	-	▪ Land use

Actions n°	Impact Factor	VESCs (Components)		
		Physical	Biological	Social
2, 3, 4, 5, 6, 9, 10, 12, 13, 14, 15, 16, 18, 20, 21	Demand for solid waste treatment/disposal	▪ Soil ▪ Surface Water ▪ Groundwater ▪ Air Quality ▪ Solid Waste	▪ Birds ▪ Fauna	▪ Community, Health, Safety and Security
3, 16, 18	Demand for liquid waste and wastewater treatment/disposal	▪ Soil ▪ Surface Water ▪ Groundwater ▪ Wastewater	▪ Flora and Habitats ▪ Fauna	▪ Community, Health, Safety and Security
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22	Energy Demand (fuel and electricity)	▪ Air Quality	-	▪ Mobility and Infrastructure
2, 3, 5, 6,10, 16, 18, 20	Water Demand	▪ Groundwater ▪ Surface Water	▪ Flora and Habitats	▪ Ecosystem Services ▪ Community, Health, Safety and Security
1, 3, 20	Workers' influx	-	-	▪ Population and Demography ▪ Community, Health, Safety and Security ▪ Mobility and Infrastructure
3, 17, 20	Demand for security management	-	-	▪ Community, Health, Safety and Security
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22	Demand for workforce	-	-	▪ Economy and Employment
1, 3, 16	Demand for goods, materials and services (supply chain)	▪ Soil ▪ Geomorphology and Topography	▪ Flora and Habitats ▪ Fauna	▪ Economy and Employment
1, 2, 3, 20, 21	Increase of traffic	▪ Air Quality ▪ Noise and Vibrations	▪ Fauna ▪ Birds	▪ Community Health, Safety and Security ▪ Mobility and Infrastructure
14, 15	Improvement of road network	▪ Air Quality ▪ Noise and Vibrations	▪ Flora and Habitats ▪ Fauna	▪ Land use ▪ Mobility and Infrastructure

Actions n°	Impact Factor	VESCs (Components)		
		Physical	Biological	Social
				▪ Economy and Employment
3, 14, 15, 19, 20	Interference with existent roads/infrastructure/services	-	-	▪ Mobility and Infrastructure
1	Introduction and spreading of invasive alien species	-	▪ Flora and Habitats	-
2, 3	Damage of cultural resources	-	-	▪ Cultural Heritage
16	Creation of synergies with local educational institute	-	-	▪ Education
16, 19	Provision of electricity to the national grid	-	-	▪ Mobility and Infrastructure

3.3 Phase 2: Identification of Environmental and Social Components Potentially Subject to Impact and Assignment of the Sensitivity Level

Each environmental and social component in the area of influence of the Project has a different sensitivity to the impact factors generated by the Project or can pose a different level of risk to the Project. The sensitivity of an environmental and social component is typically evaluated on the basis of the presence/absence of some features which define both the current degree of quality and the susceptibility to changes of the component. The **Sensitivity ("S")** of the component is defined using component-specific metrics during the baseline and can assume values between 1 and 5 associated to a definition from Low to High. The S value is assigned considering both the component's characteristics and the possible presence of sensitivity features.

The component's Sensitivity can vary from low (1) to high (5) according to the following definitions:

- **Low** (1): the component does not present elements of sensitivity;
- **Medium-low** (2): the component presents few elements of sensitivity that have limited significance;
- **Medium** (3): the component presents numerous elements of sensitivity that have limited significance;
- **Medium-high** (4): the component presents few elements of sensitivity that have high significance; and
- **High** (5): the component presents numerous elements of sensitivity that have high significance.

The Sensitivity for each Project component is defined in Table 3. It is noted that the sensitivity is evaluated considering the baseline survey completed.

Table 3: Components Sensitivity.

Components	Sensitivity elements	S value
Physical:		
Air quality	▪ The Project site is situated on greenfield, predominantly used for grazing livestock. There are no major sources of air pollution so the construction phase will likely increase the area's air pollution. ▪ The Project site does not present any significant artificial source of air emissions (e.g., major industries or heavy traffic) that may cause pollution of ambient air. The primary air emission sources in the vicinity include medium-scale mining operations, located at a significant distance from the Project site (i.e., Sholpan village granite processing plant 15 km to the south and Akbakay gold mining plant 50 km to the north). ▪ The unpaved roads with high-speed vehicles and machinery traffic generating emissions are also at a significant distance from the Project site (i.e., A-358 Burybaital, Merke highway, 20 km to the southeast). ▪ There are no major receptors nearby the WPP site. The closest sensitive receptors are the individual seasonal shepherds that move around the area with the livestock. Nomadic shepherds and their animals potentially crossing the Project site would be exposed temporarily to the construction-related atmospheric emissions, which are expected to be limited in time and amounts. Other than that, the nearest settlements are Kiyakty village at 20 km and Mirny village at 25 km. It is unlikely that these villages will be influenced by the air emissions related to the construction of the OHTL or the WPP, due to the distance. ▪ There are no air quality monitoring stations operated by the National Hydrometeorological Service "Kazhydromet" on the Project area or in its immediate vicinity. The closest air quality monitoring station is located in Shu town, about 100 km far from the area where the WTGs will be installed but located within the area affected by the construction of OHTL (i.e., nearby Shu substation). This station measures PM2.5, PM10, SO_2, CO, NO_2, NO, ground-level O_3 and H_2S. In 2023, Shu's air quality measurements showed elevated pollution levels. ▪ Due to the intrinsic characteristics of the area (desert/arid conditions), natural emission of particulate matter is considered the main natural source of air emissions.	**Medium - Low (2)**
Geomorphology and Topography	▪ The Project site lays on a landscape characterized by slopes, with relevant geomorphological features. ▪ Considering a longitudinal section of the WPP footprint, the highest elevations (starting at 570-600 m asl) are found in the northwest part of the footprint, and these decrease towards the southeast part, where the elevations are around 500 m. Therefore, a variation of about 100 m is found between the northwest and	**Medium (3)**

Components	Sensitivity elements	S value
	southeast portions of the WPP site. The decrease in elevation is not very gradual, with many valleys and ridges also observed along the section. ▪ Regarding the elevation of the OHTL, in Yukgress SS the elevation is around 350 m asl, and it gradually goes up until reaching 550 m in North Mirny SS. From North Mirny SS to South Mirny SS the elevations decrease slightly, about 50 m (from 550 m to 500 m). And from South Mirny SS towards the south the elevations decrease more sharply until its intersection with the A-358 highway (from about 500 m to 390 m), from where they gradually rise until reaching the Shu SS, at 490 m asl. Various modifications of the topography are therefore observed along the OHTL for installing the foundations. ▪ Locally located quarries (between 100 and 200 km) are planned to supply raw materials for the Project. Same region, but different districts from where the WPP is located.	
Soil	▪ The first geotechnical assessment results highlighted that on the WTGs installation site there are various soil elements consisting of a) topsoil made of hard clayey sand with plants roots b) non-uniform loam soil with variable coarsening c) gruss-rock and coarse medium gravels with sand clay aggregate-eluvium of rocky soils and d) hard interlayered siltstones, sandstones and mudstones. These soils are not highly susceptible to erosion; however, after land clearing, the natural balance between soil formation and erosion rates will be altered, possibly intensifying erosion processes and also increasing the risk of pollution. ▪ Based on the available data and information on current and past Project site land uses, a soil contamination due to anthropogenic activities is not expected. A potential on-site soil pollution might be due to the site-specific natural characteristic of the soil, but not related to human activities, so no soil sampling and testing was conducted.	**Medium (3)**
Hydrology and Surface Water	▪ There are numerous seasonal surface water bodies within the WTGs installation site and in its immediate surroundings. They flow outwards from the Project footprint, down the slopes. Water springs are also present within the WTGs installation area. ▪ Flood risk is considered unlikely in the WPP site due to seasonal streams that flow outward from the Project's footprint. However, during the rainy season these streams can carry considerable amounts of water to downstream regions, which may affect communities and infrastructure located in lower topographies.	**Medium - High (4)**

Components	Sensitivity elements	S value
	▪ In lowland areas, such as the Sarysu and Shu districts, nearby the OHTL corridor, intense rainfall and snow melting can lead to flooding. ▪ The closest permanent surface water bodies are Lake Balkhash (located about 60 km northeast of the WPP), and the Shu River (located about 60 km southwest of the WPP). Such water bodies are far from the WPP site; However, Lake Balkhash is quite close to the final part of the northern portion of the OHTL, around 350m from the Yukgress Substation; and the southern portion of the OHTL will cross the Shu River and its floodplain. The Shu River floodplain is subjected to seasonal enlargements and fluctuations. ▪ The mudflows have a low probability to be generated considering the natural soil status.	
Hydrogeology and Groundwater	▪ During the boreholes drilling for the geotechnical surveys, the groundwater table was not reached. Four geotechnical boreholes with 25m depth each were drilled. ▪ For the ESIA groundwater survey campaign, the groundwater was sampled from existing local boreholes and analysed. The laboratory analysis revealed exceedances of the Project standards threshold limit values for Bicarbonate, Sodium, Calcium, Magnesium, Manganese, Chloride, Nickel, Boron, Barium, Total Suspended Solid, Biochemical Oxygen Demand and Total faecal coliform. It was determined that the pollutants detected/measured do not influence the use of groundwater for construction purposes; however, their concentrations imply that the groundwater must not be used for drinking purposes (is not potable) because some are of major concern for human health. The high concentrations of pollutants detected are likely due to Jambyl region's extensive industrial and agricultural activities, the absence of a proper wastewater/sewage water collection and treatment system in and around the Project area, the use of saline water to fill the former uranium mines voids, and the type of soils and local lithology. ▪ The main characteristics of the Project site aquifers (such as depth, porosity, recharge rates, flow paths, sizes, boundaries, etc.) are unknown.	**Medium (3)**
Noise	▪ The Project area is uninhabited and there are no anthropogenic sources of noise. ▪ During the onsite baseline noise measurements, no noise sources have been identified. ▪ The surrounding sensitive receptors (villages and seasonal herders) will surely be affected by the noise generated during the Project construction.	**Medium (3)**

Components	Sensitivity elements	S value
	▪ Because of the construction of roads and the OHTL, the Project construction will expose to noise a large area. ▪ The wind turbines will likely generate sound emissions that fall in the range of 35–45 decibel (“dB”) when heard from 300 meters away. Such sounds will depend on the site-specific atmospheric conditions and topography. Operating wind turbines can create several types of sounds: broadband sound (white noise), infrasonic sound (always present in the environment at frequencies lower than the limit of audible range), impulsive sound (brief and variable in its amplitude, generated when disturbed airflow interacts with turbine blades) and tonal sound (generated from the mechanical pieces turning the turbine’s blade rotation into power). This leads to a medium sensitivity of the area which is currently uninhabited and has no major anthropogenic sources of noise. ▪ BESS units emit noise through cooling systems, inverters and transformers. Fans (i.e., internal cooling mechanisms used to prevent overheating and internal failure) are the primary cause of noise in BESS. Moreover, power conversion devices like inverters, also emit continuous humming noise.	
Shadow Flicker	▪ The closest sensitive receptors are seasonal nomadic herders who move through the area with their livestock, who would potentially be temporarily exposed to shadow flicker. However, as they do not reside permanently, but only pass through and use the area for grazing, the sensitivity of these receptors can be considered low. ▪ The nearest sensitive villages considered for shadow flicker are located around 19 km away from the Project site, therefore without risk of shadow flicker impacts.	**Low (1)**
Solid Waste	▪ Currently, it is identified a lack of appropriated solid waste landfills and treatment plants in Mirny vicinities (< 200 km) to treat large part of the waste that will be generated during construction. ▪ In Mirny there is a municipal solid waste landfill; however, given its operational status, is not sure whether it will be possible or not using it for disposing of the Project solid waste. ▪ In the Project site surroundings, there are no relevant waste recycling and valorisation units.	**Medium - High (4)**

Components	Sensitivity elements	S value
	▪ The construction Phase will generate major quantities of solid waste (most of it being non-hazardous waste, but hazardous waste will also be generated in smaller quantities). The amount will decrease during the operation phase.	
Wastewater	▪ The Project construction will likely generate major quantities of hazardous and non-hazardous liquid waste such as oils and chemicals residues, equipment and machinery washing/cleaning wastewater and domestic/sewage wastewater from workers' facilities. ▪ At the Project site or in its vicinities there is no sewage system. ▪ Liquid household waste of the area is generally transported by specialized companies using vacuum trucks to the nearest disposal sites. ▪ The Project will generate large amounts of wastewater compared to the overall area generation. ▪ No information is available on existent and operational wastewater treatment plants nearby.	**Medium - High (4)**
Biological:		
Terrestrial habitats and ecosystems (Flora and Fauna)	▪ Five main types of habitats were identified at the scoping stage northern and/or southern areas: Xerophytic rocky low mountains; Outcrops of flat granite slabs; Saxual valley forests; Sagebrush and sagebrush deserts on gently undulating plains; and Gently sloping solonchak depressions on the plains. ▪ Landcover type within the Project site includes shrubland, herbaceous vegetation, and bare/sparse vegetation. ▪ Regel's tulip, listed in the Red Book of the Republic of Kazakhstan, is present within the Project site. ▪ Other flora species endemic to the region were also recorded across the scoping stage northern and southern areas. ▪ Seven herptofauna were recorded at the scoping stage northern and/or southern areas, of which the steppe tortoise is classed as Vulnerable on the IUCN red list. ▪ Ten species of mammals (excluding bats) were recorded during surveys in the scoping stage southern area. Of these, the argali (Near Threatened on the IUCN red list) and goitered gazelle (Vulnerable on the IUCN red list) are present within the Project site. ▪ Literature suggests there could be a range of invertebrates present on the Project site.	**High (5)**

Components	Sensitivity elements	S value
Freshwater habitats and ecosystems (Flora and Fauna)	▪ Access to water is limited during the summer, with the rivers and streams almost dry in the second half of June. Only in some places small temporary reservoirs with an open water surface remained. ▪ It is considered there are no freshwater bodies within the Project site. ▪ There are wetlands present to the southwest and northeast of the Project area in the wider region. ▪ Seven notable freshwater species are present within the wider region.	**Low (1)**
Birds	▪ The Project site supports numerous bird species, for which a number are included in the Red Data Book of the Republic of Kazakhstan and/or IUCN red list. ▪ Birds of prey that nest within or adjacent the Project site include long-legged buzzard, golden eagle, steppe eagle, saker falcon, and kestrel. ▪ The Project site is used by a range of migratory birds of prey birds, waterbirds, and other passerines.	**High (5)**
Bats	▪ Based on literature, multiple bat species could be present at the Project site, including species listed on the Red Data Book of the Republic of Kazakhstan and/or IUCN red list. ▪ Cracks in the numerous natural outcrops of rock can provide shelter and roosting opportunities for bats, however the combination of arid conditions, desert biotopes, topography, remoteness from human settlements is unfavourable for bats. ▪ Bat surveys across the scoping stage northern and southern areas recorded six species. All six species are classed as Least Concern on the IUCN red list, and none of the bat species are included in The Red Book of the Republic of Kazakhstan.	**Medium-low (2)**
Protected Areas (PAs)	▪ Zhusandala Important Bird and Biodiversity Area (IBA) and Key Biodiversity Area (KBA) is located 68km to the east of the Project site. ▪ Zhusandala State Reserved Zone is located to the south of southern project area and partially overlaps with the Project site. The Reserved Zone supports grassland (95.65%), shrubland (3.89%) and bare areas (0.4%) as well as 231 species of birds and 56 species of mammals. Of these bird species, one is classified as IUCN Critically Endangered, five Endangered, and six Vulnerable bird species with one Critically Endangered and two Vulnerable mammal species also known to be present.	**Medium - High (4)**

Components	Sensitivity elements	S value
	▪ Andasay State Nature Preserve is located approximately 9.5km to the west of the Project site.	
Social:		
Population and demography	▪ Kazakhstan is an Upper Middle-Income country based on the 2024 DAC list of ODA recipients of the OECD. ▪ Despite some recent improvement, the stability of the country is still considered relatively low under the Fragile State Index, and Kazakhstan is placed under the “Alert” category. While in terms of governance, the country shows good levels of governance. ▪ Considering civil rights international indexes, Kazakhstan presents major issues in terms of freedom of expression, freedom in political rights and civil liberties. Based on the Global Freedom Status reports for 2024, Kazakhstan is considered a “Not free” country. ▪ The Project site is located within the Moiynkum District of the Jambyl Region of Kazakhstan. The nearest villages to the Project site are Sholpan (15km from the site), Kiyakty (20 km from site) and Mirny (25 km from site). ▪ Regarding the Project AoI, the population close to the Project site resides in challenging and unstable conditions, struggling with access to clean drinking water for themselves and their livestock, and lack of a reliable cellular network and internet connectivity which further isolates these communities. ▪ Considering that the primary source of income of these communities is often tied to government aids, residents are hesitant to express their political preferences openly, mindful of living in an authoritarian context. ▪ Tension is registered locally between Kazakh and Russian populations.	**Medium-High (4)**
Land use	▪ Based on the Global Property Rights Index, 25% of the adult population in Kazakhstan, feel insecure in their land and property overall. ▪ The Project site include agricultural land, industrial land, specially protected natural areas, forest reserve land, and reserve land. ▪ A significant portion of the Project site (particularly the large northeastern part) lies on Forest Fund lands, while another large portion, as well as some parts of its southern area, falls under Reserve land.	**High (5)**

Components	Sensitivity elements	S value
	▪ Part of land identified for the Project site is allocated to private entities, Independent Entrepreneurs (“IE”), for economic activities purposes, mainly grazing of livestock.	
Economy and Employment	▪ The Consumer Price Index (CPI) in Kazakhstan from 2022 to 2024 shows fluctuations in inflation and economic conditions over this period. ▪ Kazakh population living below the subsistence minimum was recorded at 5.1% in the second quarter of 2023; this trend is in notable decline. The same applies for the unemployment rate which has slightly decreased to 4.7% in 2023 and accompanied by an increase in the minimum wage, contributing to a reduction in poverty rates to 8.8%. ▪ The workforce strongly relies on resource extraction, particularly oil. There is a major need for skill development in the labour market in order to differentiate the country’s economy. Disparities in income distribution persist, particularly between urban and rural areas. ▪ In more recent years the Moiynkum District, interested by the Project, has shown a declining trend in working population, employed population, wage earners and self-employed workers. While the unemployment rates has remain quite stable, the District showed a significant decline of youth unemployment and general increase in the number of individuals not participating in the labour force. ▪ Regarding the industry sector in the Project area, the region lack agricultural activities due to the chronic lack of water resources and the primary local activities have shifted to cattle grazing and fishing in Balkhash Lake; however, due to environmental conditions overall livestock farming is challenging. ▪ The Moiynkum District is also characterized by a developing industrial landscape, with factories specialized in fish processing, metallurgy, mining and granite extraction. ▪ The Mirny community experience high level of unemployment with residents interviewed expressing their concern for the difficulties in securing stable livelihoods. In the area the export of natural resources, such as livestock and grains are significant at local level.	**Medium-High (4)**
Education	▪ Kazakhstan has a literacy rate of approximately 99.8% for adults. ▪ Concerning educational rates in the Project AoI, the education system in Mirny Village is limited, particularly regarding higher educational opportunities. Local residents travel to Taraz, where three universities offer degree programs, or to Moiynkum, where there is one college for vocational training. In Mirny itself, the	**Low (1)**

Components	Sensitivity elements	S value
	educational facilities consist of just one school, which serves the primary and secondary education needs of the community, as well as a kindergarten for early childhood development. ▪ In Mirny Village most respondents possessed secondary vocational education.	
Community Health, Safety and Security	▪ Kazakhstan's healthcare system provides free medical services, for universal health coverage for all citizens. ▪ Considering the Project AoI, public health services in Mirny Village are limited, the village has two doctors and one paramedic available to provide basic healthcare and one ambulance that serves the community. ▪ In case of serious emergencies or more complex medical needs, residents are transported to the Moiynkum hospital for advanced medical care. The Moiynkum hospital is located at approx. 150km from the Project site.	**Medium-High (4)**
Mobility and Infrastructures	▪ The villages near the Project site are isolated and with a significant number of abandoned multi-story buildings. ▪ Access to water is challenging for residents. In Mirny and Kiyakty villages water is delivered by truck from Khantau, providing 300 liters per household 2-3 times a month. There is a water pipeline connected to Balkhash that opens twice a day; however, residents confirm that the water coming from this pipeline is undrinkable. ▪ All the villages near the Project site have access to electricity, however Southern Kazakhstan faces significant energy deficiency. The energy deficiency is compounded by a reliance on aging infrastructure and insufficient investment in the energy sector. ▪ Due to the shortage of water in the region, homes are unable to accommodate modern sanitary facilities such as flushing toilets or wastewater treatment systems. This absence of essential infrastructure leads to a reliance on rudimentary sanitation methods. ▪ In Kazakhstan, the level of mobility for people with disabilities is improving due to national programs; however, in the project AoI has been assessed that the overall abandonment and degraded infrastructure reveal a complete lack of provisions for individuals with limited mobility. For what concern transportation, the options in Mirny village are limited; the village is served by a single train cart. The main preferred option for residents is traveling by private cars.	**Medium-High (4)**

Components	Sensitivity elements	S value
Cultural Heritage	▪ The Project site has been assessed and found to contain few archaeological objects, namely petroglyphs and mounds, which were taken into consideration in the layout of the WPP in order to avoid their contamination or destruction. Beside those, no other known tangible cultural heritage; however, it is important to consider that the WPP is situated within a region rich in historical significance and cultural landmarks. The region indeed hosts few mausoleums. In proximity to the project site, the Khantau Mountains are noteworthy for their ancient rock art and archaeological features. ▪ Concerning intangible cultural heritage, the area around windfarm serves as a reservoir of intangible cultural heritage (“ICH”) linked the Kazakh nomadic culture.	**Medium-Low (2)**
Landscape and visual quality	▪ The southern and western regions of the Moiynkum District are characterized by low hills and ridges, surrounded by sandy mounds. In contrast, the northeastern part of the district borders Balkhash Lake, where the shoreline of the Shu-Ili Low Hill Terrain attracts significant land features. This area, part of the Kyrgyz Alatau, rises to an elevation of 1,800 meters above sea level, while the Khantau ridge reaches 1,053 meters from the Ai-Tau peak. ▪ The Project site is predominantly located on the flat-topped Maizharylgan Mountains, with its northern section extending onto the Jambyl Mountain. Dominant plant species include various types of wormwood, camel thorn, marsh grasses, reeds, and shrubs, which thrive across the landscape. ▪ The region's ecosystem is sensitive to various anthropogenic pressures, including climate change, overgrazing, and unsustainable agricultural practices.	**Low (1)**
Ecosystem services	▪ Natural resources in the Moiynkum district, such as phosphorites and rare metals, are key to its economy. These resources are extensively mined and exported (mainly Black Metals; Colored Metal; Rare and Rare Earth Metals; Fluorspar and Associated Components; Manganese Ores and Gold; Baryte, Feldspar, and Manganese Ore and Associated Components). ▪ Due primarily to the impact of climate change, the Jambyl region is affected by water scarcity. Within the Project AoI few aquifers and complexes containing fresh and slightly saline groundwater were identified. However, the outcomes of the test performed show that the groundwater can be used only for construction	**Medium (3)**

Components	Sensitivity elements	S value
	purposes and it is not drinkable. The amount of water that will be needed for construction activities and poorness of the aquifers can significantly affect the reserves of water of the region.	

3.4 Phase 3: Impact Assessment

3.4.1 Scoring of Impact Factors

The **impact factors** identified during the analysis of the Project (and through the definition of the Project phases and Project actions) are assessed for their relevance, using a scoring system. The parameters considered to assess the impact factor score are the following:

Duration ("D"): is the duration of the impact factor. It may vary from short to long according to the following definitions:

- Short: if shorter than one month;
- Medium-short: if between one month and six months;
- Medium: if between six months and two years;
- Medium-long: if between two and five years; and
- Long: if over five years.

Frequency ("F"): is the frequency of the impact factor. It may vary from concentrated to continuous according to the following definitions:

- Sporadic, a single event;
- Moderately frequent, few events evenly or randomly distributed over time;
- Frequent, several events evenly or randomly distributed over time;
- Highly frequent, high number of events evenly or randomly distributed over time; and
- Continuous, event with no interruption over time.

Geographic extent ("G"): is the geographical area within which the impact factor can exert its effects. It may vary from Project site to transboundary according to the following definitions:

- Project footprint: the impact factor is confined within the boundaries or exclusively controlled by the Project;
- Local: the impact factor extends to the areas or communities neighbouring the project site;
- Regional: the impact factor extends to an area beyond the surroundings of the project site and to regional physical (airshed – watershed, etc.) or administrative boundaries;
- Beyond regional: the impact factor extends throughout several regions or to the entire country; and
- Global: the impact factor has an international or global reach.

Intensity ("I"): is a measure of the physical, economic or social extent of the impact factors. It may vary from negligible to very high according to the following definitions:

- Negligible: the impact factors cannot be easily detected or perceived and are unlikely to cause any detectable change in the target environmental or social components;
- Low: the impact factors can be detected or perceived but effects are unlikely to cause tangible changes in the target (environmental or) social components;
- Medium: the impact factors are within legal standards or accepted good industry practices and/or effects are likely to cause tangible changes in the target environmental or social components;

- High: the impact factors are at the limit of legal standards or accepted good industrial practices and/or effects are likely to cause serious impairment in the target environmental or social components; and
- Very high: the impact factors are at risk of exceeding the limits of legal standards or good accepted industrial practices and/or effects are likely to cause very serious to catastrophic damage to the target environmental or social components.

Each of the parameters listed above can have a value between 1 and 5. The severity of the impact is determined through an **impact factor score** which sums the score of each of the 4 parameters, hence it can assume a value between 5 and 20.

3.4.2 Impact Value Calculation

The calculation of the **impact value** is done by multiplying the Impact Factor Score for the value of the sensitivity of the target component, determined during the baseline assessment. The result is then weighted considering the impact reversibility.

The reversibility is the property of an impact to reduce its intensity over time and to eventually disappear entirely. **Reversibility ("R")** may vary from reversible to irreversible according to the following definitions:

- Short term: if the initial condition of the component will be restored in a period between weeks and months after the end of the impact factor and/or the restoration activities;
- Short/mid-term: if the initial condition of the component will be restored in a period between a few months and one year after the end of the impact factor and/or the restoration activities;
- Mid-term: if the initial condition of the component will be restored in a period between one year and five years after the end of the impact factor and/or the restoration activities;
- Long term: if the initial condition of the component will be restored in a period between five and 25 years after the end of the impact factor and/or the restoration activities; and
- Irreversible: if it is not possible to predict restoration to the initial conditions.

The reversibility is measured on a scale between 1 and 5.

The **impact value ("IV")** is calculated by multiplying the Impact Factor Score with the component's Sensitivity level and with the Reversibility, according to the following formula: IV= IFS x S x R.

3.4.3 Mitigation Measures

The final assessment is made once the enhancement of mitigation measures is adopted. Mitigation measures are means to prevent, reduce or control adverse environmental effects of a project, and include restitution for any damage to the environment caused by those effects through replacement, restoration, compensation or any other means.

The proposed mitigation measures are the result of an interactive process between the impact assessment and the engineering design. There are some measures which result directly from the application of local regulation, and we call them "embedded", in some cases obvious for the specificity of the project. In addition to these, we propose in the study further measures based on the Good Industry Practices and from the experience of other similar projects which follow the mitigation hierarchy and will help to reach compliance with Lenders' requirements.

3.4.4 Residual Impact Calculation

The next step consists in assessing the effectiveness of the mitigation measures in reducing or eliminating the negative impact (or to maximize the positive one). The mitigation measures should be defined with reference to the mitigation hierarchy listed below in descending order of effectiveness:

- Avoid;
- Minimize;
- Restore; and
- Compensate.

The effectiveness of the mitigation measures defined in the environmental and social management plan is assessed using expert's judgement and the outcomes from previous applications of similar mitigation measures to similar projects. The definitions of the mitigation effectiveness may vary from none to high, as described below:

- None: the measures can reduce the impacts by less than 20% of the expected outcome;
- Low: the measures can reduce the impacts by 20% - 40% of the expected outcome;
- Medium: the measures can reduce the impacts by 40% - 60% of the expected outcome;
- Medium-high: the measures can reduce the impacts by 60% - 80% of the expected outcome; and
- High: the measures can reduce the impacts by more than 80% of the expected outcome.

The mitigation effectiveness is measured on a scale from 1 to 0.2 (1 = minimum effectiveness; 0.2 = maximum effectiveness).

Positive impacts are typically associated with economic and social opportunities and sometimes with environmental aspects a project can solve (for example: a project located in a brownfield where existing environmental issues can be addressed). Projects are typically promoting activities to enhance the economic, social and environmental opportunities through specific programs, plans and measures including, for example, professional skills generation, community investment, shared value programs, remediation programs, biodiversity conservation projects, etc.

The assessment of positive impacts is based on the same parameters used to assess the negative ones. The only difference is that the mitigation measures are replaced by enhancement measures, or measures to maximize the potential positive impacts.

The enhancement measures effectiveness defined in the environmental and social management plan is assessed using expert's judgement and the outcomes of previous application of similar enhancement measures to similar Projects. The definitions of the enhancement effectiveness may vary from *none* to *high* as shown below:

- None: the measures can enhance the positive impacts by less than 10% of the expected outcome;
- Low: the measures can enhance the positive impacts by 10% - 20% of the expected outcome;
- Medium: the measures can enhance the positive impacts by 20% - 30% of the expected outcome;
- Medium high: the measures can enhance the positive the impacts by 30% - 40% of the expected outcome;
- High: the measures can enhance the positive impacts by more than 40% of the expected outcome.

The **Residual Impact Value ("RIV")** is calculated multiplying the impact value with the impact mitigation effectiveness as per the following formula: **RIV = IV x M.**

3.4.4.1 *Scale of Residual Impacts*

The scale of the residual impacts resulting from the methodology described above ranges from 0.8 to 500. The impact value is then scaled to 5 levels by dividing into 5 classes with an equal number of values, the entire distribution of values obtained.

The residual Negative impacts are classified into 5 levels according to Table 4:

Table 4: Five levels of residual negative impacts.

Residual impact score	Residual impact definition	
0.8 – 33.0	Negligible	
33.1 – 76.0	Low	
76.1 – 136.0	Medium	
136.1 – 228.0	High	
228.1 – 500.0	Very High	

The residual Positive impacts are classified into 5 levels according to Table 5:

Table 5: Five levels of residual positive impacts.

Residual impact score	Residual impact definition	
0.8 – 33.0	Negligible	
33.1 – 76.0	Low	
76.1 - 136.0	Medium	
136.1 - 228.0	High	
228.1 – 500.0	Very High	

3.4.5 Overall Assessment

The methodology described above allows for an analytical assessment of impacts caused by individual impact factors over individual components. The process therefore ends with a table presenting several impacts from different impact factors for each component.

The table defines the assessment of the component's overall impact. It is a synthesis of the impacts on a component from all the impact factors generated by the Project actions. The impact assessment provides a comprehensive view of the impact value that actually affects the environmental or social component.

The impact assessment is expressed based on the assessor's experience, assigning higher weight to the values less favourable to the component's protection, in order to guide the assessment toward a more prudential approach.

Impacts are presented in separate tables for negative and positive impacts to avoid automatic trade-offs and/or mediating between positive and negative aspects, as they are often targeting different sections of the community.

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