



Karavasta Solar Project

Ecosystem Services Assessment

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Executive Summary

The Karavasta Solar Project is a renewable photovoltaic (PV) energy project located in the Divjaka region of Albania, which includes the following components:

- A photovoltaic plant (PV Plant) occupying 185 hectares (Ha) with a peak installed capacity of 140 MW
- Approximately 21 km long 220 kV overhead line (OHL) with 59 towers connecting the PV Plant with an existing electrical substation in Fieri.

The Karavasta Solar Project ESIA has been approved and 2022 key project milestones include:

- Start of construction in 3Q 2022 (July)

Energies Group GmbH has been commissioned to undertake an Ecosystems Services Assessment (ESA) of the Karavasta Solar Project construction and operational impacts.

The key data sources used in the assessment were the Karavasta Solar Project ESIA, site visits completed in December 2021, consultation with the team completing the Livelihood Restoration Plan (LRP), review of the LRP household survey data and ESIA disclosure meetings in June 2022. An assessment framework has been implemented to align with applicable guidance and includes scoping, identification and screening of ecosystem services as well as an impact assessment stage to confirm significance. Mitigations included in the ESIA have been reviewed and additional mitigations have been recommended where applicable.

A total of eight potential ecosystem services have been identified at the scoping stage. These include:

- Livestock
- Honey production
- Capture fisheries
- Hunting
- Pollination
- Hydrology processes
- Ethical / Recreational and tourism
- Semi and natural habitats

Following a screening process, the following six ecosystem services were selected for a more detailed impact assessment:

- Livestock
- Honey production & pollination combined
- Pollination
- Hydrology processes
- Recreational and tourism
- Semi and natural habitat

The impact assessment ranked all impacts as minor or negligible, no significant adverse impacts were identified. There is no risk to the value or functionality of the ecosystem services from the construction or operation of the Karavasta Solar Project. There is potential to create a positive impact to hydrology processes, through rehabilitation and regular maintenance of the PV Plant area drainage that is currently poorly maintained.

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Abbreviations

Abbreviation	Definition
AC	Alternate current
AU	Administrative Unit
dB	Decibel
DC	Direct current
EBRD	European Bank for Reconstruction and Development
EIA	Environmental Impact Assessment
ESA	Ecosystem Services Assessment
ESIA	Environmental and Social Impact Assessment
EU	European Union
GWh	Gigawatt-hour
GHG	Greenhouse gas
Ha	Hectares
HV	High Voltage
IFC	International Finance Corporation
km	Kilometre
kV	kilovolt
LAeq	A-weighted Leq sound level
LRF	Livelihood Restoration Framework
LRP	Livelihood Restoration Plan
MW	Megawatt
NDC	National Determined Contribution
OHL	Overhead Line
OST	Operatori I Sistemit të Transmetimit (Transmission System Operator)
PV	Photo Voltaic
REA	Regional Environmental Authority
RSIR	Route Social Impact Register
SCADA	Supervisory Control and Data Acquisition
TWh	Terawatt-hour

1 Introduction

1.1 Report purpose

This report presents an ecosystems services assessment consistent with the requirements of the International Finance Corporation (IFC) and European Bank for Reconstruction and Development (EBRD) to support the approved Voltalia Karavasta Solar Project Environmental and Social Impact Assessment (ESIA) (Ref. 1).

The ESIA (Ref. 1) was approved in 2021 by the competent authority. The Livelihood Restoration Plan (LRP) baseline data collection, including household surveys, was completed in 1Q 2022 (Ref 9).

1.2 The Karavasta Solar Project

The Karavasta Solar Project is a renewable photovoltaic (PV) energy development located in the Divjaka region of Albania (see Figure 1.1), which includes the following components:

- A photovoltaic plant (PV Plant) occupying 185 Ha with a peak installed capacity of 140 MW
- Approximately 21 km long 220 kV overhead line with 59 towers connecting the PV Plant with an existing electrical substation in Fieri.

1.3 Project Organisation

The Voltalia Karavasta Solar Project organisation chart is provided below:

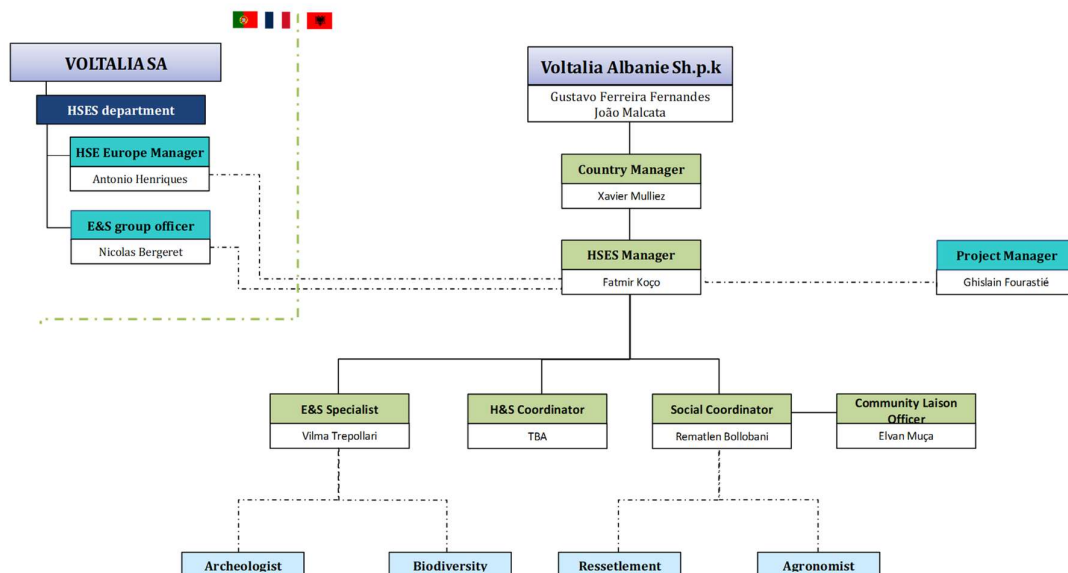




Figure 1.1 Karavasta Solar Project Location

2 Ecosystem Services Overview

2.1 Applicable ecosystem Services Standards and guidance

The EBRD and IFC environmental and social policies and supporting guidance notes (See Section 9 for all references, Ref. 2 and 3) recognise the need to protect and conserve biodiversity, including ecosystem services. The policies highlight the need for projects to consider ecosystem services and integrate their identification, monitoring and management into:

- The planning and execution of stakeholder engagement
- The environmental and social assessment of projects
- Land acquisition and social impact management
- Biodiversity data collection and assessments and
- General project governance and implementation of the mitigation hierarchy.

The World Resources Institute has issued a guidance on the integration of ecosystem service assessment into the impact assessment process (Ref. 4) and corporate ecosystem services review (Ref. 5).

Within Albanian legislation there is no explicit reference to ecosystem services; however, the legislative requirements for environmental, biodiversity and livelihood assessment and mitigation as well as stakeholder consultation cover the broader objectives of ecosystem services management and are detailed in Section 3 of the ESIA (Ref. 1).

2.2 Ecosystem Classification and Assessment Guidance

Ecosystem services are defined by the IFC as the benefits that people, including businesses, derive from ecosystems. IFC Guidance Note for Performance Standard 6 (Ref. 3) includes four categories of ecosystem services:

- Provisioning ecosystem services provide goods or services and include:
 - Agricultural products, seafood and game, wild foods, and ethnobotanical plants
 - Water for drinking, irrigation and industrial purposes and
 - Forest areas, which provide the basis for many biopharmaceuticals, construction materials, and biomass for renewable energy.
- Regulating ecosystem services provide contribution to human well-being arising from an ecosystems influence of natural processes and include:
 - Climate regulation and carbon storage and sequestration
 - Waste decomposition and detoxification
 - Purification of water and air
 - Control of pests, disease and pollination and
 - Natural hazard mitigation.
- Cultural ecosystem services are non-material contribution to human well-being and include:

- Spiritual and sacred sites
- Recreational purposes such as sport, hunting, fishing and ecotourism and
- Scientific exploration and education.
- Supporting services are the natural processes that maintain the other services and include:
 - Nutrient capture and recycling
 - Primary production and
 - Pathways for genetic exchange.

The IFC Guidance Note for Performance Standard 6 (Ref. 3) defines two types of ecosystem services, associated with the characteristics of interaction:

- Type I: Provisioning, regulating, cultural and supporting ecosystem services, over which the client has direct management control or significant influence, and where impacts on such services may adversely affect communities.
- Type II: Provisioning, regulating, cultural and supporting ecosystem services, over which the client has direct management control or significant influence, and on which the project directly depends for its operations.

If an impact to an ecosystem service is likely, a systematic assessment is required to determine whether priority ecosystem impacts will occur. The assessment shall consider:

- The project's likelihood to have an impact on the service and
- The project's direct management control or significant influence over that service.

Type I priority ecosystem services are defined under the following circumstances:

- Project operations are likely to result in a significant impact on the ecosystem service
- The impact will result in a direct adverse impact on affected communities "livelihood, health, safety, and/or cultural heritage"; and
- The project has direct management control or significant influence over the service.

Type II priority ecosystem services are defined under the following circumstances:

- The project directly depends on the service for its primary operations and
- The project has direct management control or significant influence over the service.

3 Ecosystem Services Assessment Methodology

The ESIA (Ref. 1) did not explicitly consider ecosystem services; however, to support the ESIA, stakeholder engagement was completed, and field-based assessments of the physical environment, including hydrological assessments, water and air quality and noise measurements and biodiversity surveys were undertaken.

The process of ecosystem services assessment for the Voltalia Karavasta Solar Project is summarised in Figure 3.1 below and constitutes a systematic approach to the evaluation of the project and its associated activities that complements the ESIA. Further detail is provided below.

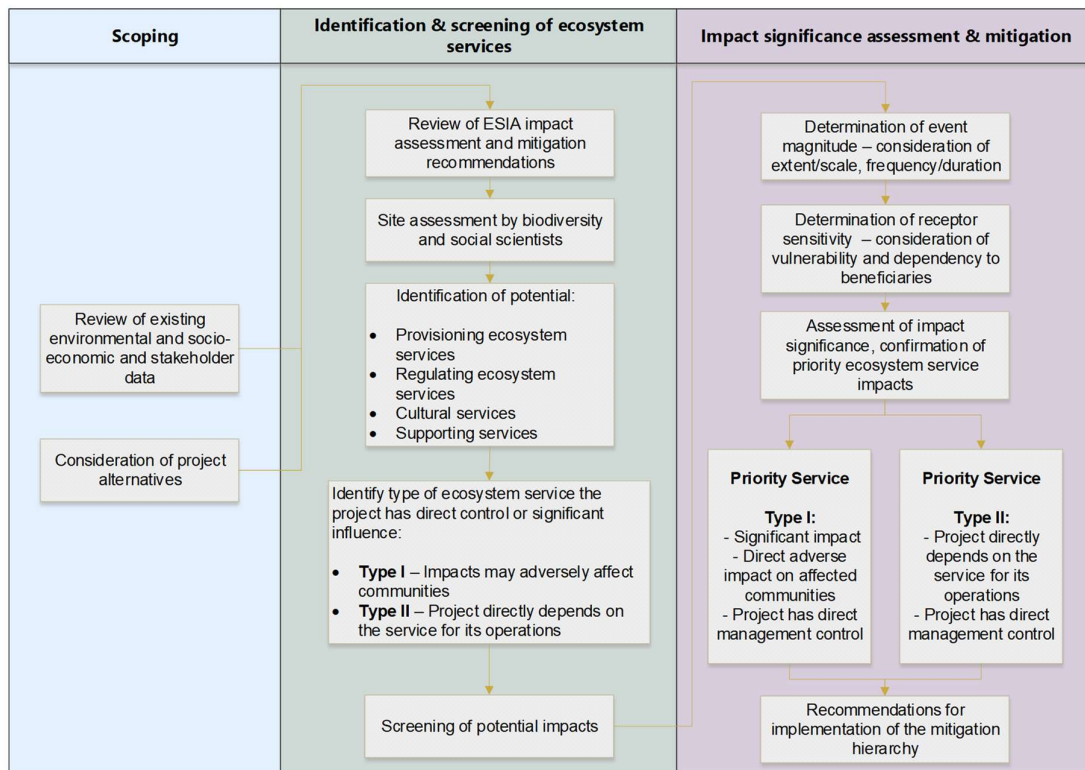


Figure 3.1 Ecosystem Services Assessment Process

3.1 Scoping

Scoping is the first step in the ecosystem services assessment process, providing a high-level assessment of anticipated “interactions” between project activities and environmental and social components that provide or benefit from ecosystem services. Scoping focuses the assessment, eliminating activities from the full impact assessment process based on their limited potential to result in discernible impacts.

To arrive at a conclusion to ‘scope out’ an ecosystem service, a mixture of expert scientific judgement based on prior experience of similar activities and events and, in some instances, scoping level quantification / numerical analysis is used.

The Karavasta Solar Project scoping process has included:

- Review of existing environmental and socio-economic data provided within the ESIA

- A site visit to the project location and surrounding area
- Liaison with the team completing the LRP and supporting activities, detailed in Section 5.4.

3.1.1 Assessment of Project Alternatives

The initial step in defining a project is to identify, at a conceptual level, viable alternatives to the project at two levels:

- Alternatives to the development, including the “no development” option, and
- Engineering or construction alternatives within the selected project’s concept design definition.

Consideration of the no “development option” and Karavasta Solar Project alternatives are presented in Section 2.6 of the ESIA (Ref. 1). In addition, there has been further consideration of alternatives, summarised below.

The proposed location for the PV Plant was defined by the Ministry of Infrastructure of Albania and is a state land not owned by private entities. There is evidence of informal grazing of livestock on parts of the land, and this and any other livelihood activities on the site will be taken into account as part of the Livelihood Restoration framework (LRF) and LRP development.

The key principle in determining the route of the OHL was avoidance of the following areas to the extent possible:

- Populated areas and housing
- Forested areas
- Parks and natural reserves
- Special landscapes or landscapes with an architectural and historical value
- Geologically unstable areas
- Farming lands, especially those with vineyards and orchards.

The proposed route has been selected specifically to avoid the need for any physical displacement of buildings, including households and businesses. The route also avoids, to the extent possible, land parcels planted with perennial trees, including orchards and vineyards, which would otherwise be impacted by easement restrictions, as well as taking longer to recover following any construction disturbance.

Further route selection has resulted in a refinement of the route to reduce the number of agricultural land parcels impacted by the project as well as to reduce the number of crossings of the Seman river and associated disturbance to the riparian habitat.

Refinements to the final routing are now being undertaken in terms of location of individual pylons; where feasible, these are being located at the boundary/edge of farm parcels. This will reduce the impacts of permanent land take for the pylons and orphan land issues.

3.2 Identification and Screening of Ecosystem Services

To support the identification and screening of ecosystem services the following data was reviewed:

- ESIA and associated socio-economic survey data
- LRP household survey
- Four additional ESIA disclosure meetings where completed in June 2022 in communities along the OHL route and adjacent to the plant area
- Onshore environmental surveys presented in the ESIA that include biodiversity, noise, visual context, air quality, noise, soil quality, hydrological, socio-economic and cultural heritage baseline surveys
- Meteorological and hydrological data.

The review informed the planning of site visits completed by Spartak Koci (a biodiversity specialist) and Ani Plaku (a social scientist) in December 2021 to support the confirmation of possible ecosystem services and screening process.

The screening of ecosystems services focused on confirming the below criteria:

- Is the ecosystem service present within the footprint of the PV Plant and OHL and the area where construction or operational direct and indirect impacts may occur, defined as the Area of Influence
- Will the project likely have an impact on the service
- Does the project have management control or significant influence over the service

Those ecosystem services that did not trigger the above criteria were screened out of the assessment process and are listed in Appendix 1.

3.3 Impact Significance Assessment

To systematically assess potential impacts (an interaction between a project activity and ecosystem service) to Type I and II services, an assessment framework has been developed that ranks impact according to its “significance” determined by considering “impact magnitude” of and “service sensitivity”.

Professional judgement, with the input from relevant experts, has been used when applying the framework. The potential to use quantitative analysis of impacts was limited, and the key data sources were the ESIA, the site visits in December 2021, the LRP household survey and the additional ESIA disclosure meetings in June 2022.

3.3.1 Method for Determining Impact Magnitude

Impact magnitude considers two parameters, which are equally weighted and are each assigned a rating of “1”, “2”, or “3”. Two indicators of impact magnitude used are:

- Extent / Scale – The spatial footprint of the impact created by the construction and operation of the Karavasta Solar Project as well as the spatial extent of the service that is impacted
- Frequency / Duration – The temporal extent of the impact created by the construction and operation of the Karavasta Solar Project, considering the duration and frequency

Extent / Scale: Ranges from:

- **1** – Impacts confined to within 1 km of the Karavasta Solar Project (the PV Plant Area and OHL) footprint
- **2** – Impacts extending beyond 1 km of the Karavasta Solar Project (the PV Plant Area and OHL) footprint but remaining within 7 km, and impacts no more than 50% of an area critical to the habitat / ecosystem service function
- **3** – Impacts extending beyond 7 km of the Karavasta Solar Project (the PV Plant Area and OHL) footprint, and impacts more than 50% of an area critical to the receptors habitat / ecosystem service function.

Frequency / Duration: Ranges from:

- **1** – Infrequent impacts and impacts of short duration
- **2** – Impacts of medium frequency and duration
- **3** – Frequent impacts and impacts of long duration.

Overall impact magnitude is scored from low (1) to high (6) by adding the individual parameter scores:



Resulting individual ratings are summed to give the overall impact magnitude ranking, see Table 3.1.

Table 3-1 Impact Magnitude Rankings

Impact Magnitude	Score (Summed Parameter Rankings)
Low	1-2
Medium	3-4
High	5-6

3.3.2 Method for Determining Service Sensitivity

Receptor sensitivity considers two parameters, which are equally weighted and are each assigned a rating of "1", "2", or "3". The two indicators of sensitivity used are:

- Vulnerability considers the nature, extent, condition, as well as changes (external to the project) of the service and its capacity to adapt to change
- Dependency considers importance of the service to users in terms of livelihoods, health, safety and cultural heritage

Vulnerability (to the identified stressor): Ranges from:

- **1** – Service supply / functionality affected to a minor extent, abundant sources available, beneficiaries' access is at very low risk

- **2** – Service supply / functionality moderately affected, reduction in abundance / availability / access, where thresholds associated with dependence are not exceeded
- **3** – Material changes or constraints to service supply / functionality, to abundance / availability / access, where thresholds associated with dependence are exceeded.

Dependency: Ranges from:

- **1** – Service benefits generate very low to no dependency and there are other sources of easily available/accessible comparable alternative services
- **2** – Service benefits have a medium level dependency and there are other alternative sources with medium level availability/accessibility constraints
- **3** – Service benefits have a high level of dependency and there are very limited alternative sources with material availability/accessibility constraints.

Overall receptor sensitivity is scored from low (1) to high (6) by adding the individual vulnerability and dependency scores, see table 3.2.



Table 3-2 Service Sensitivity Rankings

Sensitivity	Score (Summed Parameter Rankings)
Low	1-2
Medium	3-4
High	5-6

3.3.3 Method for Determining Impact Significance

Impact significance, as a function of impact magnitude and sensitivity, is subsequently ranked, as presented in Table 3.3 below.

Table 3-3 Impact Significance

		Service Sensitivity		
		Low	Medium	High
Impact Magnitude	Low	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Significant

	High	Moderate	Significant	Significant
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Any impact ranked as “significant” would trigger the priority ecosystem service classification as per the IFC Guidance for Performance Standard 6 (Ref. 3).

A type I priority ecosystem services associated with the construction and operation of the Karavasta Solar Project would result in an adverse impacts to affected communities.

A type II priority ecosystem services associated with the construction and operation of the Karavasta Solar Project would result in an adverse impact to the service the project is directly dependent for its operations.

4 Environmental and Socio-Economic Overview of the Project Area of Influence

4.1 General Characteristics and Hydrology

The Karavasta Solar Project PV Plant is located 3.8 km west from the Adriatic coast of Albania, 14 km northwest of Fieri. The PV Plant is ~ 0.5 km from the Seman river, a major river in western Albania with a catchment of over 5,000 km² that is formed by confluence of two rivers, the Devoll and the Osum.

The PV Plant will occupy 185 Ha of land within a relatively flat area with a 2 m change in elevation across the site, approximately 2 m above sea level and composed of sand to sandy loam soils (see Figure 4.1).

The area is poorly vegetated by salt tolerate species including semi natural salt marsh / meadow habitat (recognised within Annex 1 of the EU Habitats Directive) which has been modified over time, is not actively cultivated, and is used by informal herders for grazing of livestock.

The PV Plant is adjacent to the Divjakë-Karavasta National Park; approximately 50% of the PV Plant lies within the International Bird Area and Key Biodiversity Area that is centred in the Divjaka-Karavasta National Park (see Section 4.3 for further details).



Figure 4.1 PV Plant Area

The PV Plant is situated within an extensive area of drainage channels of over 7,000 Ha, which were constructed in the second half of the 20th century and are no longer fully functional as a result of continued poor maintenance. Due to the low elevation and the poorly functional drainage systems in the vicinity of the PV Plant flooding and standing water in periods of sustained rainfall are common and can limit vehicle access (see Figure 4.2 of the key drainage features). There are 5 main drainage areas that include:

- The Seman river
- The Dokollareve canal
- The Myzeqe Canal and Canal North
- The Canal South

- The Hoxhara drainage channel

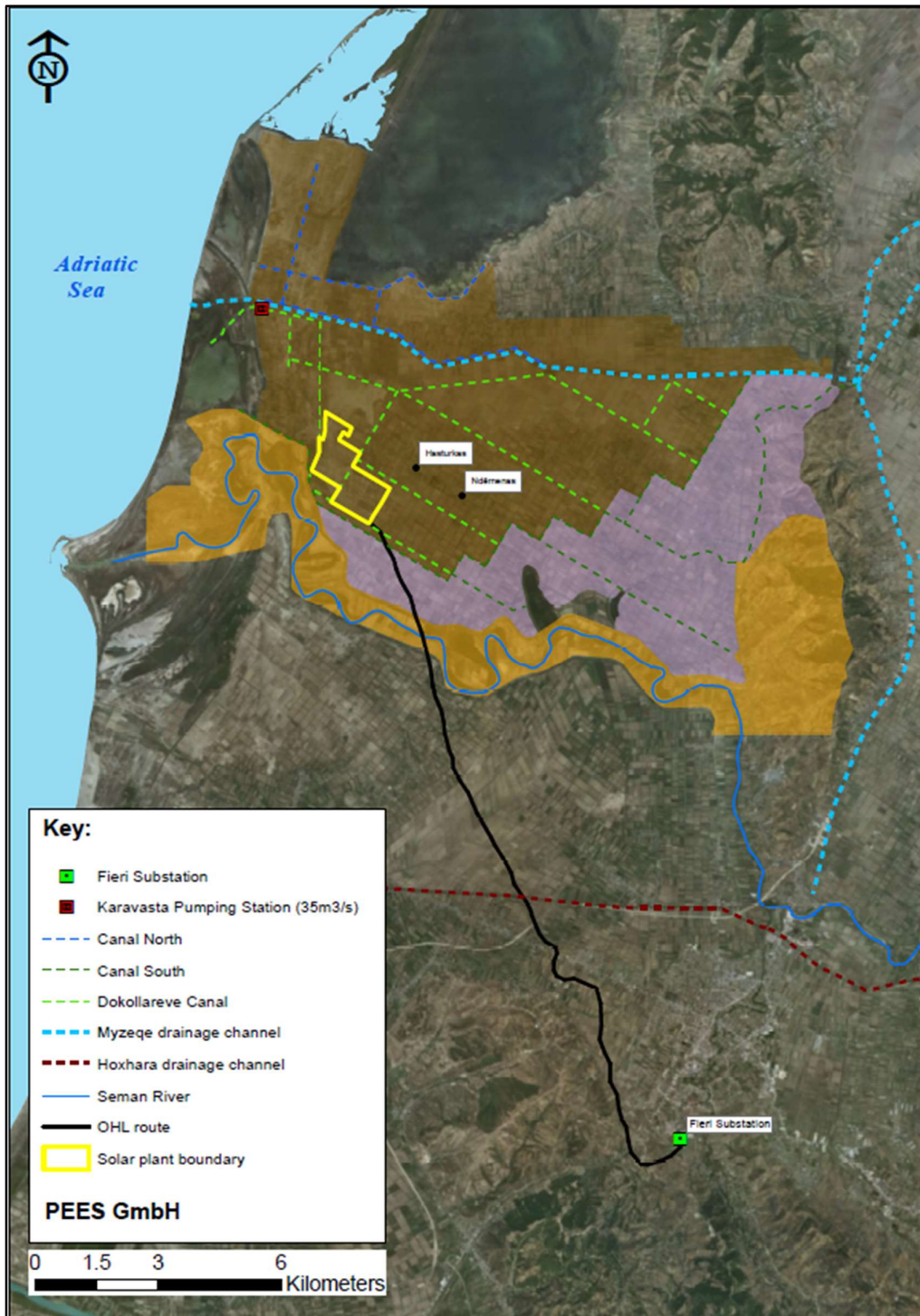


Figure 4.2 Key Drainage features in the Project Area of Influence

The nearest residential community, Hastukasi, is situated ~1 km from the north-western boundary of the PV Plant, with closest isolated single dwelling 500 m west (see Figure 4.3) and 350 m north-east of the PV Plant.



Figure 4.3 Single Dwelling 500 m west of PV Plant

The land along the OHL is predominantly actively cultivated agricultural land. There is a single OHL crossing of the Seman river at the locations of towers 9 and 10 and a crossing of the Ujitja / Hoxhara drainage channel near the Dermenas community between towers 29 and 30 (see Figure 4.4). The LRP socio-economic survey reported that along the OHL route, twice as many parcels were cultivated with annual arable crops (the most common at the time of the survey; alfalfa 46%, wheat 36% and oat 29%) and annual perennial fruit crops (the most common at the time of the survey; olive 43%, fig 10%, grape 6.5%, pomegranate 5.6% and citrus 4.5%). Grazing of livestock has been observed at the PV Plant as the area is not cultivated and provide sparse poor quality grazing vegetation.



Figure 4.4 Seman River Crossing Location

4.2 Socio-economic Characteristics

The ESIA (Ref. 1) reports that agricultural and livestock activities are the most common source of income for 46% of households; whilst 34% are retired, 7.4% of the respondents were unemployed and actively looking for employment and 7% worked in the private sector. These numbers are consistent with the LRP household survey.

According to the ESIA socio-economic survey 90.4% of the households in the study area cultivate their land for households needs and sporadically for sale. The ESIA socio-economic survey reported that 71% of the households owned livestock, LRP household survey the number was lower; 45% of the surveyed households owned livestock. The most common livestock during the LRP household survey were chickens and cows. The ESIA socio-economic survey reported and the LRP household survey reported that between 50-41% of the household residents use of livestock products for subsistence purposes.

During the ESIA socioeconomic survey, one household was reported as engaged in fishing. No households in the LRP household survey reported they engage in fishing. During the ecosystem services assessment site visit in December 2021, evidence of fishing activity was observed in many of the irrigation channels and natural water courses including the Seman river and the Ujitja / Hoxhara drainage channel (see Figure 4.5). During the ESIA disclosure meeting engagement, in June 2022, a single fisherman was identified and engagement confirmed fishing was exclusively for subsistence purposes to support his primary vocation, farming.



Figure 4.5 Evidence of fishing activity observed in December 2021

In the LRP socio-economic survey and the ESIA socioeconomic survey no participants reported participating in apiculture. A total of five households were confirmed in participating in apiculture via the ecosystem services assessment site visit in December 2021 and ESIA disclosure meetings in the June 2022. All five households were located within 1km of the PV plant area and the number of beehives ranged from three to ten for four of the households and used for personal consumption. One household reported as having 120 beehives and generates income from the activity.

As Informal hunting is common in Albania, it is likely to occur within the Project Area of Influence. Within 5 km south-west of the PV Plant evidence of hunting for waterfowl

or brown hare has been observed by the report authors during visits to this area (not associated with the Karavasta Solar Project) prior to 2021. Evidence of hunting was not recorded in the ESIA (Ref. 1). No observations of hunting were recorded in the December 2021 visit but have been observed by the LRP team, but no households that participated in the LRP household survey reported the hunt.

There is an established paved road network in the vicinity of the PV Plant and OHL route. There is a paved access to the communities of Ndërmenas and Hasturkas, which are the communities closest to the PV Plant. Access beyond these communities to the PV Plant or coastal area is via unpaved tracks, currently some of which go through the area of the PV Plant.

4.3 Designated Biodiversity Areas

There are three protected areas within the Project Area of Influence (see Figure 4.6), which include:

- The Divjaka-Karavasta National Park located adjacent to the western boundary of the PV Plant
- The Nature Monument of Kurora e Semanit located less than 3 km to the east of the OHL
- The Nature Monument Pylli I Levanit, located 2km south-west of the OHL.

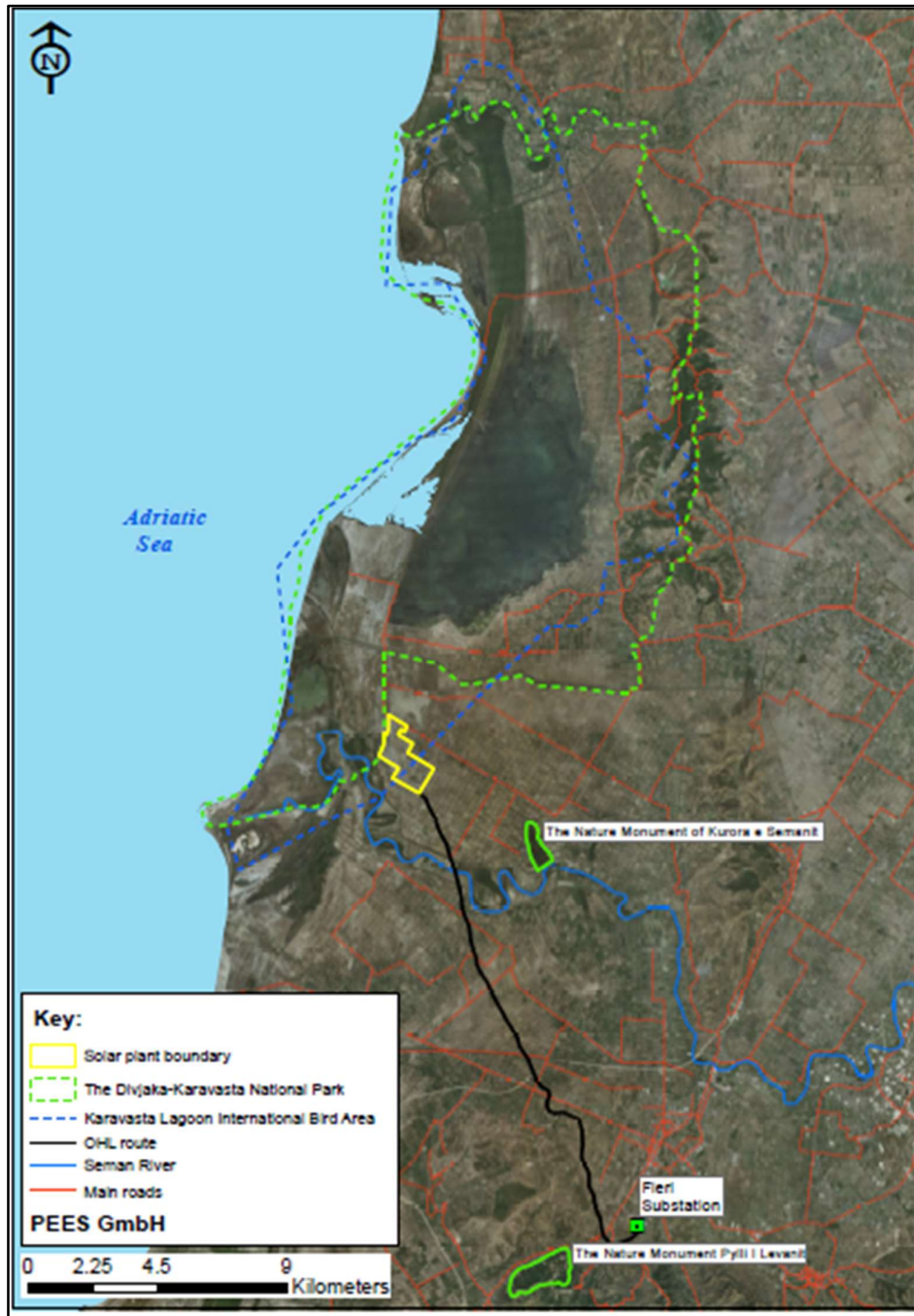


Figure 4.6 Protected Areas within Project Area of Influence

In addition to the protected areas, important biodiversity features are:

- Approximately 50% of the PV Plant is within the International Bird Area and Key Biodiversity Area that is centred on the Divjaka-Karavasta National Park

- Breeding bird observations within the ESIA (Ref. 1) have limitations as the surveys were completed in January, February, August, and November and would have missed the main breeding period in the spring / early summer. Within the ESIA (Ref. 1) up to five bird species out of a total of 35 species observed were considered as probably breeding.
- Within the PV Plant, due to the decline of the arable agricultural practices, saltmarsh / meadow habitat is now present, which is a recognised habitat within Annex 1 of the EU Habitats Directive (Habitat code 1310 and 1410)
- A number of species included in the EU Habitat Directive have been observed within the Seman river riparian habitat (note, the OHL towers avoid the riparian habitat and are located in cultivated land), the drainage channels and the general area of the PV Plant. These include otter, badger, golden jackal, three species of frog, five lizard species, seven snake species, one tortoise and two terrapin species.

4.3.1 Divjakë-Karavasta National Park

The Divjakë-Karavasta National Park borders the western boundary of the PV Plant for 1 km. The Park has a visitor centre and employs a team of rangers that also support enforcement of hunting bans. In 2017 Birdlife International reported that substantive conservation measures are being implemented but these are not comprehensive and are limited by resources and capacity. The Park covers 22,230 Ha that include:

- Four lagoonal areas that are connected to the surrounding rivers and irrigation channel network
- Estuaries of the Shkumbin river in the north and the Seman river in the south
- Forest areas including natural umbrella pine forests within the northern part of the Park and
- Coastal habitat including sand dunes.

The Park is of national and international importance for migratory, wintering and breeding bird populations and is a listed wetland area under Ramsar Convention. The Park has also been listed as a Candidate for the Emerald Network under the Bern Convention, as an Area of Special Conservation Interest, and Important Bird Area and as a pilot area for the Natura 2000 network.

In 2021 Birdlife International reported approximately 250 bird species, among them 15 Globally Endangered bird species, at least 80 species in Annex 1 of the Birds Directive and some five bird species exceeding the 1% threshold of the biogeographic population. The Park supports 84,000 wintering waterbirds, 12,000 breeding birds and many more migrating waterbirds. Important species of global conservation concern include:

- Wintering species, such as Common Pochard (*Aythya ferina*), Long-tailed Duck (*Clangula hyemalis*), Velvet Scoter (*Melanitta fusca*), White-headed Duck (*Oxyura leucocephala*), Greater Flamingo (*Phoenicopterus roseus*) and raptor species including the Greater Spotted Eagle (*Clanga clanga*)
- Resident / nesting species of seabirds, such as the Yelkouan Shearwater, Turtle Dove (*Streptopelia turtur*), Dalmatian Pelican (*Pelecanus crispus*), and triggering species for the Ramsar qualification – Pygmy Cormorant (*Microcarbo pygmaeus*).

The Divjakë-Karavasta National Park attracts domestic and international tourists, participating in bird watching activities as well visiting restaurants, hotels and beach facilities mostly located in the northern part of the Park, approximately 15 km to the north of the PV Plant.

Fishing is reported as an important occupation for the inhabitants of the lagoon communities, with participation via registered cooperative groups and on an informal basis. There is limited available data on the numbers of households that rely on fishing in the Divjakë-Karavasta area; the 1996 Karavasta Lagoon Management Plan reports that fishing is the secondary occupation for circa 500 coastal households.

4.3.2 Kurora e Semanit Nature Monument

Kurora e Semanit Nature Monument is a riparian forest area, less than 3 km to the east of the OHL, upstream of the Seman river (see Figure 4.7). The 44-Ha area of well-preserved natural forest provides nesting and roosting habitat for birds and natural riparian habitat.

The nature monument is adjacent to the Seman river to the south and surrounded by cultivated land to the east and north, with footpath access to the monument for day visitors via the adjacent community of Adriatik to the west. There is also a paved vehicle access to Adriatik.



Figure 4.7 Kurora e Semanit Nature Monument

4.3.3 Pylli I Levanit Nature Monument

The Pylli I Levanit Nature Monument is a forest area located on a hilly terrain 2 km to the south-west of OHL towers 53 and 54 (see Figure 4.8), that provides nesting and roosting habitat for birds as well as terrestrial species. The nature monument is

surrounded by cultivated land and is adjacent to a well-established road link between Fieri and Vlore.



Figure 4.8 Pylli I Levanit Nature Monument

4.4 Cultural Heritage

There are two established Christian cultural heritage sites Within the vicinity of the Karavasta Solar Project.

The Saint Thanasi Church built in 1778 is a recognised Christian place of worship (see Figure 4.9). It is located within the Divjakë-Karavasta National Park in the village of Karavasts, 5 km north-east of the PV Plant.

A small chapel called Kisha e Shën Marinës (see Figure 4.10) is located just over 1 km from the northern boundary of the PV Plant.



Figure 4.9 Saint Thanasi Church



Figure 4.10 Kisha e Shën Marinës Chapel

5 Stakeholder Engagement

Stakeholder engagement was completed to support the scoping and disclosure of the ESIA (Ref. 1) and further engagement was undertaken to support the development of the LRP including a household survey of the directly affected households. A summary of the engagement completed for the ESIA, extracted from the Voltalia Karavasta Solar Project LRF, is provided below.

5.1 ESIA Public Meetings

In accordance with Albania national EIA legislation, a public hearing was organised to present the ESIA process to stakeholders. Invitation letters with 30 copies of the non-technical summary of the ESIA were made available to the local communities and sent to the municipality of Divjake, Fieri and to the Regional Environmental Authority (REA). The same letter with 10 copies of the ESIA non-technical summary was sent to the Administrative Units (AU) of Karavasta, Libofshe, Topoje, Dermenas and Qender.

Posters with information about the public hearing and contact details were displayed in the villages near the site of the PV Plant and along the route of the OHL. In addition, an announcement was published in the local and national press and was disseminated through radio and television for 20 consecutive days. For stakeholders who could not be present at the public hearing, a link was provided to enable online participation.

5.2 ESIA Consultation Meetings

Consultation meetings were organized during both the scoping and ESIA phases of the Karavasta Solar Project to provide stakeholders with background information about the proposed development and to give stakeholders the opportunity to raise issues and / or concerns. Invitations to stakeholders were sent via letters and emails. Invitation letters of notification were distributed to all key stakeholder groups identified. Other forms of notifications included display of posters and distribution of leaflets in the affected villages and residential settlements.

For the draft scoping report, an online consultation meeting was organized to discuss relevant issues related to the Scoping Report disclosure and its preliminary findings. All the stakeholders identified in the first phase of engagement were notified via email of the publication of the Scoping Report and then notified of online consultation after the lapse of the 30-day disclosure period. In addition, posters and flyers was distributed to inform the local communities. The Scoping Report was made available on the Project website and officially delivered to each of the AUs crossed by the Karavasta Solar Project.

The following onsite engagement meetings were carried out:

- Between the 21st – 25th September 2021: a total of 16 meetings were carried out with national, regional and local authorities with the participation of 53 officials
- October 2021: engagement with local communities was conducted through ad-hoc meetings with more than 30 community members in the villages of Ndërnenas and Hasturkas
- February 2021: following confirmation of the route alignment, engagement with local communities residing along the OHL was carried out.

Four additional ESIA disclosure meetings were completed in June 2022 in communities along the OHL route and adjacent to the plant area. The meetings were attended by 76 stakeholders. To support the identification of ecosystem service users during the meeting slides were included to describe the concept of ecosystem services and participants were asked if they or were aware of members of their community that use ecosystem services. A total of seven households were identified as potential ecosystem users. After further discussion with households and community visits, five new households that use ecosystems (one capture fishing and four apiculture) were verified and a questionnaire was used to assess the extent of their dependency and significance of the ecosystem services in terms of livelihoods, health, safety and cultural heritage.

5.3 ESIA Socio-Economic Survey

A socio-economic survey was undertaken to collect relevant baseline information and to engage with stakeholders. The survey team distributed leaflets to 364 households interviewed during the socio-economic survey.

According to the survey, the biggest challenges faced by the households residing in the area relate to unemployment and economic issues, as well as infrastructure and public utilities, such as access to drinking water and sanitation, and poor health service provision.

5.4 Livelihood Restoration Plan Engagement and Supporting Studies

To support completion of the LRP the below engagement was completed:

- Government ministries and agencies, including:
 - Transmission System Operator (OST)
 - Albanian Ministry of Infrastructure and Energy
 - Albanian Ministry of Agriculture and Rural Development
 - Albanian Ministry of Culture
- Local government stakeholders, such as representatives for the Fieri and Divjakë municipalities
- Agricultural institutions and agencies
- Civil society organisations
- Affected households to support land compensation and land access planning.

In addition to further stakeholder engagement, has been completed that provides additional information on the relevance of ecosystem services associated with those households affected by the Karavasta Solar Project:

- A comprehensive socio-economic survey of all identifiable directly-affected households to gather individual households data
- A Land, Farm and Crops Survey will be completed in parallel with the socio-economic survey to record all standing crops, grazing areas and confirm land ownership, as well as an agronomic baseline assessment to confirm land quality and productivity
- A Route Social Impact Register (RSIR) has been developed to ensure any impacts beyond the Karavasta Solar Project footprint (e.g., loss of access

during construction that may impact agricultural areas, livestock, households and businesses) are identified and mitigation measures proposed.

The socio-economic survey of all identifiable directly-affected households involved 146 households. The survey questionnaire included questions to assess the extent of their dependency and significance of the ecosystem services in terms of livelihoods, health, safety and cultural heritage. None of the participants reported to be engaged in hunting, fishing or apiculture. The most relevant information to support this assessment of ecosystems services was the type of the annual crops and perennial trees to support an understanding of the pollinators foraging habitat in the project area of influence.

6 Project Description

6.1 Project Purpose

The Albanian government is working towards a reliable and more sustainable energy sector, development of which is based on exploiting all energy options to meet Albania's energy demand and create added value for Albanian citizens in alignment with the principles of environmental, economic and social responsibility.

Historically, electricity generation in Albania has been almost exclusively from hydropower. In 2017 the country had a total installed capacity of about 2,100 MW, of which only 100 MW was thermal. In 2017 annual electricity consumption was about 7.1 TWh with a peak load demand of 1.4 GWh. Therefore, Albania imports electricity from neighbouring countries.

Albania benefits from an average of 360 days of sunshine in key locations, and energy production from solar PV is an important potential source of electricity that will help to meet the goals of Albania's National Strategy on Energy and will, in particular, assist in:

- Diversifying energy sources
- Developing internal energy sources of primary energy in a sustainable and competitive manner
- Reducing Albania's dependence on hydropower and imported electricity
- Increasing the reliability and security of energy supply
- Improving the cost effectiveness of power supply systems
- Achieving objectives for renewable energy sources and energy efficiency
- Achieving National Determined Contribution (NDC) Objectives for reducing Greenhouse Gas Emissions (GHGs).

6.2 Main Project Components and Key Characteristics

6.2.1 PV Plant

The plot available for the PV Plant consists of 196 Ha of currently state-owned land, with the proposed footprint occupying a total area of 185 Ha. The PV Plant land ownership will be transferred to Voltalia Albanie Sh.p.k (Albania). Once built the ownership of the OHL infrastructure will be transferred from Voltalia Albanie Sh.p.k to Operatori i Sistemit të Transmetimit (OST)

The Karavasta Solar Project is designed as a 140 MW direct current (DC) horizontal single-axis tracking PV park and will deliver 120 MW alternating current (AC) to the grid. The Plant itself consists of solar PV modules, module tracking systems, inverters and step-up transformer / sub-station, allowing connection to the OHL and ultimately to the national grid, through the sub-station at Fieri, approximately 20 km south-east.

The Karavasta Solar Project will also require a building to accommodate the Supervisory Control and Data Acquisition (SCADA) equipment for the command, control and protection. The SCADA system will be manned by technicians employed for the control, operation and maintenance of the Karavasta Solar Project.

In addition to the above key components the PV Plant will include the following infrastructure:

- Onsite (buried) cabling
- Drainage systems
- Fencing and security facilities
- Access tracks
- Material storage facilities.

During the construction phase, one or more temporary construction compound(s), including site offices, material, and equipment storage etc., will be required as well as temporary roads to facilitate access to all parts of the site under development.

Figure 6.1 shows the footprint of the PV Plant, including the demarcation of the perimeter fence and location of the substation.

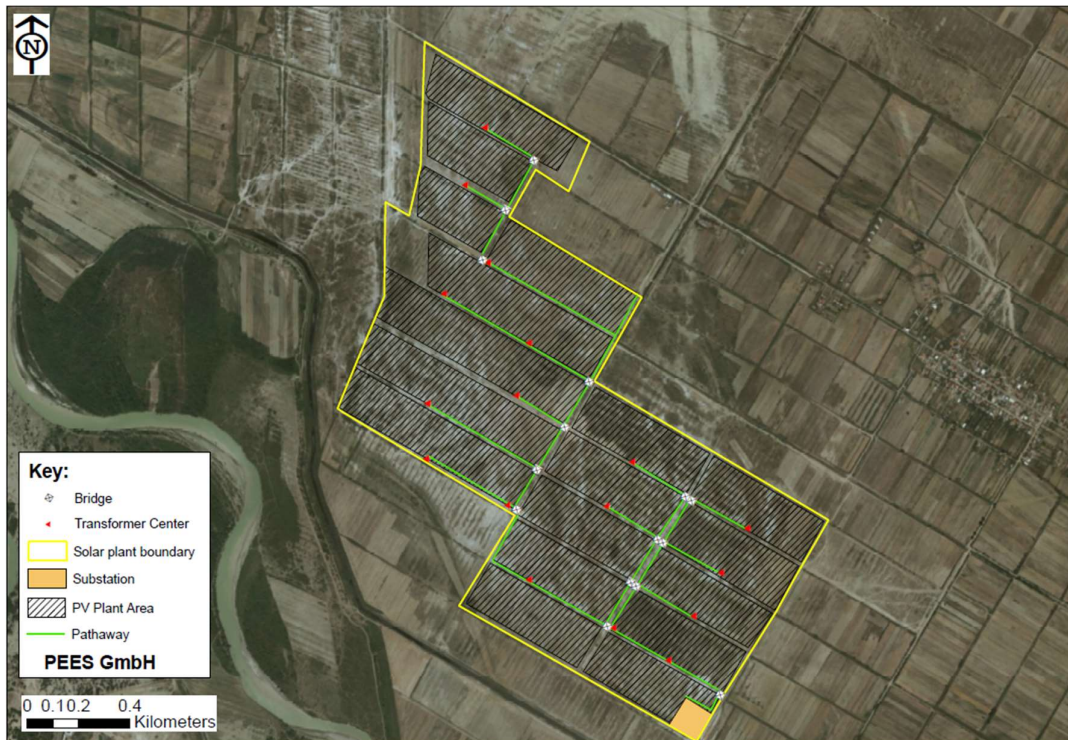


Figure 6.1 PV Plant Layout

6.2.2 Overhead Line (OHL)

The Karavasta Solar Project requires a 220-kV Overhead Line (OHL) to enable transmission and connection to the national grid. The height of the towers will be 30-40 m. The OHL will be approximately 21 km long, with 59 towers (see Figure 6.2).

Once built, the ownership of the OHL infrastructure will be transferred from Voltalia to OST. The footprint of each tower would be 10 m x 10 m, and the land required for these would be permanently acquired.

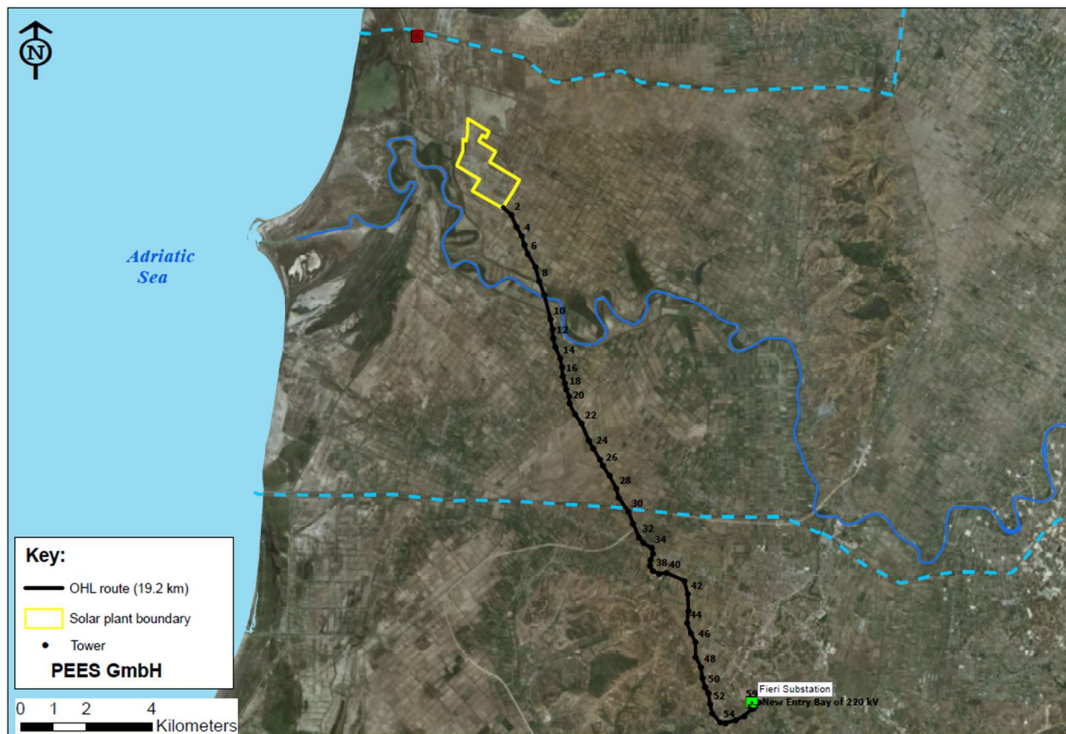


Figure 6.2 Route of Overhead Line

The wayleave required for the OHL will be a total width of 50 m, 25 m on either side of the cable centre line. The OHL will traverse approximately 700 land parcels, requiring permanent land acquisition for installation of the towers and access roads, temporary land access during construction, and will result in easement restrictions, including vegetation height restrictions to ensure land use in the vicinity of the pylons does not create safety issues.

During the construction phase, access roads will be required to construct the pylons, as well as to provide temporary access for installation of the lines.

6.3 Project Phases and Activities

The Karavasta Solar Project can be divided into four key phases as follows:

- Mobilisation / Pre-construction: site preparation and mobilisation of equipment and materials to site
- Construction and Installation: civil and electrical works and equipment installation
- Operation and Maintenance: plant operation and routine maintenance
- Decommissioning or Extension: dismantling of equipment and associated facilities and site restoration, or extension of lifespan through renewal of components.

6.3.1 Mobilisation / Pre-Construction

The mobilisation / pre-construction phase includes transportation of project components, equipment and materials to the site, as well as site preparation, which involves clearing, grading and levelling of the site and establishment of on-site facilities including a temporary construction compound.

A temporary 'base camp' will be developed for employees prior to initial site preparation and will be located within the PV Plant perimeter.

During the site preparation period the workforce required for site security, manual labour, civil works, transportation of goods and other similar services will most likely be drawn from the local labour pool.

6.3.2 Construction and Installation

The construction phase for the PV Plant will include many activities and phases, such as:

- Construction and upgrade of internal and external access roads
- Levelling off the ground
- Fencing around the site
- Installation of PV Power Units
- Pile driving for mounting structure
- Construction of electrical substation and foundations
- Excavation, trenching and cable laying
- Installation of a septic tank
- Construction of buildings
- Erection of overhead high voltage (HV) power lines
- Testing and commissioning
- Site clean-up.

A section of the site will be used as a laydown area where shelters, equipment, portable sanitary facilities and containers will be located.

To provide access to the site from the nearby public road a short access route will need to be prepared to a level acceptable for safe transport of equipment, material and people to and from the site (including diggers, loaders, bulldozers, cranes and transport trucks). The need for cut and fill areas and / or borrow pits at the PV sites, along roads and at substation / transformer sites will only be known after the final design has been completed.

The construction of the OHL will be undertaken in the following sequential steps:

- Preparatory work:
 - Micro-siting and finalization of the locations of towers and route of OHL
 - Mobilisation of engineering machinery to the OHL route

- Construction of platforms for pylons and delivery of materials along the OHL route
- Construction work:
 - Marking out of foundation, earth works and excavations
 - Installation of foundations and grounding devices
 - Assembly, installation, alignment and fixing of pylons
- Installation work:
 - Rolling out and connecting wires and cables, lifting them onto pylons, stretching and fixing on pylons
 - Installation of vibration dampers, remote spacers and mounting loops.

It is envisaged that to 200 people will be employed during the construction. No onsite workers' accommodation is envisaged.

Voltalia have committed externally (within the LRP) to improve the existing access road to the east of the PV Plant, which will allow access to the coast and lagoon.

6.3.3 Operation and Maintenance

Due to the passive nature of solar PV plants, no emissions are expected during operation with a very limited quantities of waste being generated. No significant noise generating equipment or machinery will be operated and the need for storage of hazardous materials on site is limited.

Day to day facility operations will involve both regular on-site preventive and corrective maintenance tasks in order to keep the PV Plant in optimal working order, ensuring an extended system lifespan and compliance with manufacturer warranty requirements (e.g. cleaning of PV modules). Corrective maintenance will be undertaken as required in response to failures, such as repair or replacement of damaged or faulty equipment.

Once completed and commissioned, the OHL it will be handed over to the State Transmission System Operator (OST) to manage operation and maintenance.

Approximately 20 jobs will be created through the operation phase, including skilled and semi-skilled labour (such as electrical and mechanical technicians) and unskilled labour (such as module cleaners and security personnel), for a duration of 30 years.

6.3.4 Decommissioning or Extension

The Karavasta Solar Project is expected to have an economic lifespan of 30 years, and the power plant infrastructure would either be decommissioned or extended and upgraded (if a new license is granted) once it has reached the end of its economic life.

Extending and upgrading the Karavasta Solar Project would consist of replacing old PV modules with new ones, increasing the total peak power of the PV Plant (a process called "repowering") or increasing the power of the PV Plant by adding new elements such as trackers, PV modules or transformers.

If the Karavasta Solar Project is to be decommissioned, then the site will be returned to condition as close to its original state as possible decommissioning would be expected to take between 6 and 12 months, and a Decommissioning Plan would be

prepared in advance to manage any temporary impacts arising from decommissioning works.

6.4 Project Schedule

The construction of the Karavasta Solar Project is planned to commence in Q2 2022 and be in full operation in Q3 2023. The expected duration of the construction phase includes 3 months for site preparation and 8 months for construction of the PV Plant and OHL. The final construction schedule will be specified during the detailed design phase. **Error! Reference source not found.** shows the key estimated dates.

Table 6.1: Key Estimated Dates

Project Stage	Key dates
PV Plant construction	Start 3Q 2022 – July
OHL construction	Start 3Q 2022 - July

6.5 Summary of Project Land Take

The Karavasta Solar Project is still in detailed design phase, which includes efforts to further avoid and minimize displacement. However, key land take impacts can be estimated at this stage and are provided in Table 6.2 below.

Table 6.2: Estimated Project Land Take

Project Phase	Component	Estimated Land Take	Duration
Construction	PV Plant Area	185 Ha	Permanent
	OHL Pylons	Approx. 59 pylons with 10 m x 10 m base	Permanent
	OHL Access Roads and Construction Corridor	8 m wide track/corridor	Temporary
Operations	OHL Right-of Way	25m Wayleave each side of OHL	Permanent (partial restrictions)

7 Ecosystem Identification, Screening and Assessment

7.1 Introduction

This section presents the identification, screening and assessment of ecosystem services associated with the construction and operational phases of the Karavasta Solar Project. The mitigation measures within the ESIA (Ref. 1) have been summarised and additional mitigations recommended, where required. The impact assessment methodology follows the process described in Section 3.

As the decommissioning activities have yet to be defined and are not planned within the next 30 years, decommissioning impacts have not been considered.

7.2 Identification of Ecosystem Services

The ecosystem services identification process is described in Section 3 and included:

- Desk based review of existing information
- Meetings with the SRA team completing the LRP
- Site visits in December 2021 with the team completing the socio-economic survey.
- Consultation with stakeholders during the June 2022 ESIA disclosure meetings

A total of five ecosystem services have been identified and are summarised in Tables 7.1 to 7.4. The relationship between ecosystems, services, benefits and beneficiaries is provided in Figure 7.1. Appendix 1 lists those ecosystems services that are considered as not applicable to the Karavasta Solar Project.

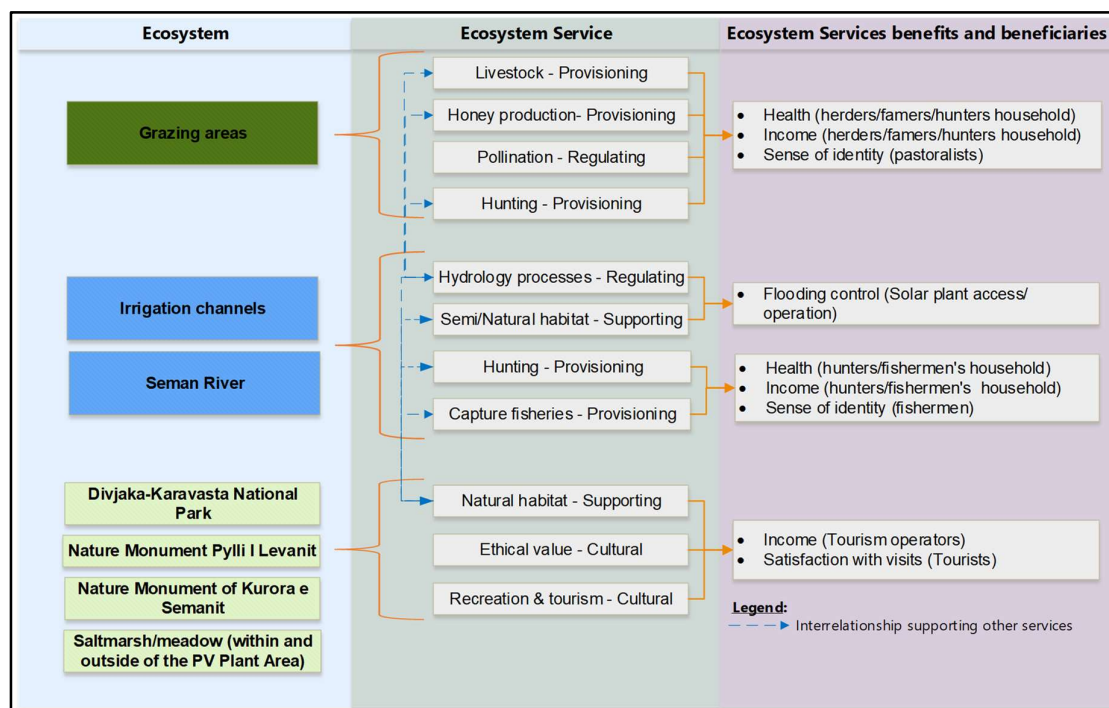


Figure 7.1 Ecosystems Services Relationships

Table 7-1 Karavasta Solar Project Provisioning Ecosystem Services

Name and Type	Summary
<p>Livestock</p> <p>Type I impact – may adversely affect communities</p>	<p>The ESIA socio-economic survey reported that 71% of the households owned livestock, LRP household survey the number was lower; 45% of the surveyed households owned livestock. The most common livestock during the LRP household survey were chickens and cows. The ESIA socio-economic survey and the LRP household survey reported that between 50-41% of the household residents use of livestock products for subsistence purposes.</p> <p>Herder dwellings with livestock for non-subsistence purposes are more numerous within the Seman reiver area near the plant area and between OHL towers 1-10 where there is less intensive arable agriculture and better access to available grazing land.</p> <p>The PV Plant land is state owned with no currently enforced access restrictions and provides poor quality available grazing. In order to minimise disturbance, continued access will be assured for informal grazing to areas in the vicinity of the Plant Site. Following construction, access to the plant site for grazing of sheep will also be facilitated. This is aligned with standard practice, as grazing of sheep is normally used in PV Plant Sites to prevent grass and other plants from obstructing solar panels. The Project will engage with herders in advance to ensure grazing activities are carried out in a safe way. Access routes will be established in order to maintain passage around/through the PV Plant Area.</p> <p>The PV Plant land is within a larger area of similar if not better grazing potential.</p>
<p>Honey production, apiculture</p> <p>Type I impact – may adversely affect communities</p>	<p>In the LRP socio-economic survey and the ESIA socioeconomic survey no participants reported participating in apiculture. A total of five households were confirmed in participating in apiculture via the ecosystem services assessment site visit in December 2021 and ESIA disclosure meetings in the June 2022. All five households were located within 1km of the PV plant area and the number of beehives ranged from three to ten for four of the households and used for personal consumption. One household reported as having 120 beehives and generates income from the activity.</p> <p>The PV Plant Area includes saltmarsh / meadow, which are also extensively found in the surrounding area. Saltmarsh / meadow is a recognised foraging habitat for pollinators including honeybees (Ref. 6).</p> <p>It is assumed that vegetation cover within the PV Plant after construction phase clearing will re-establish however the impact of solar panel shade and livestock grazing will influence the extent and type of vegetation re-establishment and slow or alter revegetation.</p>
<p>Capture fisheries</p> <p>Type I impact – may adversely affect communities</p>	<p>During the ESIA socioeconomic survey, one household reported fishing as an activity for household subsistence purposes only. During the LRP household survey none of the households reported fishing activity.</p> <p>During the ecosystem services site assessment in December 2021, evidence of fishing activity was observed in many of the irrigation channels and natural water courses including the Seman river and the Ujitja / Hoxhara drainage channel outside of the PV Plant. In addition, fishing along</p>

Name and Type	Summary
	<p>the coastline occurs, with the PV Plant Site being used for access to the beach as well as other alternative access tracks. During the ESIA disclosure meeting engagement, in June 2022, a single fisherman was identified and engagement confirmed fishing was exclusively for subsistence purposes to support his primary vocation, farming.</p> <p>Irrigation channels within the PV Plant are connected to the surrounding extensive network of channels that extend over a significantly larger area.</p> <p>Alternative access to the beach area will be available throughout the project and access restrictions will be avoided. Volitalia have committed externally (within the LRP) to improve the existing access road to the east of the PV Plant, which will allow access to the coast and lagoon.</p>
<p>Hunting</p> <p>Type I impact – may adversely affect communities</p>	<p>During the ESIA stakeholder engagement and LRP household survey no households report as participating in hunting. Evidence of hunting has been observed less than 5km to the south-west of the PV Plant Area, along the OHL route between towers 7 and 9, and it is assumed that hunting will occur within the Project Area of Influence.</p> <p>The PV Plant Area habitat is not unique or of materially better quality than the surrounding habitat for commonly hunted waterfowl or brown hare. For waterfowl there is a far better quality habitat outside of the Project Area of Influence with extensive wetland areas.</p>

Table 7-2 Karavasta Solar Project Regulating Ecosystem Services

Name	Summary
<p>Pollination</p> <p>Type I impact – may adversely affect communities</p>	<p>The PV Plant Area includes saltmarsh / meadow, which are also extensively found in the surrounding area. Saltmarsh /meadow is a recognised foraging habitat for pollinators including honeybees (Ref. 6).</p> <p>It is assumed that vegetation cover within the PV Plant after construction phase clearing will re-establish however the impact of solar panel shade and livestock grazing will influence the extent and type of vegetation re-establishment and slow or alter revegetation.</p> <p>There is limited information on the cultivated crop types in the vicinity of the PV Plant, the LRP socio-economic survey provides information on the OHL route. Assuming the LRP socio-economic survey is representative for the area surrounding the PV Plant, the dominance of alfalfa, a recognised agroecological crop, that supports pollinators and the limited extent of fruit trees indicate that the surrounding cultivated land would provide viable pollinator foraging habitat.</p>
<p>Hydrology processes</p> <p>Type II service: Operation dependent on service provision</p>	<p>The PV Plant is situated within a significantly larger area with extensive, poorly maintained irrigation channels.</p> <p>The whole area is at risk from a number of different flood events, caused by the Seman river, drainage channel flooding, or surface flooding during intense rainfall.</p>

Table 7-3 Karavasta Solar Project Cultural Ecosystem Services

Name	Summary
<p>Ethical/ Recreational and tourism</p> <p>Type I impact – may adversely affect communities</p>	<p>There is a limited amount of information on the extent of the ethical and spiritual importance of ecosystems within the Project Area of Influence and the assessment will focus on recreational and tourism aspects.</p> <p>The most important cultural ecosystem services within the Project Area of Influence are the three protected areas described in Section 4.3.</p> <p>The three protected areas have varying levels of enforcement with the Divjaka-Karavasta National Park being the largest, most mature and well established with hotels, beach facilities and Park visitor centre, 7-15 km to the north of the PV Plant.</p> <p>The two other protected areas within the Project Area of Influence (The Kurora e Semanit Nature Monument less than 3 km to the east of the OHL and the Pylli I Levanit Nature Monument 2 km south-west of the OHL) do attract tourist but there is no potential impacts from planned construction or operational activities as they are over 2 km from the OHL and access through/adjacent to the Protected areas to support Karavasta Solar Project construction or operation is not required.</p>

Table 7-4 Karavasta Solar Project Supporting Ecosystem Services

Name	Summary
<p>Semi and Natural Habitat that support</p> <p>Type I impact – may adversely affect communities</p>	<p>Within the PV Plant Area saltmarsh / meadow habitat is present which supports the native plant communities that support pollinators and avifauna foraging due to the decline in agricultural practices and maintenance of the irrigation channels.</p> <p>Saltmarsh / meadow is also present in the wider Project Area of Influence that supports a variety of natural and semi natural habitats including forest areas, riparian habitat, aquatic habitat and coastal habitats approximately 4km to the west of the PV Plant.</p> <p>The PV Plant has a very small direct interface with the Divjaka-Karavasta National Park boundary (1 km). The Divjaka-Karavasta National Park covers an area of over 22,230 Ha. This section of the Park is a mixture of actively or abandoned cultivated land or riparian habitat. The most ecological important parts of the Park are 7-15 km from the PV Plant.</p> <p>The OHL tower locations avoid the Seman river riparian natural habitat and are located in cultivated land.</p>

7.3 Screening of Ecosystem Services

To select ecosystem services that qualify full assessment process, a screening process was undertaken via discussions with the team working on the LRP and from the December 2021 site visits. Those ecosystem services that are considered to benefit from further assessment are listed in Table 7.5.

Table 7-5 Karavasta Solar Project construction and operation ecosystem services requiring full impact assessment

Name	Type	Justification
Livestock: Provisioning	Type I: Impacts on such services may adversely affect communities	Due to the extent of household reliance on livestock and potential restrictions to grazing within the PV Plant Area during construction and to a lesser degree during the operational phase. Noting grazing will be allowed to the extent possible and access restrictions will be mitigated by alternative access being provided.
Honey production: Provisioning Pollination: Regulating		On a precautionary basis as five households were located within 1km of the PV plant area.
Natural Habitat: Supporting		On a precautionary basis as the PV Plant is adjacent to the Divjaka-Karavasta National Park and within its hydrological catchment and within the vicinity of the Seman river.
Recreational and tourism: Cultural		On a precautionary basis and only for the Divjaka-Karavasta National Park, as PV Plant is adjacent to the Park.
Hydrology processes: Regulating	Type II: Operation dependent on service provision	Due to the dynamic flood risk in the surrounding area, and fragility of the drainage network as a result of poor maintenance. Improvements to the drainage network within the PV Plant will reduce flood risk in the operations phase.

The following ecosystem services have been screened out of the further assessment process are listed in Table 7.6 and include:

- Ecosystem services which the Karavasta Solar Project has very limited interaction with
- Ecosystem services for which there is an absence of potential impact mechanisms to the associated beneficiaries
- Ecosystem services for which the supply is considered to be extensive and not at risk of fragmentation within the surrounding area.

Table 7-6 Karavasta Solar Project construction and operation ecosystem services NOT requiring full assessment

Name	Type	Justification
Capture fisheries: Provisioning	Type I: Impacts on such services may adversely affect communities	The absence of planned construction within or directly adjacent to the Seman river. Fishing has not been observed within the PV Plant and not considered to provide suitable locations.

Name	Type	Justification
		<p>PV Plant construction and operation will improve drainage channel function and supply of water downstream.</p> <p>All of the engagement activities completed to date have identified two households participating in fishing.</p>
Hunting: Provisioning		<p>No reports of households participating in hunting within the PV Plant</p> <p>Access restrictions during construction and operation of the PV Plant will be mitigated by alternative access being provided.</p> <p>Voltalia have committed externally (within the LRP) to improve the existing access road to the east of the PV Plant, which will allow access to the coast and lagoon.</p>

7.4 Assessment of Ecosystem Services

7.4.1 Livestock: Provisioning

This section presents the assessment of impacts on potential livestock ecosystem service during the construction and operation of the Karavasta Solar Project.

Access changes and permanent loss of grazing land to informal herders that graze livestock within the PV Plant are the main potential source of impact. Alternative access will be established to maintain accessibility and grazing will be permitted within the PV Plant area to the extent that is possible.

There are no continuous routine operational phase discharges, emissions or noise sources from the Karavasta Solar Project that could affected grazing quality.

Existing mitigation, defined in the LRP and ESIA (Ref. 1) considered in this assessment include:

- Avoidance:
 - Alternative access will be provided
 - Grazing will be permitted within the PV Plant area during the operations phase
- Minimisation:
 - Control of PV Plant construction to ensure downstream water supply and quality changes are minimized and do not disrupt grazing quality outside of the PV Plant
 - Hazardous materials and emergency response management to avoid contamination of surface water and soil
- Restoration:
 - Reinstatement of temporary disturbed areas during construction will include reprofiling and re-vegetation

- Offset/Compensation: Not applicable.

Impact Magnitude

Parameter	Explanation	Rating
Extent/ Scale	<p>The PV Plant area is currently available for grazing and is of low quality due to the patchy and sparse vegetation. Within 5 km of the plant, the PV Plant covers ~12% of the accessible/non-cultivated grazing land, which is of similar or better quality.</p> <p>The PV Plant land includes tracks that are used to access grazing land in the surrounding area. Alternative access will be provided during construction and operation to avoid impacts.</p> <p>The OHL towers have a 6x6m footprint, which will be cleared of vegetation during construction. Natural revegetation of non-cultivated areas (~12 of the 59 towers) will enable their continued use for grazing where applicable.</p>	1
Frequency/ Duration	Informal herders of the PV Plant land will not be restricted from using the area for grazing. Temporary grazing loss will occur in the tower locations during construction.	2
Total		4 Medium

Service Sensitivity

Parameter	Explanation	Rating
Vulnerability	Grazing land supply will be impacted to a very minor extent as abundant alternative accessible grazing is available and will not be functionally impacted by the Karavasta Solar Project.	1
Dependency	Herders have very low to no dependency on the PV plant and OHL route for grazing. There are no reported users that exclusively use the PV Plant or the OHL tower locations for grazing and the extent of alternative accessible grazing is materially larger than the area impacted.	1
Total		2 Low

Overall Impact Ranking and Recommendations for Livestock: Provisioning

		Service Sensitivity		
		Low	Medium	High
Impact Magnitude	Low			
	Medium	Minor		
	High			

The impact ranking for the livestock ecosystem service is considered to be minor and further mitigation is not recommended.

7.4.2 Honey Production: Provisioning and Pollination: Regulating

This section presents the assessment of potential impacts on honey production as well as pollination ecosystem service during construction and operation of the Karavasta Solar Project.

PV Plant construction will cause temporary and permanent changes to vegetation cover density, quality and type, the extent of permanent loss of land from the building of the PV Plant substation and support buildings is very limited. The 185-Ha PV Plant is surrounded by significantly larger area of more diverse foraging habitat including forest areas, riparian habitat, aquatic habitat, coastal habitats as well as more established better quality salt marsh/meadow that would support pollinators. In addition the current prevalence of cultivating alfalfa (growing on 46% of the agricultural parcels surveyed as part of the LRP household survey) also provides pollinator foraging habitat.

The impact from vegetation clearance of the OHL towers is considered not material.

There are no continuous operational phase discharges or emissions from the Karavasta Solar project that could affected pollinator foraging as side from vegetation clearance works during the operations phase.

Existing mitigation, defined in the LRP and ESIA considered in this assessment include:

- Avoidance: Not applicable
- Minimisation:
 - Control of PV Plant construction to ensure downstream water supply and quality changes are minimized and don't disrupt vegetation cover outside of the plant
 - The use of pesticide for the management of alien invasive species will be under strict control and on as necessary. No agents identified as being prohibited will be used and wherever possible mechanical means will be the preferred method.

- Restoration:
 - Reinstatement of temporary disturbed areas during construction will include reprofiling and re-vegetation
- Offset/Compensation: Not applicable.

Impact Magnitude

Parameter	Explanation	Rating
Extent/ Scale	A total of five households were confirmed in participating in apiculture, within 1km of the PV plant, via the ecosystem services assessment site visit in December 2021 and ESIA disclosure meetings in the June 2022. Assuming the bees and other wild pollinators have a conservative foraging range of 3km, the PV Plant Area represents less than 10% of the available surrounding foraging area, the majority of which is of better quality than the PV Plant area.	1
Frequency/ Duration	Temporary loss of pollinator foraging areas will occur during construction. Re-vegetation within the PV Plant Area will support re-establishment of habitat for pollinators.	1
Total		2 Low

Service Sensitivity

Parameter	Explanation	Rating
Vulnerability	There are other pollinator foraging areas of at least equal quality and availability within the immediate area of the PV Plant.	1
Dependency	Four household has been identified as having beehives use the honey for subsistence purposes. One household undertakes commercial scale apiculture.	1
Total		2 Low

**Overall Impact Ranking and Recommendations for Honey Production:
Provisioning and Pollination: Regulating**

		Service Sensitivity		
		Low	Medium	High
Impact Magnitude	Low	Negligible		
	Medium			
	High			

The impact ranking for the honey production ecosystem service is considered to be negligible and further mitigation is not required.

To support this assessment, it is recommended that:

- Consideration should be given to promoting revegetation of suitable native vegetation to support pollinators with a growth height that will not interfere with PV panel performance as well as creating dedicated areas with the PV plant where grazing is controlled to promote flowering species survival
- All of those households participating in apiculture are included on a stakeholder watchlist which will be used by Voltalia to undertake regular engagement on the status of the project

7.4.3 Natural Habitat: Supporting

This section presents the assessment of potential impacts on natural habitats ecosystem service during the construction and operation of the Karavasta Solar Project.

The PV Plant construction and operation will interact with the below natural habitat:

- The PV Plant Area is located within an area of that includes saltmarsh / meadow habitat recognised within Annex 1 of the EU Habitats directive (Habitat code 1310 and 1410).
- The PV Plant area is ~0.5 km of the Seman river riparian habitat and the OHL crosses the river at one location (between OHL tower 9 and 10) and the towers are approximately 30 m and 300 m from the nearest riparian habitat.
- The Karavasta Solar Project has a very small direct interface with the Divjaka-Karavasta National Park boundary (1 km)
- The PV Plant is within a network of drainage channels not directly connected to the Divjaka-Karavasta National Park.

The ESIA (Ref. 1) does not include predicted noise modelling. There are numerous pre-existing 3rd party noise sources throughout the Project Area of Influence, especially along the OHL from the network of roads, wide spread farming,

municipality drainage channel maintenance works, third party construction activity and residential areas.

Construction noise levels from mobile equipment and static generators will elevate existing noise levels locally during the construction of the OHL towers (less than 1 month per tower) and for over 6 months at the PV Plant location.

It is assumed that the most significant Karavasta Solar Project mobile construction noise sources are large equipment such as a large bulldozer (Caterpillar D9) operating during the daytime. Based on measured noise levels from previous use of this equipment in similar applications and natural noise attenuation as per British Standard 5228 (Ref. 7), constructed related noise impacts will be indiscernible from daytime background noise levels of 45 LAeq dB within 700 m.

There are no continuous routine operational discharges, noise sources or emissions from the Karavasta Solar project that could affected keystone species critical to the function of the natural habitat. However, there is the potential operational impact associated with the PV panels and the OHL causing bird collision mortality. The risk of electrocution from the high voltage OHL is considered low as the distance between the OHL earthed and live components is considered to exceed the wingspan of the largest of the bird typically found in the area (Greater Spotted Eagle, wingspan up to 1.70 m).

There is little evidence of behavioural changes in birds due to the reflective surface of PV panels being perceived as water bodies, termed “lake effect” (Ref. 8). To help qualify this assumption a recommendation has been included to help confirm the mortality of water-obligate birds, which rely on water for take-off and landing, compared to other bird types.

Existing mitigation, defined in the ESIA (Ref. 1) considered in this assessment include:

- Avoidance:
 - The OHL route was changed to reduce the crossings of the Seman river from total of two to one. In addition, the OHL towers avoid the riparian habitat
- Minimisation:
 - The OHL towers design includes measure to reduce electrocution potential
 - The OHL will have bird diverters
 - Hazardous materials and emergency response management to avoid contamination of surface water and soil
 - Alien invasive species protocol
 - Construction stage pre-clearance ecological surveys, and construction mitigation developed if nesting sites are identified
 - Good construction industry wildlife management practise, including injured wildlife protocol, workforce awareness sessions, reduced speed limits, wildlife interaction reporting, waste and litter controls
- Restoration:
 - Reinstatement of temporary disturbed areas during construction will include reprofiling and re-vegetation

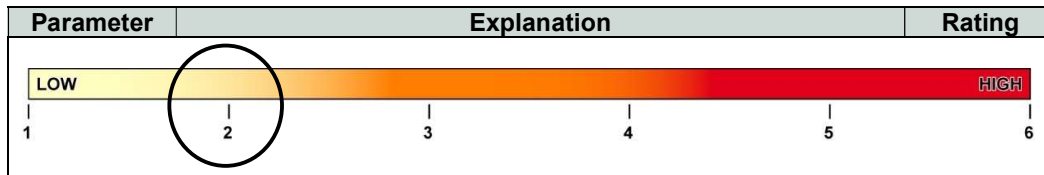
- Offset/Compensation: Not applicable.

Impact Magnitude

Parameter	Explanation	Rating
Extent/ Scale	<p>Construction related changes to vegetation and drainage will be confined to natural habitat within the PV Plant. Noise impacts will extend beyond the boundary of the PV Plant by less than 1 km.</p> <p>Avifauna collision mortality has the potential to occur within the PV Plant and along the OHL, considering its proximity to adjacent areas of surface water and the Divjaka-Karavasta National Park, and to a lesser extent along the OHL route.</p>	1
Frequency/ Duration	<p>It is assumed that vegetation cover within the PV Plant after construction phase clearing will re-establish itself and impacts are temporary.</p> <p>Noise impacts will not be continuous and be primarily limited to the construction period.</p> <p>Bird collision mortality risk will exist for the duration of the project operation although the extent will be varying e.g., depending on weather/light conditions, operational activity within the PV Plant that will discourage bird presence.</p>	2
Total		3 Medium

Service Sensitivity

Parameter	Explanation	Rating
Vulnerability	<p>Changes to the natural habitat functionality and associated benefits are considered to be minor due to the revegetation of the PV Plant area.</p> <p>The PV Plant is situated within a significantly larger areas of similar, more diverse natural habitat including the Divjaka-Karavasta National Park, the Seman river and coastal area.</p> <p>The saltmarsh / meadow within the PV Plant is similar to the surrounding area, especially to the immediate north and west which is also degraded former irrigated agricultural land. The changes to vegetation cover during construction and revegetation as well as the bird collision mortality risk are considered to present minor impacts to the natural habitat functionality.</p>	1
Dependency	The potential isolated, localised and short-term disturbance to the natural habitat is not considered to create a risk to the associated service benefits or to the beneficiaries.	1
Total		2 Low



Overall Impact Ranking and Recommendations for Natural Habitat: Supporting

		Service Sensitivity		
		Low	Medium	High
Impact Magnitude	Low			
	Medium	Minor		
	High			

The impact ranking for the natural habitat ecosystem service is considered to be minor and further mitigation is not required.

To support this assessment, it is recommended that:

- The use of bird diverters on the OHL is confirmed
- During the operations phase, records of bird mortality within the PV Plant are kept that include photographs to aid in bird identification.

7.4.4 Recreational and Tourism: Cultural

This section presents the assessment of potential impacts on recreational and tourism ecosystem service of the Divjaka-Karavasta National Park during the construction and operation of the Karavasta Solar Project.

Construction activities will be confined to the PV Plant and OHL, outside of but adjacent to Divjaka-Karavasta National Park. The primary potential impact to the Divjaka-Karavasta National Park is associated with construction related traffic disturbance and noise. Within the ESIA (Ref. 1) there is a predicted total of 600-800 construction truck movements, with an average of 12 trips per day. The construction site access roads will avoid the main road to the most popular and developed part of the Divjaka-Karavasta National Park. Noise impacts are discussed in Section 7.4.3 and are not considered to present a source of disturbance to the Park users.

Visual impacts are not considered material due to the low level of visual intrusion, considering:

- The PV Plant Area and OHL is >7 km from the main visitor areas within Divjaka-Karavasta National Park and will not be visible

- The OHL route will be visible from Kurora e Semanit Nature Monument, but the visual landscape at this location is already impaired by the adjacent village.

There are no continuous routine operational phase discharges, noise sources or emissions from the Karavasta Solar project that could affected the tourism potential, quality or function of the Divjaka-Karavasta National Park.

Existing mitigation, defined in the ESIA (Ref. 1) considered in this assessment include:

- Avoidance:
 - The PV Plant avoids direct impacts to the Divjaka-Karavasta National Park
- Minimisation:
 - A Construction Traffic Management Plan will be implemented to reduce traffic disturbance
 - Measures have been adopted to reduce avifauna impacts (see Section 7.4.4)
- Restoration:
 - Reinstatement of temporary disturbed areas during construction will include reprofiling and re-vegetation
- Offset/Compensation: Not applicable.

Impact Magnitude

Parameter	Explanation	Rating
Extent/ Scale	PV Plant construction activities will create local noise disturbance that will extend less than 1 km from the PV Plant Area, into the adjacent Divjaka-Karavasta National Park confined to an area of abandoned agricultural land with no current tourism potential.	1
Frequency/ Duration	PV Plant construction will have the longest and most regular source of disturbance that will extend for up to 1 year.	1
Total		2 Low

The figure shows a horizontal scale for impact magnitude. The scale is a bar with a color gradient from yellow on the left (labeled 'LOW') to red on the right (labeled 'HIGH'). The scale is numbered 1 to 6. A circle is drawn around the number 2, indicating the total impact rating.

Service Sensitivity

Parameter	Explanation	Rating
Vulnerability	There is very low risk to the functionality or value of the Divjaka-Karavasta National Park to the absence of continuous direct impacts.	1

Parameter	Explanation	Rating
Dependency	The isolated, localised and short-term disturbance to the southern part of the Divjaka-Karavasta National Park is not considered to create a risk to the Park's associated service benefits or to the beneficiaries.	1
Total		2 Low

Overall Impact Ranking and Recommendations for Recreational and Tourism Habitat: Cultural

		Service Sensitivity		
		Low	Medium	High
Impact Magnitude	Low	Negligible		
	Medium			
	High			

The impact ranking for the recreational and tourism ecosystem service is considered to be negligible and further mitigation is not required.

7.4.5 Hydrology processes: Regulating

This section presents the assessment of potential impacts on hydrology process ecosystem service during the construction and operation of the Karavasta Solar Project. Construction and operation of the Karavasta Solar Project is at risk to hydrological process as the PV Plant is in an area at risk of flooding.

Construction related ground disturbance, irrigational channel crossings and maintenance works have the potential to disturb water flows if construction planning and execution do not implement the mitigations outlined in the ESIA. Overall, it is considered that the Karavasta Solar Project has the potential to create a positive impact, through rehabilitation and regular maintenance of the drainage infrastructure within the PV Plant area, that currently is in a poorly maintained condition. No construction OHL works are planned in the Seman river or in its riparian habitat.

Existing mitigation, defined in the LRP and ESIA (Ref. 1) considered in this assessment include:

- Avoidance:

- The OHL route was changed to reduce the crossings of the Seman river from total of two to one. In addition, the OHL towers avoid the riparian habitat
- Minimisation:
 - Control of PV Plant construction to ensure downstream water supply and quality changes are minimized and do not disrupt vegetation cover outside of the plant area
 - Implementation of the Erosion and Sediment Control Procedure
 - Hazardous materials and emergency response management to avoid contamination of surface water
- Restoration:
 - Reinstatement of temporary disturbed areas during construction will include reprofiling and re-vegetation
- Offset/Compensation: Not applicable.

Impact Magnitude

Parameter	Explanation	Rating
Extent/ Scale	Planned construction related changes to drainage within the PV Plant and OHL will not cause negative changes to hydrological processes. The PV Plant is within a network of drainage channels that has a total catchment more than 10 times larger than the PV Plant area and is not directly connected to the Divjaka-Karavasta National Park.	1
Frequency/ Duration	As the potential for an impact is only from an uncontrolled event that will be addressed and remedial works implemented, associated impacts are considered temporary.	1
Total		2 Low

Service Sensitivity

Parameter	Explanation	Rating
Vulnerability	There is a very low risk from unplanned activities impacting the functionality of the area hydrology and creating disruption to flood risk or surface water supply/regulation for downstream users.	1
Dependency	Considering the small spatial area of the PV Plant compared to the wider catchment area and the lack of impact to the Seman river there is a very low level of dependency on the PV Plant area for hydrology processes.	1
Total		2 Low

**Overall Impact Ranking and Recommendations for Hydrology Processes:
Regulating**

		Service Sensitivity		
		Low	Medium	High
Impact Magnitude	Low	Negligible		
	Medium			
	High			

The impact ranking for the natural habitat ecosystem service is considered to be negligible and further mitigation is not required.

8 Conclusions

Following implementation of the ecosystems services assessment methodology provided in Section 3, six services were selected for a more detailed assessment:

- Livestock
- Honey production and Pollination – combined assessment completed
- Hydrology processes
- Recreational and tourism
- Semi and natural habitat.

A summary of the overall impact score is provided in Table 8.1.

Table 8-1 Summary of Ecosystem Services Assessment

Ecosystem Service Name & Type	Type	Impact Magnitude	Service Sensitivity	Overall Impact Ranking
Livestock: Provisioning	Type I: Impacts on such services may adversely affect communities	4 Medium	2 Low	Minor
Honey production: Provisioning and Pollination: Regulating		2 Low	2 Low	Negligible
Natural Habitat: Supporting		3 Medium	2 Low	Minor
Recreational and tourism: Cultural		2 Low	2 Low	Negligible
Hydrology processes: Regulating	Type II: Impacts which the project directly depends for its operations	2 Low	2 Low	Negligible

None of the Type I ecosystem services value or functionality are at risk from the construction or operation of the Karavasta Solar Project and associated impacts are not considered as significant. No Type 1 ecosystem services qualify as priority as per the IFC Guidance Note 6 (Ref. 3).

As described in Section 7.4.5, there is potential to create a positive impact to hydrology processes, through rehabilitation and regular maintenance of the PV Plant area drainage that is currently poorly maintained. Therefore hydrology processes are not considered a priority service.

To support the impact assessment, it is recommended that:

- The LRP household survey or wider stakeholder engagement is used to re-confirm the absence of households that depend entirely on the PV Plant area for grazing

Status: Households that participated in the LRP survey reported that they do not depend entirely on the PV Plant area for grazing.

- The LRP household survey wider stakeholder engagement is used to confirm extent of apiculture in the area of the PV Plant
 - Status: No participants in the LRP household survey reported participation in apiculture.
 - Further stakeholder engagement was completed to support the ESIA disclosure in June 2022 that identified four households participating in apiculture
- If apiculture within the area of PV Plant is determined material, consideration should be given to promoting revegetation of suitable native vegetation to support pollinators with a growth height that will not interfere with PV panel performance and a maintenance regime to support pollinators
 - Status: No participants in the LRP household survey reported participation in apiculture.
 - Further stakeholder engagement was completed to support the ESIA disclosure in June 2022 that identified four households participating in apiculture
 - All five households (four from the June 2022 ESIA disclosure meetings and one from December 2021 site visit) engaged in apiculture were located within 1km of the PV plant area. The number of beehives ranged from three to ten for four of the households and used for personal consumption. One household reported as having 120 beehives and generates income from the activity.
 - The impacts to apiculture are not considered significant as presented in section 7.4.2
 - The specific details on the revegetation approach and methods will be informed by the pre-construction surveys and provided in the BMP and supporting management plans. Voltalia is considering creating dedicated areas within the PV plant where grazing is restricted to encourage pollinator recovery and manage potential loss of grazing with the affected herders.
- The use of bird diverters on the OHL is confirmed and measures to reduce risk from earth/shield wires
 - Status: The use of bird diverters has been confirmed by Voltalia
- During the operations phase, records of bird mortality within the area of PV Plant are kept that include photographs to aid in bird identification.
 - Status: The project biodiversity management plan will include the detail of the bird mortality monitoring program

9 References

Table 9-1 References

Ref No	Document / Source Title
1	Voltalia Karavasta Solar Project Environmental and Social Impact Assessment (April 2021)
2	EBRD Environmental and Social Policy 2014 and Guidance Note Performance Requirement 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
3	IFC Guidance Note Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (June, 2019)
4	World Resources Institute: Weaving Ecosystem Services into Impact Assessment. A Step-by-Step Method (October 2013). Available at: < http://www.wri.org/research/weaving-ecosystem-services-impact-assessment >
5	World Resources Institute: The Corporate Ecosystem Services Review. Guidelines for Identifying Business Risks & Opportunities Arising from Ecosystem Change (February 2012). Available at: < http://www.wri.org/research/corporate-ecosystem-services-review >
6	European Environment Agency. European Topic Centre on Biological Diversity. Report for a list of Annex I habitat types important for Pollinators (Technical Paper No 1, June 2020) Available at: < http://www.researchgate.net/publication/344630093_Report_for_a_list_of_Annex_I_habitat_types_important_for_Pollinators >
7	British Standard 5228:2:2009 Code of Practice for Noise and Vibration Control on Construction and Open Sites
8	Kosciuch K, Riser-Espinoza D, Geringer M, Erickson W (2020) A summary of bird mortality at photovoltaic utility scale solar facilities in the Southwestern U.S. PLOS ONE 15(4). Available at: < https://doi.org/10.1371/journal.pone.0232034 >
9	The Livelihood Restoration Plan (LRP) household survey socioeconomic report

Appendix 1 Ecosystems Services Excluded from Screening

The table below details those ecosystem services that are not considered applicable for assessment.

Service	Subcategory	Definition	Screening criteria questions – Yes/No		
			Is the ecosystem services present	Will the project likely have an impact on the service	Does the project have management control or significant influence over the service
Provisional Services: The goods or products obtained from ecosystems					
Food	Crops	Cultivated plants or agricultural products harvested by people for human or animal consumption as food	Yes – along the OHL route	Yes – compensation will be implemented	Yes
	Livestock	Animals raised for domestic or commercial consumption or use	Yes	Yes – see section 7 for assessment	Yes partially – see section 7 for assessment
	Capture fisheries	Wild fish capturing via fishing	Yes	Yes – see section 7 for assessment	Yes partially – see section 7 for assessment
	Apiculture	Production of honey for domestic or commercial consumption or use	Yes	Yes – see section 7 for assessment	Yes partially – see section 7 for assessment
	Aquaculture	Fish, shellfish, and/or plants that are bred and reared in ponds, enclosures, and other forms of freshwater or saltwater confinement for purposes of harvesting	No	No	NA
	Wild Foods	Edible plant and animal species gathered or captured in the wild	Yes	Yes – see section 7 for assessment	Yes partially – see section 7 for assessment

**Voltaia Karavasta Solar Project
Ecosystem Services Assessment**

Service	Subcategory	Definition	Screening criteria questions – Yes/No		
			Is the ecosystem services present	Will the project likely have an impact on the service	Does the project have management control or significant influence over the service
Biological Raw Materials	Timber and other wood products	Products made from trees harvested from natural forest ecosystems, plantations, or non-forested lands	No	No	NA
	Fibres and resins	Non-wood and non-fuel fibres and resins	No	No	NA
	Animal skins	Processed skins	No	No	NA
	Ornamental Resources	Products derived from ecosystems that serve aesthetic purposes e.g. good weaved from reeds	No	No	NA
Biomass fuel		Biological material derived from living or recently living organisms	No	No	NA
Freshwater		Inland bodies of water, groundwater, rainwater, and surface waters for household, industrial, and agricultural uses	No	No	NA
Genetic resources		Genes and genetic information used for animal breeding, plant improvement, and biotechnology	No	No	NA

**Voltaia Karavasta Solar Project
Ecosystem Services Assessment**

Service	Subcategory	Definition	Screening criteria questions – Yes/No		
			Is the ecosystem services present	Will the project likely have an impact on the service	Does the project have management control or significant influence over the service
Biochemicals, natural medicines, and pharmaceuticals		Medicines, biocides, food additives, and other biological materials derived from ecosystems for commercial or domestic use	No	No	NA
Regulating services: The contributions to human well-being arising from an ecosystem’s control of natural processes					
Regulation of air quality		Influence ecosystems have on air quality by emitting chemicals to the atmosphere (i.e., serving as a “source”) or extracting chemicals from the atmosphere (i.e., serving as a “sink”)	No	No	NA
Regulation of climate	Global	Influence ecosystems have on the global climate by emitting greenhouse gases or aerosols to the atmosphere or by absorbing greenhouse gases or aerosols from the atmosphere	No	No	NA
	Regional and local	Influence ecosystems have on local or regional temperature, precipitation, and other climatic factors	No	No	NA
Regulation of water timing and flows		Influence ecosystems have on the timing and magnitude of water runoff, flooding, and aquifer recharge, particularly in terms of the water storage potential of the ecosystem or landscape	Yes	Yes – see section 7 for assessment	Yes partially – see section 7 for assessment

**Voltaia Karavasta Solar Project
Ecosystem Services Assessment**

Service	Subcategory	Definition	Screening criteria questions – Yes/No		
			Is the ecosystem services present	Will the project likely have an impact on the service	Does the project have management control or significant influence over the service
Erosion control		Role ecosystems play in retaining and replenishing soil and sand/aggregate deposits	No	No	NA
Water purification and waste treatment		Role ecosystems play in the filtration and decomposition of organic wastes and pollutants in water; assimilation and detoxification of compounds through soil and subsoil processes	No	No	NA
Regulation of diseases		Influence that ecosystems have on the incidence and abundance of human pathogens	No	No	NA
Regulation of soil quality		Role ecosystems play in sustaining soil's biological activity, diversity, and productivity; regulating and partitioning water and solute flow; storing and recycling nutrients and gases; among other functions	No	No	NA
Regulation of pests		Influence ecosystems have on the prevalence of crop and livestock pests and diseases	No	No	NA
Pollination		Role ecosystems play in transferring pollen from male to female flower parts	Yes	Yes – see section 7 for assessment	Yes partially – see section 7 for assessment

**Voltaia Karavasta Solar Project
Ecosystem Services Assessment**

Service	Subcategory	Definition	Screening criteria questions – Yes/No		
			Is the ecosystem services present	Will the project likely have an impact on the service	Does the project have management control or significant influence over the service
Regulation of natural hazards		Capacity for ecosystems to reduce the damage caused by natural disasters such as hurricanes and tsunamis and to maintain natural fire frequency and intensity	No	No	NA
Cultural services: The nonmaterial contributions of ecosystems to human well-being					
Recreation and ecotourism		Recreational pleasure people derive from natural or cultivated ecosystems	Yes	Yes – see section 7 for assessment	Yes partially – see section 7 for assessment
Ethical and spiritual values		Spiritual, religious, aesthetic, intrinsic, “existence” or similar values people attach to ecosystems landscapes, or species	Yes	Yes – see section 7 for assessment	Yes partially – see section 7 for assessment
Educational and inspirational values		Information derived from ecosystems used for intellectual development, culture, art, design, and innovation	No	No	NA
Supporting services: The natural processes that maintain the other ecosystem services					
Semi/Natural Habitat		Natural or semi-natural spaces that maintain species populations and protect the capacity of ecological communities to recover from disturbances	Yes	Yes – see section 7 for assessment	Yes partially – see section 7 for assessment

**Voltaia Karavasta Solar Project
Ecosystem Services Assessment**

Service	Subcategory	Definition	Screening criteria questions – Yes/No		
			Is the ecosystem services present	Will the project likely have an impact on the service	Does the project have management control or significant influence over the service
Nutrient cycling		Flow of nutrients (e.g., nitrogen, sulphur, phosphorus, carbon) through ecosystems	No	No	NA
Primary production		Formation of biological material by plants through photosynthesis and nutrient assimilation	No	No	NA