TÜRKİYE PETROLLERİ ANONİM ORTAKLIĞI

OTC OFFSHORE TECHNOLOGY CENTER

SAKARYA GAS FIELD DEVELOPMENT PROJECT - ESIA

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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)

Chapter 10 - Cumulative Impact Assessment

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10.0 CUMULATIVE IMPACTS

The purpose of this chapter, for which the methodology is described in Chapter 5 is to identify cumulative impacts at two different levels:

1) **Within the Project itself**, by identifying the possible effects of the simultaneous presence of the residual impacts affecting the environmental and social components; and

2) **With other projects in the same area** (and/or its vicinity, including this Project future developments – i.e., Phase 2), by considering the spatial, temporal and thematic concomitance with other projects currently operating and/or planned.

Based on the present knowledge, the reasonably foreseeable other projects within the Project AoI defined for each component and presented in Chapter 5 are evaluated for their cumulative impacts with the Project. These projects are listed in Table 10-5 and depicted in Figure 10-1, Figure 10-2, Figure 10-3 and Figure 10-4

10.1 Cumulative Impacts within the Project Itself

As discussed in Chapter 5, cumulative impacts within the Project itself are generated by the build-up and interaction of different impact factors at a specific location or over a specific receptor. Relying on the assessment conducted in Chapter 5, the following tables briefly summarize the overall impact on each component arising from all the impact factors generated by the Project actions and the mitigation measures effectiveness (namely the ability to reduce or eliminate the negative impact or to maximize the positive one).

Offshore Components

Table 10-1: Offshore components' overall assessment for cumulative impacts within the Project itself

Environmental/Social component	Phase	Impact factors	Overall assessment
Seafloor morphology	Construction	Handling and resuspension of sediments	**Low**
		Presence of the cofferdams	
		Introduction of new offshore infrastructures	
	Operation	Presence of new offshore infrastructures	**Low**
Sediments	Construction	Handling and resuspension of sediments	**Low**
		Introduction of new offshore infrastructures	
	Operation	No impacts	
Seawater	Construction	Minor leakage of contaminants into water	**Negligible**

Environmental/Social component	Phase	Impact factors	Overall assessment
		Handling and resuspension of sediments	
		Emission of particulates and chemicals in water	
	Operation	Minor leakage of contaminants into water	**Low**
		Discharge of wastewater	
Physical oceanography	Construction	Presence of cofferdams	**Negligible**
	Operation	No impacts	
Underwater noise	Construction	Emission of underwater noise	**Low**
	Operation	Emission of underwater noise	**Low**
Plankton	Construction	Minor leakage of contaminants into water	**Low**
		Emission of light	
		Discharge of wastewater	
		Emission of particulates and chemicals in water	
	Operation	Discharge of wastewater	**Medium**
		Minor leakage of contaminants into water	
Benthic communities (*phyto- and zoobenthos*)	Construction	Handling and resuspension of sediments	**Low**
		Introduction of new offshore infrastructures	
		Discharge of wastewater	
	Operation	Presence of new offshore infrastructures	**Low positive**
Fishes	Construction	Minor leakage of contaminants into water	**Low**
		Emission of underwater noise	
		Emission of light	
		Emission of particulates and chemicals in water	

Environmental/Social component	Phase	Impact factors	Overall assessment
	Operation	Discharge of wastewater	**Medium**
		Presence of new offshore infrastructures	**Low positive**
Marine mammals	Construction	Presence of working and moving vessels	**Low**
		Emission of underwater noise	
	Operation	Presence of working and moving vessels	**Low**
		Emission of underwater noise	
		Emissions of electromagnetic fields	

Table 10-2: Overall assessment for Marine habitats

Habitats	Component	Phase	Impact factors	Overall assessment
Marine Habitats	*Benthic habitats*	Construction	Possible introduction of alien species	**Low**
		Operation	Presence of new offshore infrastructures	**Low positive**
	Pelagic habitats	Construction	Possible introduction of alien species	**Low**
		Operation	Emission of underwater noise	**Low**
			Presence of working and moving vessels	
			Minor leakage of contaminants into water	
			Discharge of wastewater	

For most offshore physical and biological components, the overall impact is assessed as Low.

As it can be noted, some components are only impacted during the construction *or* the operation phase (*e.g., sediments and physical oceanography*). Regarding these components, the cumulative phenomenon is limited.

Other components are impacted during both phases (construction and operation). Some of these components, such as Benthic communities and Fishes, are expected to also have a positive impact. For these components the cumulative negative impact is partially compensated by the positive one.

Finally, for some of the components impacted during both phases, a more significant cumulative impact is expected for *Plankton* and *Pelagic habitats* considered in general due to:

- A medium/high impact value and a modest mitigation effectiveness for *Plankton*, which is expected to be potentially impacted by 4 impact factors triggered by 4 Project actions during construction and operation phases.
- Numerous impact factors that act simultaneously on pelagic components, such as *Plankton, Fishes and Marine mammals*.

Following this assessment, particular attention should be dedicated to mitigation measures for these components (such as the ones composing the Pelagic habitats), which present risks of negative cumulative impact phenomena within the Project itself. The mitigation measures identified for each of the abovementioned components, in fact, must be reinforced as much as possible, as explained in reference to Chapter 12 ESMP Framework (and in particular for the development of future management and action plans to be updated based on the monitoring to be implemented). In order to mitigate these cumulated impacts, a Biodiversity Management Plan will be prepared.

Social

Table 10-3: Overall Assessment for Social Components

Environmental/Social component	Phase	Impact factors	Overall assessment
Population and Demography	Construction	Immigration of workers and other people	**Low**
	Operation	Immigration of workers and other people	**Negligible**
Economy and Employment	Construction	Demand for workforce	**Low**
		Demand for goods, materials and services	
		Local inflation	
	Operation	Benefit to national economy	**Low**
		Demand for workforce	
		Demand for goods, materials and services	
		Local inflation	
Land Use patterns	Construction	Changes in land use	**Low**
Infrastructure and services	Construction	Increase and modification of traffic onshore	**Low**
		Demand for freshwater	

Environmental/Social component	Phase	Impact factors	Overall assessment
		Demand for waste disposal services	
	Operation	Increase and modification of traffic onshore	**Low**
		Demand for freshwater	
		Demand for waste disposal services	
Health issues and facilities	Construction	Dust emissions	**Low**
		Exhaust emission from vehicles and construction machinery	
		Emission of aerial noise	
		Emission of vibrations	
		Increase and modification of traffic onshore	
		Immigration of workers and other people	
	Operation	Emission of gaseous pollutants and/or greenhouse gases	**Low**
		Noise	
		Vibration	
		Increase and modification of traffic onshore	
		Immigration of workers and other people	
Onshore Cultural Heritage	Construction	Removal of soil	**Neutral**[1]
Marine Archaeology	Construction	Handling and resuspension of sediments	**Negligible**
		Presence of the cofferdams	
		Introduction of new offshore infrastructures	
Ecosystem services-fishery	Construction	Minor leakage of contaminants into water	**Low**
		Emission of Underwater Noise	
		Emission of light	

[1] https://www.iccrom.org/sites/default/files/2018-07/icomos_guidance_on_heritage_impact_assessments_for_cultural_world_heritage_properties.pdf

Environmental/Social component	Phase	Impact factors	Overall assessment
		Presence of working and moving vessels	
		Emission of light	
		Emission of chemicals in water	
	Operation	Discharge of wastewater	**Medium**
		Minor leakage of contaminants into water	
Marine Traffic	Construction	Presence of working and moving vessels	**Low**
Tourism	Construction	Presence of working and moving vessels	**Low**
		Presence of the cofferdams	
Visual Aesthetics	Construction	Removal of natural vegetation	**Low**
		Removal of soil	
		Emission of light	
		Change in land use	
	Operation	Presence of new onshore infrastructures	**Medium**
		Emission of light	

For most social components, the overall impact is assessed as Low.

As it can be noted, some components are only impacted during the construction or operation phase. Regarding these components, the cumulative phenomenon is limited. In case of benefit to national economy, impact is evaluated as very high positive. Other components are impacted during both phases (construction and operation). For these components the cumulative negative impact is partially compensated by the very high positive impact of benefit to national economy.

Finally, for some of the components impacted during both phases, a more significant cumulative impact is expected for *economy and employment, infrastructure and services, health issues and facilities, ecosystem services (fisheries)* considered in general due to:

- High impact value, high and low mitigation effectiveness for *economy and employment*, which is expected to be potentially impacted by a single Project action, triggered by 3 impact factors during construction and operation phases.
- Low impact value, low to medium mitigation effectiveness for *infrastructure and services*, which is expected to be potentially impacted by 2 Project actions, triggered by 3 impact factors during construction and 2 Project actions, triggered by 6 impact factors during operation phase.
- Low to medium impact value, low to medium mitigation effectiveness for *health issues and facilities*, which is expected to be potentially impacted by 2 Project actions, triggered by 6 impact factors during construction and operation phases.

- Low to medium impact value, low to medium mitigation effectiveness for *ecosystem services-fishers*, which is expected to be potentially impacted by 3 Project actions, triggered by 7 impact factors during construction and 1 Project action, triggered by 2 impact factors during the operation phase.

Following this assessment, particular attention should be dedicated to mitigation measures for these components (such as the ones composing the ecosystem services - fishers), which present risks of negative cumulative impact phenomena within the project itself. The mitigation measures identified for each of the abovementioned components, in fact, must be reinforced as much as possible, as explained in Chapter 12 Environmental and Social Management Framework (and in particular for the development of future management and action plans to be updated based on the monitoring to be implemented). Since management of cumulative impacts of the Project within itself requires addressing individual impact factors with a holistic approach, several management plans for these will be prepared, such as Livelihood Restoration Plan, Stakeholder Engagement Plan and several other management plans for social components.

Onshore Biological

Table 10-4: Overall assessment for onshore Biological Components

Environmental component	Phase	Impact factors	Overall assessment
Flora	Construction	Removal of natural vegetation	**Negligible**
		Emission of dust and particulate matter	
		Possible introduction of alien species	
		Removal of soil	
	Operation	Emission of dust and particulate matter	**Negligible**
Freshwater fauna	Construction	Emission of dust and particulate matter	**Negligible**
		Emission of aerial noise and vibrations	
		Increase and modification of traffic onshore	
		Discharge of wastewater	
		Changes in flow/circulation in natural water bodies	

Environmental component	Phase	Impact factors	Overall assessment
		Minor leakage of contaminants into water	
		Emission of light	
		Possible introduction of alien species	
	Operation	Demand of freshwater	**Low**
		Discharge of wastewater	
		Emission of aerial noise and vibrations	
		Emission of light	
		Increase and modification of traffic onshore	
Terrestrial fauna	Construction	Removal of natural vegetation	**Low**
		Emission of aerial noise and vibrations	
		Possible introduction of alien species	
		Removal of soil	
		Increase and modification of traffic onshore	
		Emission of light	
	Operation	Emission of aerial noise and vibrations	**Low**
		Emission of light	

Environmental component	Phase	Impact factors	Overall assessment
		Increase and modification of traffic onshore	
Birds	Construction	Removal of natural vegetation	**Low**
		Emission of aerial noise and vibrations	
		Increase and modification of traffic onshore	
		Emission of light	
		Minor leakage of contaminants into water	
	Operation	Presence of new onshore infrastructures	**Low**
		Discharge of wastewater	
		Emission of aerial noise and vibrations	
		Emission of light	
		Increase and modification of traffic onshore	
Habitats	Construction	Removal of natural vegetation	**Low**
		Possible introduction of alien species	
		Removal of soil	
		Possible introduction of alien species	
	Operation	Discharge of wastewater	**Low**
Legally protected areas and internationally protected areas	Construction	Removal of natural vegetation	**Negligible**

Environmental component	Phase	Impact factors	Overall assessment
		Emission of dust and particulate matter	
		Emission of aerial noise and vibrations	
		Possible introduction of alien species	
		Emission of light	
	Operation	Emission of aerial noise and vibrations	**Negligible**
		Emission of light	

For almost all of the onshore biological components the expected impacts are generally low to negligible.

The construction and operation phases are characterized by different project actions with mostly specific impact factors. In particular, the removal of natural vegetation is only related to the construction phase and together with other impact factors such as, emission of aerial noise and vibration, and emission of dust and particulate matter could present a cumulative effect on different components. However, the generally medium to high efficiency of the mitigation measures reported in Chapter 7 are able to reduce the cumulative negative impacts.

Among the onshore biological components those in need of attention due to possible cumulative impacts within the project itself are:

- *Terrestrial Fauna*, which is expected to be potentially impacted by 6 impact factors triggered by 4 project actions during construction phase and only and 3 impact factors from 1 project action during operation phase;
- *Birds*, which is expected to be potentially impacted by 5 impact factors triggered by 3 project actions during construction phase, and 5 impact factors from 1 project action during operation phase;
- *Habitat*, which is expected to be potentially impacted by 4 impact factors triggered by 3 project actions during construction phase, and 1 impact factor from 1 project action during operation phase.

Following this assessment, particular attention should be dedicated to mitigation measures for these components which present risks of negative cumulative impact phenomena within the Project itself. The mitigation measures identified for each of the abovementioned components, in fact, must be reinforced as much as possible, as explained in reference to Chapter 12 ESMP Framework. In order to mitigate these cumulated impacts, a Biodiversity Management Plan will be prepared.

Onshore Physical

Table 10-1: Overall Assessment for Onshore Physical Components

Environmental/Social component	Phase	Impact factors	Overall assessment
Soil and subsoil	Construction	Removal of soil	**Low**
		Minor leakage of contaminants into soil	
	Operation	Minor leakage of contaminants into soil	**Low**
Noise	Construction	Emission of aerial noise	**Low**
	Operation	Emission of aerial noise	**Low**
Vibrations	Construction	Emission of vibrations	**Low**
Hydrology and surface water quality	Construction	Changes in flow/circulation in natural water bodies	**Low**
		Discharge of wastewater	
		Minor leakage of contaminants into water	
	Operation	Discharge of wastewater	**Low**
Hydrogeology and Groundwater Quality	Construction	Demand for freshwater	**Medium**
		Discharge of wastewater	
		Minor leakage of contaminants into water	
	Operation	Demand for freshwater	**Low**
		Discharge of wastewater	
Air quality	Construction	Dust emissions	**Low**
		Exhaust emissions from vehicles and construction machinery	
		Exhaust emissions from vessels	
	Operation	Emission of gaseous pollutants and/or greenhouse gases	**Medium**

For almost all of the onshore physical components, the overall impact is assessed as Low, except for the construction phase hydrology and groundwater quality and operation phase air quality for which the overall assessment is Medium.

All onshore physical components are impacted during both phases (construction and operation). Hence a more significant cumulative impact is expected for *soil and subsoil, noise and vibration, hydrology and surface water quality, hydrogeology and groundwater quality, air quality* considered in general due to:

- Low to medium impact value, medium to medium-high mitigation effectiveness for *soil and subsoil*, which is expected to be potentially impacted by 2 Project actions, triggered by 2 impact factors during construction and 1 Project action, triggered by 1 impact factor during operation phase.
- Low to medium impact value, medium mitigation effectiveness for *noise and vibration*, which is expected to be potentially impacted by 1 Project action, triggered by 1 impact factor during construction and operation phases.
- Medium to high impact value, medium to high mitigation effectiveness for *hydrology and surface water quality*, which is expected to be potentially impacted by 1 Project action, triggered by 3 impact factors during construction and 1 Project action, triggered by 1 impact factor during operation phases.
- Low-medium to medium impact value, low to medium-high mitigation effectiveness for *hydrogeology and groundwater quality*, which is expected to be potentially impacted by 1 Project action, triggered by 3 impact factors during construction and 1 Project action, triggered by 2 impact factors during the operation phase.
- Low to medium impact value, low mitigation effectiveness for *air quality*, which is expected to be potentially impacted by 2 Project actions, triggered by 3 impact factors during construction and 1 Project action, triggered by 1 impact factor during the operation phase.

Following this assessment, particular attention should be dedicated to mitigation measures for these components–, which present risks of negative cumulative impact phenomena within the Project itself. The mitigation measures identified for each of the abovementioned components, in fact, must be reinforced as much as possible, as explained in respective chapters and in Chapter 12 Environmental and Social Management Framework (and in particular for the development of future management and action plans to be updated based on the monitoring to be implemented). Monitoring of the impacts, as described in respective chapters, followed by an adaptive management and monitoring approach is essential, i.e.:

- mitigation measures and monitoring outcomes are evaluated after each monitoring campaign,
- measures and monitoring approach is improved and revised as needed,
- respective management plan(s) is (are) revised as required.

10.2 Cumulative Impacts with Other Projects in the Same Area

Cumulative impacts with other projects can result from the incremental impact generated by the sum of the impacts of the Project with those of other existing or planned projects on same areas or resources. The cumulative impacts (on onshore and offshore components) have been assessed taking into account spatial, temporal or thematic overlap with other projects or facilities in the AoI of the Sakarya Gas Field Development (SGFD) Project Phase 1. The **spatial** overlap has been defined as the overlap of a facility with the Area or Areas of Influence of the components of the SGFD Project. The **temporal** overlap has been defined as the concomitance between the facilities construction or operation phases with those of the Sakarya Gas Field Development Project. Lastly, the **thematic** overlap has been defined as the overlap due to the pressures exerted by different projects on the same components.

The projects that are at present under development, construction, operation and/or are currently planned for the near future are listed in Table 10-5. Being out of the scope of this ESIA, and as stated in Chapters 1 and 3, the Project Phase 2 has been considered to be independent of the Phase 1.

Table 10-5: Projects potentially overlapping with Sakarya Gas Field Development Project Phase 1.

Project name	Onshore/ Offshore	Commissioner	Short description	Started in / Planned for	Current status	Overlap[2]
TP-OTC SGFD Project Phase 1 – Drilling – testing – development of Offshore wells	Offshore	TP-OTC	Under Phase 1 a total of 4 wells have already been installed. Of the remaining 6 wells, 5 were already drilled but are yet to be completed, while 1 has yet to be drilled. Construction is thus expected to continue for another 6 to 7 months.	Ongoing. Planned to be completed in 2023	Ongoing	This project is expected to overlap **spatially** with the Offshore Physical and Biological AoI and **temporally** with the Project Phase 1 construction phase and possibly operation phase
TP-OTC SGFD Project Phase 2 – Drilling – testing – development of Offshore wells	Offshore	TP-OTC	Under Phase 2, the natural gas whose production will continue in Sakarya Gas Field will be connected to the subsea production system with up to 30 additional wells under Phase 2, reaching up to a total of 40 producing wells with Phase 1 and 2 combined.	Planned to start in 2023	Planning	This project is expected to overlap **spatially** with the Offshore Physical and Biological AoI and **temporally** with the Project Phase 1 operation phase
TP-OTC SGFD Project Phase 2 – Offshore Pipeline	Offshore	TP-OTC	A 24 inches pipeline (60.96 cm) or above will be needed to transport the additional gas produced in Phase 2 from the wells to the onshore. While the route is not final as of the date	Construction planned to start in 2023	Planning	The Phase 2 – Offshore Pipeline is expected to overlap **spatially** with the Offshore Physical and Biological AoI (at least in the shallow coastal area) and

[2] AoI refer to AoI defined for SGFD Project Phase 1 in this ESIA.

Project name	Onshore/ Offshore	Commissioner	Short description	Started in / Planned for	Current status	Overlap[2]
			of this ESIA report, one of the potential planned routes (Route 6A) is presented in Figure 10-1.			**temporally** with the SGFD Project Phase 1 operation phase
TP-OTC SGFD Project Phase 2 – OPF – Additional Units	Onshore	TP-OTC	Phase 2 will have a total processing capacity of 40 million standard m^3 and Phase 2 will require extension / expansion of Phase 1 units. Extension is planned within the Special Economic Zone allocated to TPAO for the Project, within OPF immediate battery limits and/or vicinity.	Construction planned to start in 2023	Planning	Expansion of the OPF units for Phase 2, is expected to overlap **spatially** with the onshore physical, biological and social AoI and **temporally** with the operation phase of SGFD Project Phase 1
TP-OTC SGFD Project Phase 1 – BOTAŞ Onshore Pipeline and Fiscal Metering Station (FMS)	Onshore	BOTAŞ	36 km, 48 inches pipeline and the FMS will be constructed to transport the gas. Phase 1 is presented in the figures below. BOTAŞ Pipeline and FMS are associated facilities to the SGFD Project Phase 1 and are assessed in the E&S Assessment Report presented in Appendix A.	Construction to be completed within Q4 2022.	Construction	BOTAŞ Onshore pipeline Phase 1 (Figures 1,2,3,4 and 5), will overlap **spatially** with the onshore physical, biological and social AoI and **temporall**y with the construction and operation phase of SGFD Phase 1.
TP-OTC SGFD Project Phase 2 – BOTAŞ Onshore Pipeline	Onshore	BOTAŞ	168 km, 48 inches pipeline will be constructed to transport the gas to be produced during the Phase 2 of the SGFD Project. Phase 1 and Phase 2 pipelines are presented in Figure 10-5.	Construction to start September 2022, Commissioning planned for June 2023 according to	Planning	The portion of BOTAŞ Onshore pipeline Phase 2, which falls within the Zonguldak provincial boundaries (Figure 10-5), will overlap **spatiall**y with the

Project name	Onshore/ Offshore	Commissioner	Short description	Started in / Planned for	Current status	Overlap[2]
				the national EIA (Ekoçev, 2022)		onshore physical, biological and social AoI and **temporally** with the operation phase of SGFD Phase 1.
Filyos Port / Industrial Zone Connections - Rail Road	Onshore	Ministry of Transportation, General Directorate of Infrastructure Investments.	The proposed Railway and Logistic Improvement Project aimed at constructing new railway lines to contribute overall economy and industrial development in the Filyos region. The railway line under the proposed project, which is planned to be built as part of the overall regional economic development program, consists of four main components. These components will be Gökçeler – Sanayi Line, Dock Connection, Ferry Line, Port Link. Gökçeler – Sanayi Line will be the longest line to be constructed within the scope of the project. Dock, Ferry and Port Line will provide connection to Filyos Port, where construction activities are continuing. Two alternatives are evaluated for the Port Connection and the alternative land preparation and construction activities to be	Tentatively planned to start in 2023 as stated in the ESIA (Çınar, 2021)	Planning	The project will overlap not only **spatially** but also **temporally** with the operation phase of the SGFD Project Phase 1 (Figure 10-6)

Project name	Onshore/ Offshore	Commissioner	Short description	Started in / Planned for	Current status	Overlap[2]
			selected will be decided by GDII before it starts.			
Filyos Integrated Fertilizer Production Facility Project	Onshore	Tosyali Gübre Sanayİ A.Ş.	Filyos Integrated Fertilizer Production Facility is planned to be built in Zonguldak province, Çaycuma district, Filyos Industrial Zone by Tosyalı Fertilizer Production A.Ş. Within the scope of the project, ammonia production facility, urea production facility, calcium ammonium nitrate production facility, nitric acid production facility, sulfuric acid production facility, phosphoric acid production facility, ammonium sulphate production facility, potassium nitrate production facility and dap/npk (diammonium phosphate / nitrogen-phosphorus-potassium) composite production facility are planned to be established. The project is planned to produce a minimum of 1,855,000 tons/year and a maximum of 2,020,000 tons/year of fertilizer.	Commissioning is targeted for 2025 according to the National EIA (Armada, 2022)	Planned	Project is expected to overlap **spatiall**y with the onshore physical, biological and social AoI as it will occupy almost the entire industrial area, west of the Project. Although no details about the starting date or status are currently known, this project would overlap **temporally** with the operation phase of SGFD Project Phase 1.

Project name	Onshore/ Offshore	Commissioner	Short description	Started in / Planned for	Current status	Overlap[2]
154 kV Devrek – Zonguldak 2 Energy	Onshore	Türkiye Elektrik İletim A.Ş. Genel Müdürlüğü	The project is planned to be established within the borders of Devrek district of Zonguldak province. The project is related to the 154 kV Devrek – Zonguldak 2 Energy Transmission Line, which is planned to be established between Devrek Substation and Zonguldak 2 Substations located within the borders of Merkez district of Zonguldak province. The total length of the planned energy transmission lines is approximately 33 km, and the entire line passes through the borders of Zonguldak province.	Started expropriation process (April 2022)	Planned	Project fall exclusively within the Area of Influence of the Social component (onshore) (Figure 10-3). It is not possible to determine the temporal overlap, other than assuming the eventual overlap with the operation phase of the SGFD Phase 1.
Eren Port Strengthening Project (Including Filling Area)	Onshore / Offshore	Eren Enerji Elektrik A.Ş.	Eren Port Strengthening Project is planned by Eren Enerji Elektrik Üretim A.Ş. to make the breakwaters damaged as a result of natural activities in 2018 more resistant to storms, to develop the port due to the increase in ash and gypsum exports, and to manage the container operations related to the paper mill production of the investor company in the same	Not indicated in the national EIA (Çınar, 2021).	Planned	Project falls exclusively within the Area of Influence of the Social component (onshore and offshore) (Figure 10-3, Figure 10-4). It is not possible to determine the temporal overlap, other than assuming the eventual overlap with the operation phase of the SGFD Phase 1.

Project name	Onshore/ Offshore	Commissioner	Short description	Started in / Planned for	Current status	Overlap[2]
			region (including fill area). The investment activities that are the subject of the project are grouped under three main headings as: Post-disaster port protection structures (breakwater) repair and strengthening activities, Development of the port due to the increase in ash and gypsum exports, Depending on the paper mill production, container operations become essential.			
Capacity Increase of Limestone Quarry	Onshore	Eren Enerji Elektrik Üretim A.Ş.	The Limestone Quarry Capacity Increase project, planned to be realized in the project area of 12.11 hectares, determined within the license area of 92,13 hectares, around Çatalağzı town, Kilimli district, Zonguldak province. The project area has been determined as 2 polygons and the 1st Polygon has an area of 5.78 hectares and the 2nd Polygon has an area of 6.33 hectares. Between the 2 determined polygons, there is the currently working quarry	Not indicated in the national EIA (Akçed, 2022).	Planned	Project falls exclusively within the Area of Influence of the Social component (onshore) (Figure 10-3). It is not possible to determine the temporal overlap, other than assuming the eventual overlap with the operation phase of the SGFD Phase 1.

Project name	Onshore/ Offshore	Commissioner	Short description	Started in / Planned for	Current status	Overlap[2]
			area. With this project, both the production area will be expanded, and the production amount will be increased.			
II-A Group Limestone Quarry and Crushing-Screening Facility	Onshore	T.R. Ministry of Transportation and Infrastructure General Directorate of Highways (15th Regional Directorate)	The project is planned to construct an "II-A Group Limestone Quarry and Crushing and Screening Plant" in the mine site within the borders of Güdüllü village, Çaycuma district, Zonguldak province by the 15th Regional Directorate of the General Directorate of Highways of the Ministry of Transport and Infrastructure. The planned activities of the Project are extraction of mines, facilities that perform at least one of the following activities crushing, screening washing and ore preparation process.	Not indicated in the Project Description File (Geomer, 2021).	Planned	Project falls exclusively within the Area of Influence of the Social component (onshore) (Figure 10-3). It is not possible to determine the temporal overlap, other than assuming the eventual overlap with the operation phase of the SGFD Phase 1.
I-B. Group (Marn) Mining (Borrow Material)	Onshore	General Directorate of Highways (15th Regional Directorate)	The project is planned to be carried out I-B Group (Marl) Mine (Lending Material) in Zonguldak province, Çaycuma district, Yukarıdere village. The 15th Regional Directorate of Highways will award to the contractor company for the road	Not indicated in the Project Description File (Ayaz, 2022).	Planned	Project falls exclusively within the Area of Influence of the Social component (onshore) (Figure 10-3). It is not possible to determine the temporal overlap, other than assuming the eventual

Project name	Onshore/ Offshore	Commissioner	Short description	Started in / Planned for	Current status	Overlap[2]
			construction, maintenance and repair works for road soil levelling, engineering structures and superstructure works and the surrounding state and provincial roads.			overlap with the operation phase of the SGFD Phase 1.

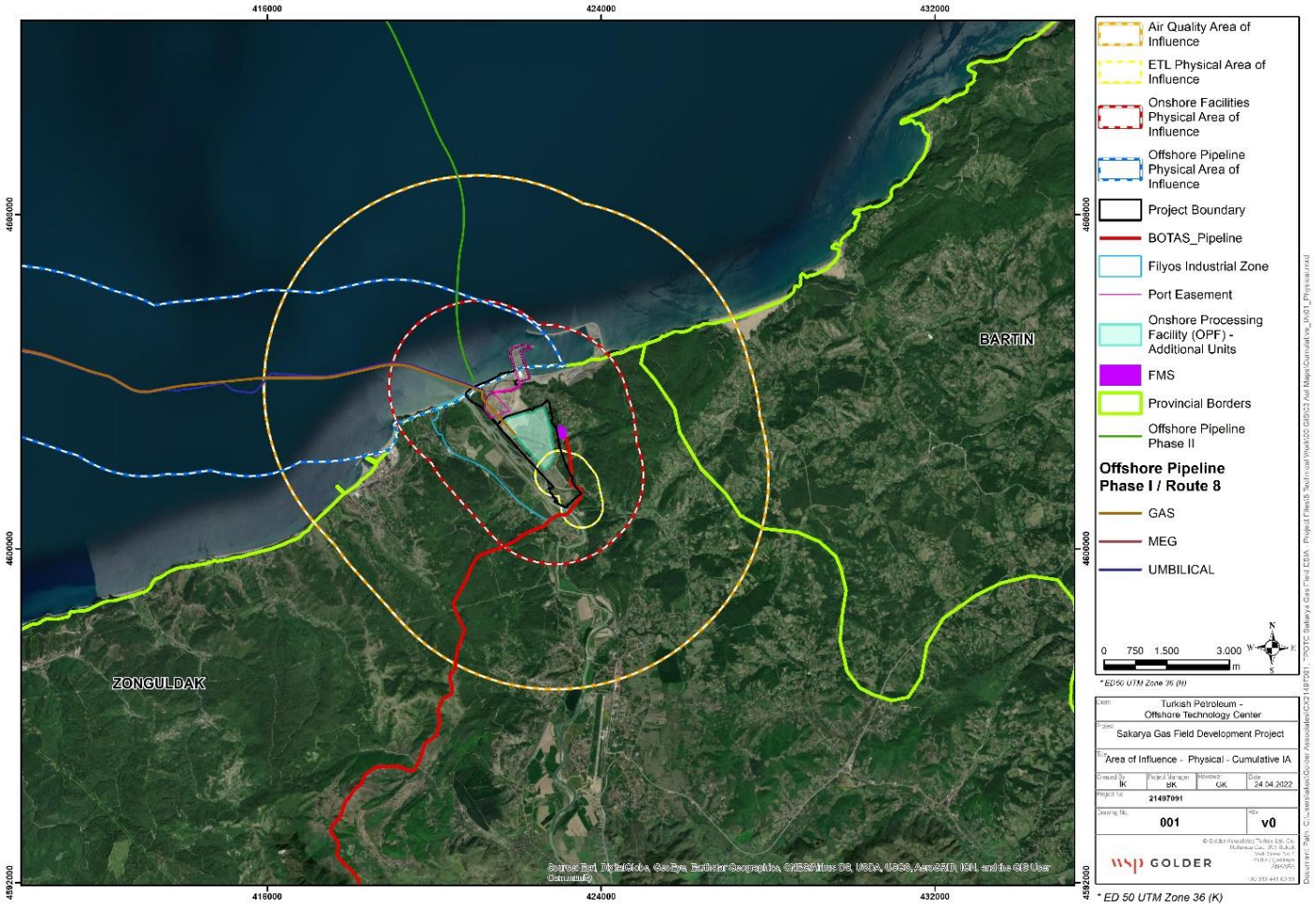


Figure 10-1: Physical AoI and facilities spatially overlapping with the Sakarya Gas Field Development Project.

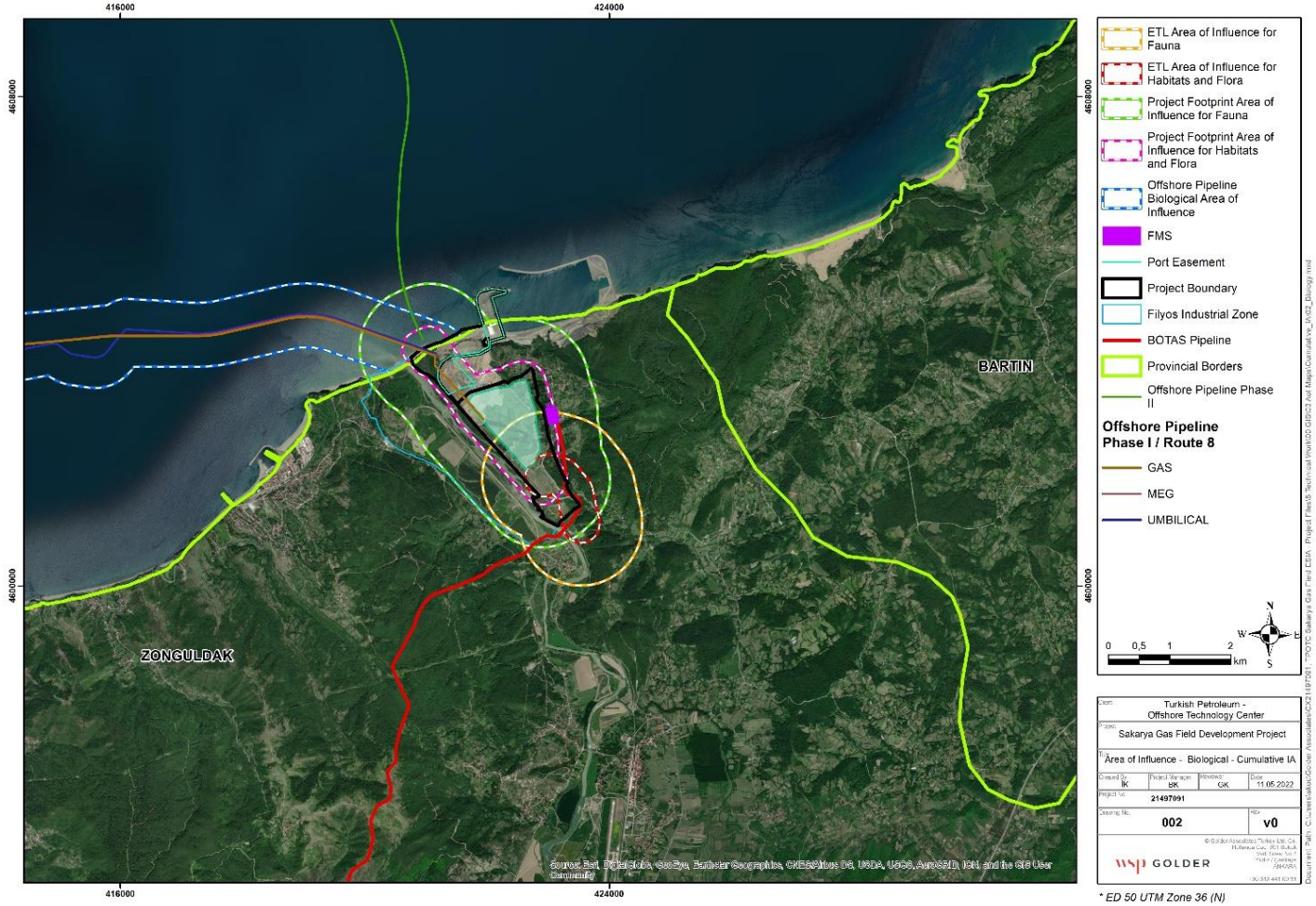
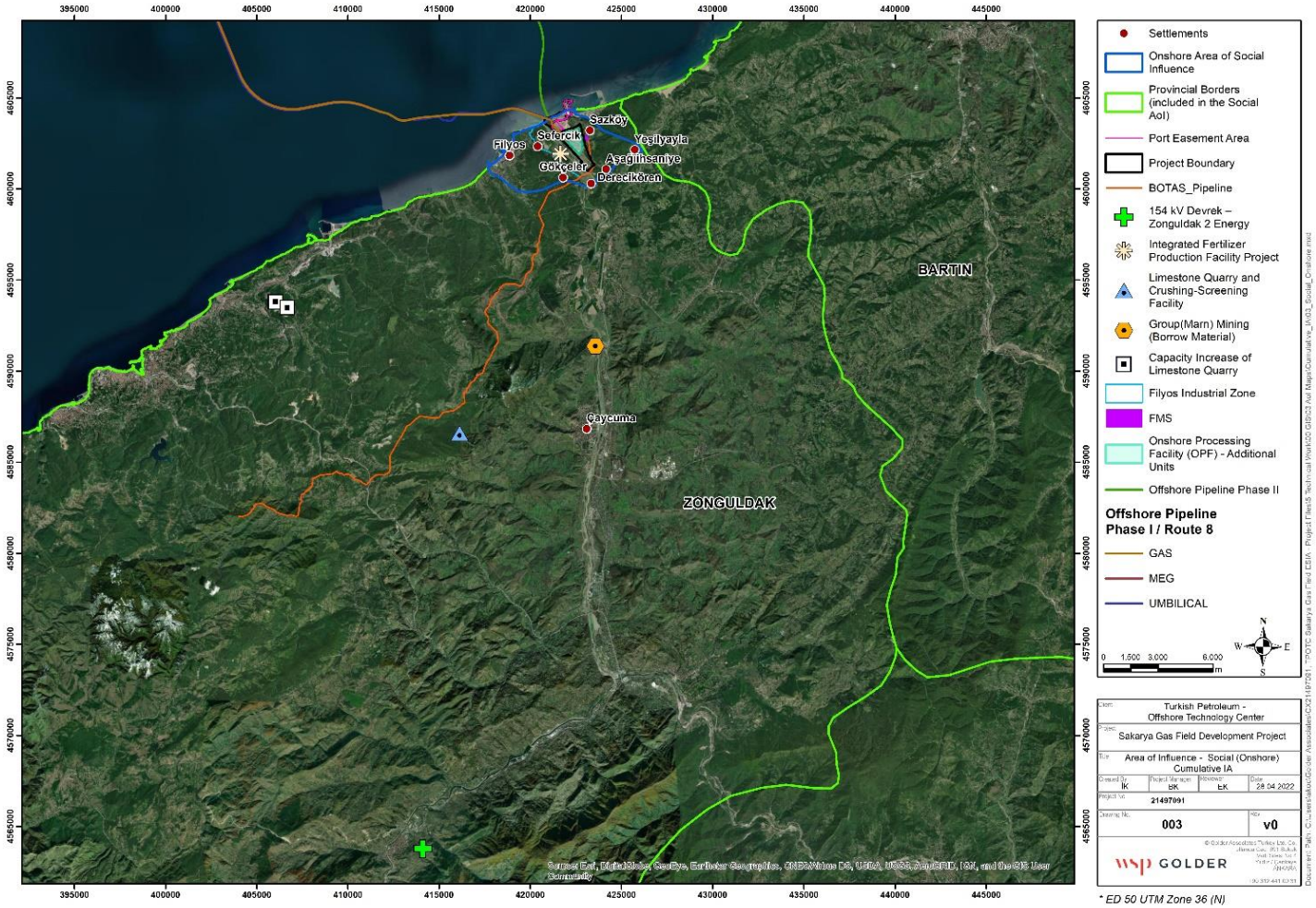


Figure 10-2: Biological AoI and facilities spatially overlapping with the Sakarya Gas Field Development Project



** ED 50 UTM Zone 36 (N)*

Figure 10-3: Social Onshore AoI and facilities spatially overlapping with the Sakarya Gas Field Development Project

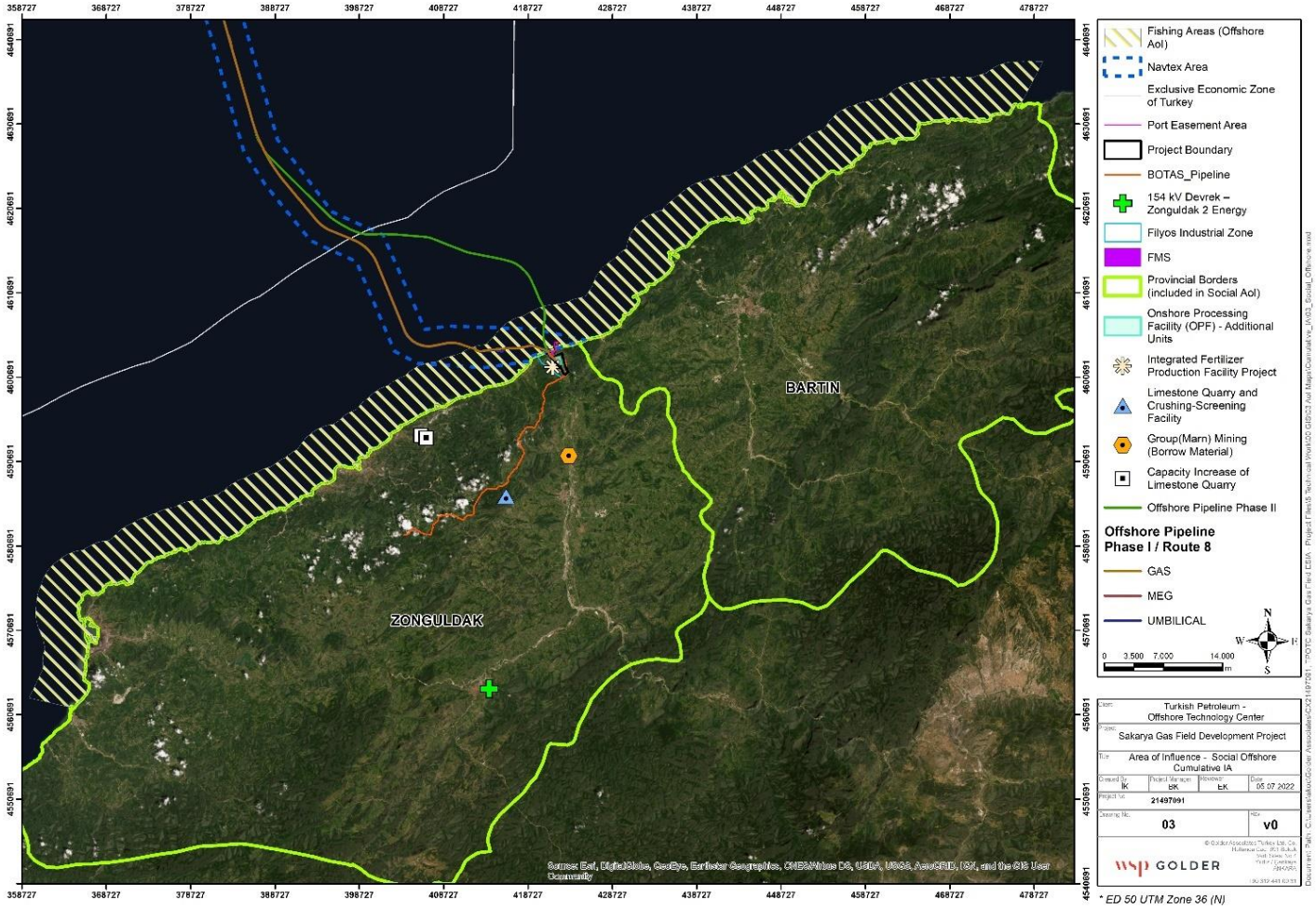


Figure 10-4: Social Offshore AoI and facilities spatially overlapping with the Sakarya Gas Field Development Project

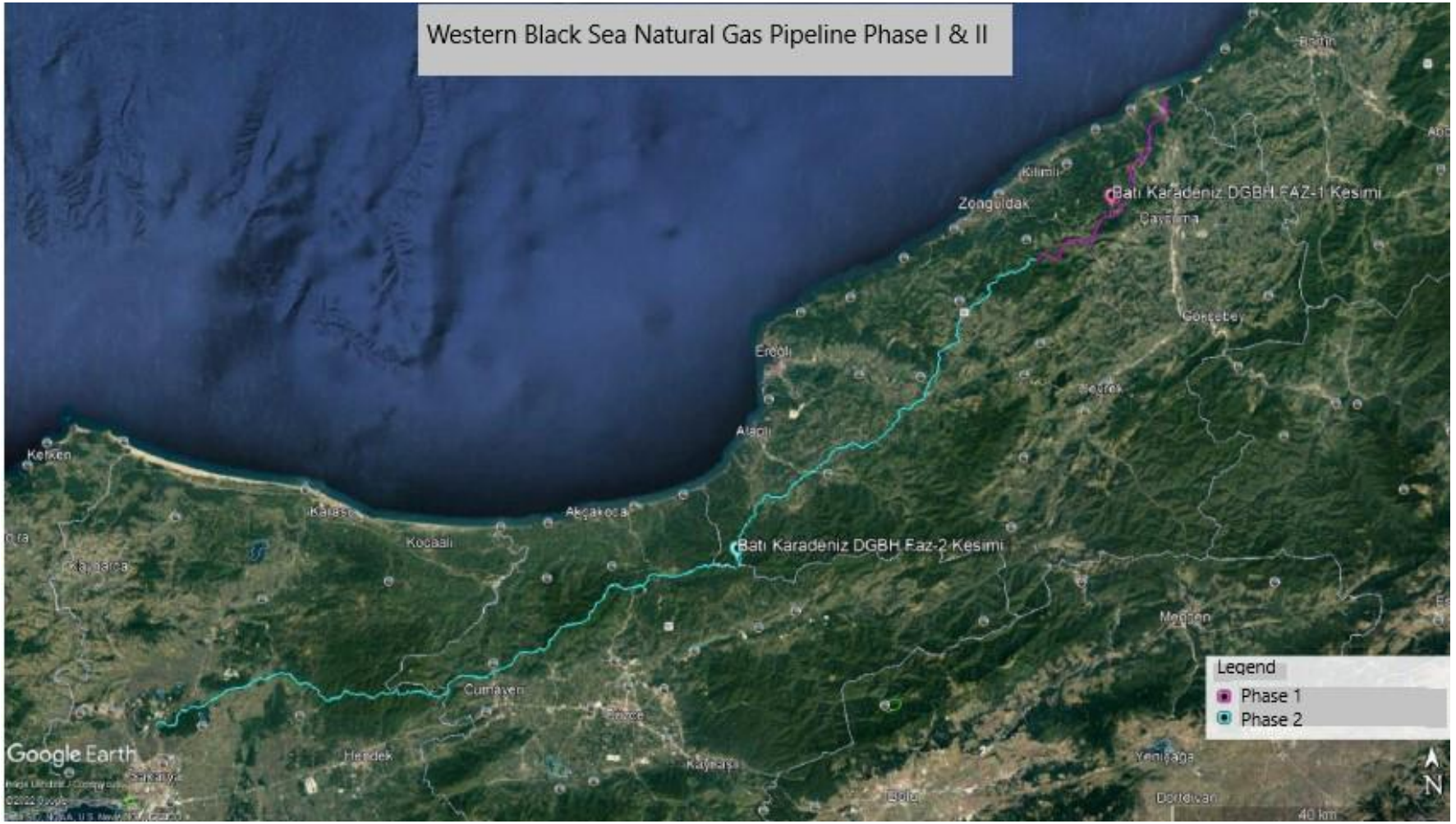


Figure 10-5: BOTAŞ Western Black Sea Natural Gas Pipelines Phase 1 and Phase 2 (Phase 2 Local EIA, Ekotek Çevre, 2022)

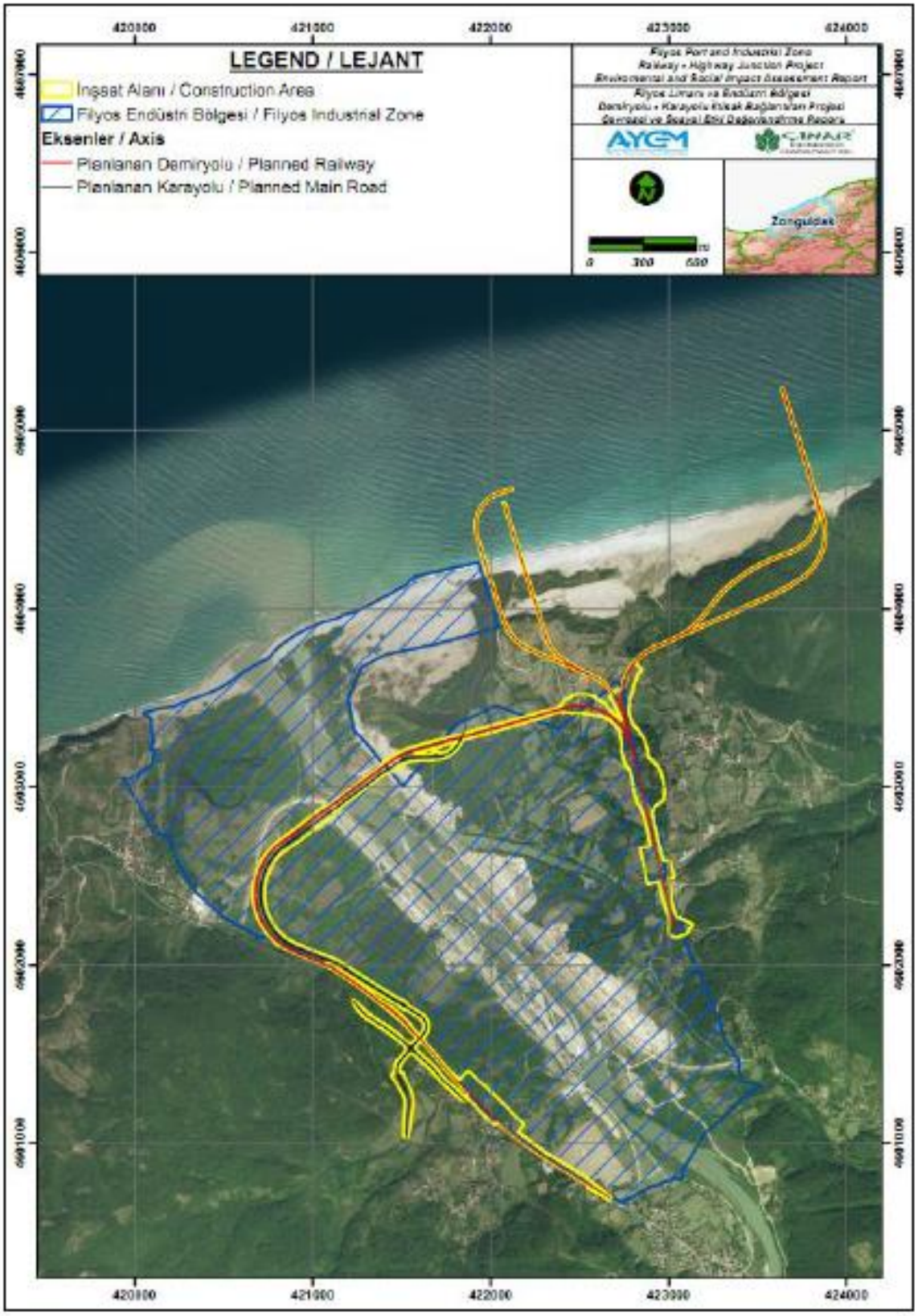


Figure 10-6: Filyos Port / Industrial Zone Connections (ESIA, Çınar, 2021)

The projects that overlap spatially and temporally with several SGFD Phase 1 components, cumulative impacts are expected for Onshore, Offshore and social components as described in Table 10-6. As a precautionary measure, a temporal overlap has been hypothesized also for the projects whose start-up period is not exactly known, such as the Filyos Integrated Fertilizer Production Facility Project.

On the other hand, for the projects that are in the Social AoI of the SGFD Phase 1 but otherwise does not spatially or temporally overlap, potential cumulative impacts are expected only for social components, as also discussed in Table 10-6.

10.3 Cumulative Impact Assessment

Considering the information available and the level of detail accessible for such information, the cumulative impact assessment is focused on the impact factors (or impact factor phenomena) on which is possible to elaborate considerations, namely:

- Emissions to atmosphere (air, noise)
- Water consumption with consequent intrusion of the saline wedge and discharges
- Changes in flow/circulation in natural water bodies
- Riverine and sea water contamination
- Habitat fragmentation
- Land acquisition
- Increase and modification of traffic Onshore
- Presence of new Onshore infrastructures
- Immigration of workers and other people
- Demand for infrastructure services

Such elements are assessed here below.

Table 10-6: Cumulative Impacts with other Projects

Environmental/ Social component	Impact factors	Cumulative type (temporal, spatial, thematic)	Impact definition and mitigation measures
• Air quality • Noise • Health issues and facilities • Flora • Freshwater fauna • Pelagic components	Emissions to atmosphere	A ***spatial*** and ***thematic*** overlap is expected between SGFD Project Phase 1 and: • the Filyos Integrated Fertilizer Production Facility Project • the Filyos Port/Industrial Zone Connections - Rail Road Project • BOTAŞ Onshore pipeline and FMS Phase 1 • BOTAŞ Onshore pipeline Phase 2 • TP-OTC SGFD Project Phase 2 – Drilling – testing –development of Offshore wells • the TP-OTC SGFD Project Phase 2 – OPF – Additional Units. A ***temporal*** overlap is also expected between the construction (only for BOTAŞ)[3] and operation phase of the Sakarya Gas Field Development Project Phase 1 and: • the Filyos Integrated Fertilizer Production Facility Project construction and operation phases • Construction and operation phases of the portion of BOTAŞ Onshore pipeline Phase 2, which falls within the Zonguldak provincial boundaries • the Filyos Port/Industrial Zone Connections - Railroad Project construction and operation phases • the TP-OTC SGFD Project Phase 2 – OPF –	The possible spatial and temporal overlap between the projects construction and operation phases may aggravate some of the impacts identified on the IA. The peak time of OPF construction activities generating dust and gaseous emissions will be June-August 2022. Therefore, an overlap of the construction activities and associated emissions (air and noise) is not anticipated to increase the intensity of impact but will broaden the area of influence (AoI) and extend the duration of impact. The operation phase emissions will overlap with the emissions of other projects; hence the intensity and spatial coverage area of impact may increase. The cumulation in the emission of pollutants due to other Projects can overall worsen the air quality in the area, with consequences on the health conditions of local communities. As mentioned in the baseline, the Project's AoI is not densely populated, and the potential receptors are limited. • Dust emissions can impact vegetation directly by covering leaf surface and indirectly through impacts on soil composition and structure • Dust deposition can also produce negative effects on vegetation, in case of freshwater environments this could cause a loss of riparian vegetation and important feeding and nesting habitats • There could be effects to fauna species through inhalation or ingestion of soil particles, especially for amphibians due to their characteristic cutaneous respiration • The increase of air pollutants in the atmosphere may affect human health • Noise impacts may cause grievances which would need to be coordinated and addressed in coordination with other projects, utilizing use of temporary barriers and limiting work to day time hours. The measures identified to minimize the physical and biological impacts for construction phase (such as implementation of dust and exhaust emission control mitigation measures set for construction machinery/vehicles and best practices for management of construction activities), and operation phase (such as mitigation and monitoring measures provided for control of fugitive and combustion emissions) should be sufficient to ensure Low residual impacts.

[3] Except for BOTAŞ, all the other facilities are expected to temporally overlap only with the SGFD Project operation phase.

Environmental/ Social component	Impact factors	Cumulative type (temporal, spatial, thematic)	Impact definition and mitigation measures
		Additional Units construction and operation phases • TP-OTC SGFD Project Phase 2 – Drilling – testing –development of Offshore wells • BOTAŞ Onshore pipeline Phase 1 construction and operation phases	• Underwater noise generated through drilling activities and operating vessels could also affect pelagic components, such as fishes and marine mammals. If emission of underwater noise persists for extended periods of time, it may change the acoustic environment to which a fish is adapted, with consequences in fish behaviour. This impact factor is however common to any vessels navigating in the AoI and its proximity, which are areas already characterized by an intense maritime traffic. The fish fauna of the area is therefore considered as possibly "habituated" to the noise of the vessel propellers. Regarding marine mammals, low-frequency noise originated by working vessel propellers could potentially interfere with acoustic signaling. However, such low frequency activities may potentially affect Low Frequency (LF) cetaceans (i.e., baleen whales) which are completely absent in the Black Sea. Although the emission of dust and particulate matter may influence flora and freshwater fauna, mitigation measures should enable Negligible residual impacts to be achieved on these components. Air quality monitoring during peak time of construction activities and periodically during operation phase will be required to ensure compliance with the applicable standards and to ensure a healthy environment for flora, fauna and human beings. Regarding underwater noise, the compliance of the mitigation measure with relevant standards (MARPOL) and the planning of activities when marine mammals are less active should be sufficient to ensure a low impact value.
• Hydrogeology and groundwater quality • Hydrology and surface water quality • Freshwater fauna	Water consumption with consequent intrusion of the saline wedge and discharges	A ***spatial*** and ***thematic*** overlap is expected between SGFD Project Phase 1 and: • the Filyos Integrated Fertilizer Production Facility Project • the Filyos Port/Industrial Zone Connections - Railroad Project • BOTAŞ Onshore pipeline and FMS Phase 1 • BOTAŞ Onshore pipeline Phase 2	Water consumption with consequent intrusion of the saline wedge is expected to be predominantly generated through the introduction of seawater into groundwater and to a lesser extent within river waters, caused by the demand of freshwater. The possible spatial and temporal overlap between the projects construction and operation phases may exacerbate some of the impacts identified on the IA, specifically on water bodies. Since there are projects in the region with a high demand for water and these waters are planned to be supplied from the water supply wells (caisson wells) which will be drilled near the Filyos River, deterioration in the relationship between the Filyos River and the groundwater and significant reductions in groundwater levels, although not overly dramatic, may be observed in the region. Both surface and groundwater

Environmental/ Social component	Impact factors	Cumulative type (temporal, spatial, thematic)	Impact definition and mitigation measures
		A ***temporal*** overlap is also expected between the construction (only for BOTAŞ) and operation phase of the Sakarya Gas Project Phase 1 and: • the Filyos Integrated Fertilizer Production Facility Project construction and operation phases • Construction and operation phases of the portion of BOTAŞ Onshore pipeline Phase 2, which falls within the Zonguldak provincial boundaries • the Filyos Port/Industrial Zone Connections - Railroad Project construction and operation phases • the TP-OTC SGFD Project Phase 2 – OPF – Additional Units construction and operation phases • BOTAŞ Onshore pipeline Phase 1 construction and operation phases	quality could be impacted by wastewater and stormwater discharges. The wastewaters are processed through wastewater treatment plants and discharged directly to Filyos River by aligning the effluent limits commitment Therefore, the impact can be considered as negligible or even a low-positive impact regarding the surface water quality when considering the baseline water quality of Filyos River. To a lesser extent, the freshwater fauna may also suffer from water collection from wells located near the Filyos River: • freshwater fauna could be affected by the reducing the canopy cover from riparian vegetation generated by the alteration on water hydrology • hydrological changes and the consequent reduction of riparian vegetation could interfere with spawning conditions of many fish and amphibian species, who frequently lay their eggs in sections of water courses rich in vegetation. The measures identified to minimize the physical and biological impacts, such as treating the wastewater or stormwater prior to discharge to comply with Project Standards identified in Chapter 2, preparation of detailed plans to mitigate hydrotest water, installation of discharge dispersion equipment, and a reduction or complete alt of water extraction in case of particularly low water levels, should be sufficient to minimize the impacts expected. For instance, the expected impacts should be Negligible on the freshwater fauna component.
	Changes in flow/circulation in natural water bodies		Changes in flow/circulation are expected within Filyos River, these will be mostly due to BOTAŞ Onshore pipeline which will cross the river upstream from the Project Area requiring substantial modifications of the regular flow of the river. Residual impacts from this activity may be cumulate with the negligible ones from the wastewater discharge from the Project and other similar impacts from the Fertilizer Production Facility Project and Filyos Port/Industrial Zone Connections - Railroad Project. This may have negative residual effects: • Hydrology and surface water quality could be affected by the modifications to the riverbed and the resuspension of sediments from the work area to the downstream section of the river • Hydrological changes may interfere with spawning conditions of many fish and amphibian

Environmental/ Social component	Impact factors	Cumulative type (temporal, spatial, thematic)	Impact definition and mitigation measures
			species, who frequently lay their eggs in sections of water courses with specific flow conditions. The mitigation measures identified in the ESIA and the preliminary mitigations of BOTAŞ, together with the already negligible residual impact of this impact factor from the Project activities suggest that the eventual cumulative impacts should be manageable. Furthermore, the freshwater monitoring activities proposed in the ESIA should help to control and manage the cumulative impact and, if necessary, intervene with appropriate additional measures.
• Hydrology and surface water quality • Freshwater aquatic biodiversity • Birds • Terrestrial fauna • Marine habitats (*benthic and pelagic communities*) • Seawater quality • Sediments	Riverine and sea water contamination	A ***spatial*** and ***thematic*** overlap is expected between SGFD Project Phase 1 and: • the Filyos Integrated Fertilizer Production Facility Project • the Filyos Port/Industrial Zone Connections - Rail Road Project • BOTAŞ Onshore pipeline and FMS Phase 1 • BOTAŞ Onshore pipeline Phase 2 • TP-OTC SGFD Project Phase 1 – Drilling – testing –development of Offshore wells • TP-OTC SGFD Project Phase 2 – Drilling – testing –development of Offshore wells • the TP-OTC SGFD Project Phase 2 – OPF – Additional Units. • the TP-OTC SGFD Project Phase 2 – Offshore Pipeline. A ***temporal*** overlap is also expected between the construction (only for BOTAŞ) and operation phase of the Sakarya Gas Project Phase 1 and: • the Filyos Integrated Fertilizer Production Facility Project	Riverine and seawater contamination is expected to be mainly generated by the discharge of wastewater and unintentional leakage of contaminants into the freshwater body (and consequently on sea waters through the mouth of the river) or directly in the marine environment during pipeline laying operations. The possible overlap between the projects construction and operation phases could worsen the potential impacts generated by riverine and seawater contamination on physical and biological components, including: • adverse effect on freshwater aquatic fauna due to chemical contamination depending on the contaminant and its concentration • negative effects on seawater quality due to nutrients contained in wastewaters (such as nitrogen and phosphorus derivates and other chemicals), which may cause eutrophication phenomena leading to uncontrolled vegetal blooms (phytoplankton), including possibly toxic species • seawater contamination, which could occur due to minor leakage of contaminants and emission of particulates and chemicals into water, subsequently impacting marine components such as plankton, fishes and marine mammals • a resuspension of the sediments due to the pipeline laying operations, which in turn can cause a reintroduction in the marine environment of the contaminants precipitated in the upper layers (when present) • changes in the plankton community composition that subsequently may be reflected on the whole marine biodiversity • benthic algal blooms, also triggered by eutrophication phenomena, that may alter the

Environmental/ Social component	Impact factors	Cumulative type (temporal, spatial, thematic)	Impact definition and mitigation measures
		construction and operation phases • Construction and operation phases of the portion of BOTAŞ Onshore pipeline Phase 2, which falls within the Zonguldak provincial boundaries • the Filyos Port/Industrial Zone Connections - Railroad Project construction and operation phases • TP-OTC SGFD Project Phase 1 – Drilling – testing –development of Offshore wells • TP-OTC SGFD Project Phase 2 – Drilling – testing –development of Offshore wells • the TP-OTC SGFD Project Phase 2 – OPF – Additional Units construction and operation phases • BOTAŞ Onshore pipeline Phase 1 construction and operation phases • the TP-OTC SGFD Project Phase 2 – Offshore Pipeline laying construction and operation phases	benthic community composition and potentially resulting in mucilage events • detrimental direct or indirect effects on birds that may use that habitat for feeding, drinking or resting • displacement of birds from the area due to the contamination and the consequent potential reduction of prey. The mitigation measures identified, such as the compliance of wastewater effluents to national and international standards, the reduced need and careful selection of chemicals requested for pre-commissioning activities (such as pipeline hydrotesting) and the effluent dispersion modelling to be performed to design the discharge point (e.g., location, need for diffusers etc.) should make the impacts manageable. In addition the numerous marine and freshwater monitoring activities proposed in the ESIA should help to control and manage the cumulative impact and, if necessary, intervene with appropriate additional measures.
• Flora • Terrestrial fauna • Birds • Habitats • Legally Protected and Internationally Protected Areas	Habitat fragmentation	A ***spatial*** and ***thematic*** overlap is expected between SGFD Project Phase 1 and: • the Filyos Integrated Fertilizer Production Facility Project • the Filyos Port/Industrial Zone Connections - Rail Road Project • BOTAŞ Onshore pipeline and FMS Phase 1 • BOTAŞ Onshore pipeline Phase 2 A ***temporal*** overlap is also expected between	Habitat fragmentation is expected to be predominantly generated through vegetation clearing and the presence of new Onshore infrastructures. Below are some of the identified impacts that could be worsen due to projects overlap. • There could be a direct habitat loss due to the removal of vegetation • There could be a destruction of suitable habitats for fauna species (including birds) using vegetation as food, shelter or nesting site • There could be impacts regarding bird species, with the potential increase of individuals mortality due to collision and electrocution especially for medium-sized and large birds The impacts generated by habitat fragmentation can be mitigated through the preventive

Environmental/ Social component	Impact factors	Cumulative type (temporal, spatial, thematic)	Impact definition and mitigation measures
		the construction (only for BOTAŞ) and operation phase of the Sakarya Gas Project Phase 1 and: • the Filyos Integrated Fertilizer Production Facility Project construction and operation phase • the first section of the "BOTAŞ" Onshore pipeline construction and operation phase • the Filyos Port/Industrial Zone Connections - Rail Road Project construction and operation phase	translocation of endangered flora species, the implementation of biological pre-construction surveys in order to identify and relocate fauna species, the fencing of the construction areas in order to avoid accidental impacts and the obligation for motorists to drive exclusively on designated routes. In addition, measures to minimize the impacts caused by the presence of new Onshore infrastructures will be implemented. Among these, the setting of speed limits and the design of elements with the aim of modifying animal behaviour. All these measures should be sufficient to limit the impacts caused by habitat fragmentation. However, particular attention should be paid to Birds, for whom the removal of natural vegetation and the consequent habitat fragmentation is expected to have a medium severity residual impact.
• Land use • Visual aesthetics	Land acquisition	A ***spatial*** and ***thematic*** overlap is expected between SGFD Project Phase 1 and: • the Filyos Integrated Fertilizer Production Facility Project • the Filyos Port/Industrial Zone Connections - Rail Road Project • BOTAŞ Onshore pipeline and FMS Phase 1 • BOTAŞ Onshore pipeline Phase 2 A ***temporal*** overlap is also expected between the construction (only for BOTAŞ) and operation phase of the Sakarya Gas Project Phase 1 and: • the Filyos Integrated Fertilizer Production Facility Project construction and operation phase • BOTAŞ Onshore pipeline and FMS Phase 1 • BOTAŞ Onshore pipeline Phase 2 • the Filyos Port/Industrial Zone Connections – Rail	The development of other projects in the Project Area will determine the potential need of land and hence additional land acquisition. Some of these projects will be developed in the industrial zone, for which the land acquisition process has already been completed, however for other projects land will be needed outside this area. To date it is not known what the land requirements of the other projects will be hence it is not possible to determine the level of impact. It is however important to highlight that in order to minimize impacts to the livelihood of current landowners and land users, land acquisition should be performed in compliance with Turkish legislation and International Standards. The development of the projects will generate impacts from a visual standpoint of the current landscape in the Project Area. These projects will introduce new buildings and infrastructures in the area, that due to their size and shape can have a significant visual impact. Their development however is in line with the productive and industrial future that the area is has been assigned. Mitigation measures can be introduced in terms of colour of the elements, presence of visual barriers and use of vegetations to limit the overall impact. As indicated in the baseline, the visual impact will also be limited due to the fact that the area is scarcely populated and that there are no touristic facilities.

Environmental/ Social component	Impact factors	Cumulative type (temporal, spatial, thematic)	Impact definition and mitigation measures
		Road Project construction and operation phase	
• Freshwater fauna • Terrestrial fauna • Birds • Air quality • Infrastructure and services • Health issues and facilities	Increase and modification of traffic Onshore	A ***spatial*** and ***thematic*** overlap is expected between SGFD Project Phase 1 and: • the Filyos Integrated Fertilizer Production Facility Project • the Filyos Port/Industrial Zone Connections -Rail Road Project • BOTAŞ Onshore pipeline and FMS Phase 1 • BOTAŞ Onshore pipeline Phase 2 • the TP-OTC SGFD Project Phase 2 – OPF – Additional Units. A ***temporal*** overlap is also expected between the operation phase of the Sakarya Gas Project Phase 1 and: • the Filyos Integrated Fertilizer Production Facility Project construction and operation phase • BOTAŞ Onshore pipeline and FMS Phase 1 • the Filyos Port/Industrial Zone Connections - Rail Road Project construction and operation phase • the TP-OTC SGFD Project Phase 2 –OPF – Additional Units construction and operation phase	An increase in vehicular traffic during the Project's construction and operation phase is expected along the road network. The possible overlap between construction and operation phases may exacerbate some of the impacts identified on the biological and social components in the Onshore IA, for instance: • the increase of traffic could cause a higher risk of accidental collisions with wildlife, especially in areas crossing or in proximity of natural habitats • stagnant water that forms at roadside or within the construction area might attract Amphibians, increasing the risk of collisions with traffic • local wildlife population could modify their behaviour and distribution due to the increase in human activity • the increase of traffic can lead to congestions on the existing roads, increased noise and pollutions and damages to the road conditions, especially if there is a significant increase of heavy vehicles. Additional traffic can also lead to an increase of accidents, with effects on the health and safety of local communities living in proximity to the roads or using them in their day to day life. The measures defined to minimize the biological and social impacts, such as setting speed limits and the design of elements aimed at modifying the behaviour of animals (e.g., crossing structures, dry ledges, fencing, right-of way jump outs, etc.), the introduction of road safety measures should be sufficient to minimize the impacts. In case of fauna, for example, despite medium to high impacts, residual values are Low given the high effectiveness of mitigation measures. Also, from a human health and safety perspective mitigation measures can be highly effective in reducing impacts.
• Population and demography • Economy and employment	Immigration of workers and other people	A ***spatial*** and ***thematic*** overlap is expected between SGFD Project Phase 1 and: • the Filyos Integrated Fertilizer Production Facility Project • the Filyos Port/Industrial Zone Connections -Rail Road Project	The presence of other projects in the Project Area, overlapping spatially and temporally with the TP-OTC Project can lead to an increase in the demand of workers, both temporary for construction activities, and permanent for the operation phase. The increase of workers can result in an overall increase of the population in the AoI, which is currently scarcely populated and consists mainly of small villages. The arrival in the area of workers can lead to tensions and conflicts with

Environmental/ Social component	Impact factors	Cumulative type (temporal, spatial, thematic)	Impact definition and mitigation measures
		• BOTAŞ Onshore pipeline and FMS Phase 1 • BOTAŞ Onshore pipeline Phase 2 • the TP-OTC SGFD Project Phase 2 – OPF – Additional Units. A ***temporal*** overlap is also expected between the operation phase of the Sakarya Gas Project Phase 1 and: • the Filyos Integrated Fertilizer Production Facility Project construction and operation phase • BOTAŞ Onshore pipeline and FMS Phase 1 operation phase • the Filyos Port/Industrial Zone Connections - Rail Road Project construction and operation phase • the TP-OTC SGFD Project Phase 2 –OPF – Additional Units construction and operation phase	the local population, potential increase of communicable diseases and additional pressure on the local infrastructure networks. Specific measures have to be implemented, particularly regarding the accommodation of workers, and they can be considered generally effective to reduce the overall impacts towards the local communities. The temporal overlap between projects and hence arrival in the area of workers has to be carefully managed through agreements between project proponents and engagement of local authorities. The employment opportunities generated by the different projects, especially of permanent type during the operation phase, can lead to overall benefits to the local economy, especially considering that the area has seen a decrease of the population, due to emigration of persons in search of better employment opportunities. Measures have been defined to maximize positive impacts and ensure that local communities can benefits of the opportunities generated by the projects. It will be particularly important that the local population is provided through training with the skills required by the projects, to maximize the use of local workforce and reduce the need to employ skilled workers from other areas. The development of the TP-OTC Project and of other projects in the area can therefore represent an important opportunity for economic development in the Project Area.
• Infrastructure and services	Demand for infrastructure services	A ***spatial*** and ***thematic*** overlap is expected between SGFD Project Phase 1 and: • the Filyos Integrated Fertilizer Production Facility Project • the Filyos Port/Industrial Zone Connections -Rail Road Project • BOTAŞ Onshore pipeline and FMS Phase 1 • BOTAŞ Onshore pipeline Phase 2 • the TP-OTC SGFD Project Phase 2 – OPF – Additional Units. A ***temporal*** overlap is also expected between the operation phase of the	The Projects that are expected to be developed in the Project Area will all require infrastructure services such as water and waste disposal services. This cumulation in the need of these services can generate increased pressure and difficulties in being able to provide them from the Municipalities or utility companies. The current level of these services has been identified in the baseline to be adequate, but in some cases some critical issues have been highlighted by representatives of local communities. The scale of the projects planned in the area means that the current infrastructures may not be able to fully respond for example to the demand of water. It is therefore important that the projects plan in advance their infrastructure needs and identify appropriate sources for their procurement, in agreement with local authorities and local utility companies. If this process is well managed it is expected that the impacts generated by the projects should be manageable. In addition, it is possible that due to the needs of the projects,

Environmental/ Social component	Impact factors	Cumulative type (temporal, spatial, thematic)	Impact definition and mitigation measures
		Sakarya Gas Project Phase 1 and: • the Filyos Integrated Fertilizer Production Facility Project construction and operation phase • BOTAŞ Onshore pipeline and FMS Phase 1 • the Filyos Port/Industrial Zone Connections - Rail Road Project construction and operation phase the TP-OTC SGFD Project Phase 2 –OPF – Additional Units construction and operation phase	some of the infrastructure networks are improved (e.g. the water distribution network) and this can become of benefit in general for the local communities.

The spatial and/or temporal overlap between different Projects is likely to generate an accumulation of impacts on the different physical, biological and social components. Although the Projects specifics are not always known, some considerations can be made:

- **Emissions** are expected to be mainly generated by the emission of pollutants together with dust and particulate matter, and noise emissions impacting mainly social, physical and biological Onshore components. Regarding the biological components, such as *Flora* and *Freshwater fauna*, the mitigation measures should allow the achievement of Negligible residual impacts. Cumulative impacts are anyway expected given the spatial and temporal overlap of the Sakarya Gas Field Development Project with other facilities. For all the projects overlapping, specifically the Fertilizer Industry, the "BOTAŞ" Phase 1 Onshore pipeline, the Port/Industrial Zone Connections - Rail Road Project and the TP-OTC SGFD Project Phase 2 – OPF – Additional Units, emissions in atmosphere via the release of dust and particulate matter is hypothesized during construction phase. On the other hand, it is conceivable that pollutants will be mostly emitted during the projects operational phase. Compared to the Sakarya Gas Field Development Project, higher emission rates could be assumed for the Fertilizer industry and the Port/Industrial Zone Connections – Rail Road Project. Regarding the TP-OTC SGFD Project Phase 2, since the nature of the operations to be carried out is likely to be similar to the current Project, it is possible to hypothesized that emissions in atmosphere are likely to be proportional to the expansions that will be implemented for the units built during Phase 1. It should, however, be considered that even after Phase 2, the emissions must be within the standard limits. Regarding underwater noise, a potential overlapping could be hypothesized between TP-OTC SGFD Project Phase 2 construction stage, due to the drilling, testing and development of the 30 additional offshore wells and the monitoring and maintenance of the offshore infrastructures for the operations of Project Phase 1. These activities are expected to generate contained impacts due to the discontinuous and temporary nature of these operations. Concerning the noise generated by drilling activities, although a greater impact on physical and biological components could be hypothesized, the depth at which the works will be carried out (2200 m) and the fact that in the Black Sea most organisms are mainly found in the first 100 meters of the water column, it is conceivable that impacts will be negligible.
- **Water consumption** is expected to affect several physical and biological components. The cumulative impact will possibly depend partly on the withdrawal source and partly on the concomitance with which such withdrawal will be performed. Regarding the Sakarya Gas Field Development Project, water will be extracted from wells, therefore potentially impacting groundwater and surface water by quality and quantity as elaborated in Chapter 7.2.1.5.2 Hydrogeology and Groundwater Quality and Chapter 7.2.1.4.2 Hydrology and Surface Water Quality. Conversely, the Fertilizer Plant is going to extract water directly from the river with relatively higher amounts of water, potentially makes higher quantitative impacts on the riverine surface water hydrology and the freshwater fauna. As per the BOTAŞ Phase 1 Onshore pipeline, water usage during the operation phase is limited. The pre-commissioning phase will include hydrotesting operations, in which water will be drawn from streams close to the pipeline route, likely including the Filyos river. An almost negligible impact is however expected since the water withdrawal should only occur during hydrotesting operations. Regarding the TP-OTC SGFD Project Phase 2, as per the emission in atmosphere, the water consumption may be the greater the greater the built during Phase 1. However, since mitigation measures will be similar to those implemented during Phase 1, comparable impacts can be expected. The Resource Efficiency Management Plan would consider this cumulative impact on water resources. If needed, the water balance, hydrogeological model would be revised, followed by developing additional mitigation measures or even water reuse options. Specifically, in the case of the SGFD Phase 1 the mitigation measures implemented ensure low residual impact and a Negligible one for the freshwater fauna.

- **Changes in flow/circulation in natural water bodies** generated by the wastewater discharges into Filyos River from the OPF and Filyos Integrated Fertilizer Production Facility Project, and by the construction activities for the Filyos Railway Bridge within Filyos Port/Industrial Zone Connections – Railroad project and the river crossing of "BOTAŞ" Phase 1 Onshore pipeline are expected to contribute to the freshwater habitat fragmentation as well as direct negative effect on river water quality, freshwater fauna and riparian vegetation. While the discharge of wastewater from the OPF and, similarly, that expected from the Fertilizer Production Facility, can be defined as negligibly impacting the flow/circulation in the river, a greater impact is expected from the construction activities from the Railroad and BOTAŞ pipeline. Active construction on the riverbed will cause the temporary and partial obstruction of flow in the river potentially impacting the fauna and riparian flora in the construction area and the downstream section of the river with also a probable increase of turbidity in the water. A series of mitigation measures have been planned to avoid and reduce impacts from all the mentioned activities and therefore reduce the residual impacts from each project, suggesting that the resulting cumulative impact should remain manageable. In addition, BOTAŞ has already planned a monitoring of baseline conditions (pre-construction surveys) and Rehabilitation/reinstatement Plan (BOTAŞ E&S Assessment) for biological components around the river crossing which, together with the monitoring activities planned as part of the ESIA, will provide all the relevant information on the conditions of freshwater fauna and riparian vegetation and will inform on the possible need for additional mitigation measures.

- **Riverine and seawater contamination** generated by the discharge of wastewater and unintentional leakage of contaminants into water bodies is, among all the impact factors, the one that can act on more components. Although wastewater will be treated to satisfy national and international limits before being poured back into the river, high volumes of treated wastewater could in time still contribute to the eutrophication of the freshwater environment, causing a general avoidance of the area from aquatic species and a potential loss of biodiversity. Moreover, leakages of contaminants that could occur due to accidental spills of hazardous materials or wastewaters from areas in proximity of freshwater bodies could reach the water through leaching, potentially aggravating the expected impacts. Regarding the Sakarya Gas Field Development Project, this impact factor is predicted to be infrequent and of a low intensity, as there are no construction activities directly in freshwater habitats. Greater impacts can be assumed in the case of the operation phase of the Fertilizer Industry, given the use of nitrogen and phosphorus derivates and other chemicals and in the case of the Railway construction phase, given the planned construction of the bridge over Filyos River. An almost negligible impact is expected in the case of the "BOTAŞ" Phase 1 Onshore pipeline, since the discharge of wastewater will, given the current available information, occur only after hydrotesting operations. Considering the pressures applied on the river by the different projects, additional mitigation measures may be taken to ensure a high level of protection of the components involved, including marine waters. In fact, even if diluted by the flow rate of the river, once reached the sea the discharged wastewaters may alter the seawater quality throughout the years (i.e., 20 to 45 years, as stated in 7.3.2), particularly in the surface layer due to the limited mixing of waters in the Black Sea. Depending on the chemical typologies and quantities, a reduction of the photosynthetic ability of the phytoplankton may also be observed, as well as phenomena of acute toxicity and/or in the zooplankton with cascading effects on the whole marine biodiversity. Natural resources that are linked to plankton (fishes, cetaceans and seabirds) may in fact reduce their presence in the area because their food disappearance. To a small extent, seawater contamination can also be caused by the pipeline laying operations, although there is no overlapping of AoIs between the two pipelines (i.e., Phase 1 and Phase 2), if not for their last sections leading to the landfall area. Here the cofferdams installation of Phase 2 could have an impact on the shallow marine coastal area although sediment analysis did not report any abnormal concentration of contaminants and therefore a

resuspension of contaminated sediments is unlikely to have an impact. The same can be said about the leakage of small amounts of contaminants caused by the movement of vessels during construction operations. Given the effects generated by riverine and seawater contamination and the possibility that these accumulate, it may be needed to implement additional measures. **Wells installed before Phase 1** may be subject to some minor accidental leakages during operation which are expected to be immediately detected by the monitoring system included in the "Well Control Plan" from Schlumberger (EPCI). Given the depth (about 2200 m), and the nature of the possible releases, the impacts expected from such uncommon events are considered to be negligible and unluckily to have a spatial or thematic overlapping with other residual impacts from the Project. This is because the offshore area where the wells are located (169 km from the coast) is anoxic below 100 m of depth and generally suitable only to bacterial life forms. In this environment only the pelagic zone above the 100 m is suitable for animal life, which consists of pelagic fish and plankton, and marine mammals. The latter group is only occasionally found at such distance from shore. From a social perspective only marine traffic and the presence of other cables and/or pipelines could cause a cumulative effect on the offshore components although, as per the biological components, this is expected to be negligible given the depth and distance from shore. The installation of the additional wells in Phase 2 could also produce releases of sediments and groundwater from wells drilling activities, these will be undertaken under EPCI supervision and according to their operation procedures. Furthermore, a field investigation for a detailed baseline study (including pelagic and benthic environments) will be carried out as part of the Phase 2 ESIA, providing information on possible impacts and receptors in the area, and informing on possible cumulative impacts requiring additional mitigation measures.

- **Habitat loss and fragmentation** is expected to be predominantly generated through vegetation clearing and the presence of new Onshore infrastructures and to essentially impact the Onshore biological components, such as *Birds, Terrestrial fauna* and *Freshwater fauna.* In the Sakarya Gas Field Development Project the residual impact is expected to be Negligible, since the removal of vegetation will interest a minor part of the Project Area and the mitigation measures proposed are expected to offer a substantial recovery. However, the presence of new Onshore infrastructures, is expected to have a potential Low residual impact especially on *Birds*. During the Project operation phase, the presence of permanent energy transmission line (ETL) and of vertical and linear infrastructures such as the new powerline, could affect bird species by causing habitat fragmentation and by increasing individuals' mortality due to collision and electrocution. The implementation of mitigation measures should nevertheless ensure a Low residual impact. As regards the Fertilizer Industry since it will be constructed within the industrial area (an environment that is already modified), it is possible to assume that any impact will be essentially due to the presence of new infrastructures. Different is the case of the railway and the Onshore pipeline, whose construction will require the modification of the natural habitat, likely generating greater impacts. For instance, the BOTAŞ pipeline is located for the most part in natural habitat and in the "Sofular Tepeleri" Key Biodiversity Area (KBA) in which critically endangered and/or endemic species are potentially present. Particular attention must therefore be paid to this impact factor, possibly carrying out additional measures in the event of a particularly significant concomitance of the projects and so as to preserve, where possible, habitats integrity.
- **Visual aesthetics** will be cumulatively impacted by other projects that will be developed in the Project Area. These projects will introduce new buildings and infrastructures in the area, that due to their size and shape can have a significant visual impact. Mitigation measures can be introduced in terms of colour of the elements, presence of visual barriers and use of vegetations to limit the overall impact.
- **Land acquisition** will be necessary also for the other projects that will be developed in the Project Area. Some of these projects will be developed in the industrial zone, for which the land acquisition process has

already been completed, however for other projects land will be needed outside this area and hence will entail additional land acquisition, changing the overall land use compared to the current situation.

- **Increase and modification of traffic Onshore** is expected along the road network both during the project construction and operation phase, posing a threat to wildlife fauna (namely *Freshwater fauna, terrestrial fauna* and *Birds*) due to a high risk of accidental collisions, to *Health issues and facilities*, due to the emission of noise and pollutants, and the increased risk of traffic accidents and also to *Air quality.* For the biological components, although the impact value is between medium and high, the mitigation measures implemented ensure the residual impact to be overall Low. An increase in road traffic is expected also for other projects, both during the construction and operation phase. It is hypothesized that risks of collisions with wildlife fauna will increase proportionally to the higher traffic volume involved in the construction and operation phases, however, no information is currently available on the number of vehicles that are going to be used for such operations. The increase of traffic can potentially create interferences with current traffic conditions, including congestions and increased time necessary to travel along the road. This can be particularly relevant in villages or in crossroads where traffic is already significant. The additional traffic can also worsen the conditions of the roads, especially if they are already not in a very good state. A Traffic Management Plan (SC26-OTC-PRJ-RS-PLN-000001 / Filyos Project Area Traffic Management Plan) has already been prepared and in force, which will be revised in compliance with the mitigations developed in the final ESIA Report and implemented, to ensure the application of measures that can reduce impacts generated by the additional traffic due to the Project. Measures will include liaising with local authorities to identify and agree on specific solutions, that can include avoiding traffic at certain hours or using alternative routes for specific vehicles.
- **Immigration of workers and other people** will occur due to the SGFD Project and other projects planned in the area. The increase of workers can result in an overall increase of the population in the AoI, which is currently scarcely populated and consists mainly of small villages. The arrival in the area of workers can lead to tensions and conflicts with the local population, potential increase of communicable diseases and additional pressure on the local infrastructure networks. Specific measures have to be implemented, particularly regarding the accommodation of workers, and they can be considered generally effective to reduce the overall impacts towards the local communities.
- **Demand for infrastructure services** will be generated also by the other projects to be developed in the Project Area. The cumulation in the need of these services can generate increased pressure and difficulties in being able to provide them from the Municipalities or utility companies. The current level of these services has been identified in the baseline to be adequate, but in some cases some critical issues have been highlighted by representatives of local communities. The scale of the projects planned in the area means that the current infrastructures may not be able to fully respond for example to the demand of water, and careful planning will have to be implemented to reduce disruptions to the extent possible.

As stated in section 10.2, a total of 8 additional facilities will only fall into the *Social* component AoI. It can be therefore hypothesized that potential cumulative impacts will have minor effects than those generated by the ones overlapping the Areas of Influence of multiple components. Some of the expected cumulative impacts, in are immigration of workers and other people, demand for workforce demand for goods materials and services, local inflation, changes in land use, increase and modification of traffic onshore, demand for freshwater, demand for waste disposal services. As the temporal overlap of these facilities are unknown it is not possible to estimate their overall impacts. It would be essential to follow-up these projects' progress and develop mitigation measures as needed and as relevant, targeting a negligible to low residual impact value.

Access restrictions for sea users is not anticipated in other projects, as such a cumulative impact has not been identified.

The expected contributing facilities to any cumulative impact on physical and biological components within the Project's AoI are limited to those from the Filyos Integrated Fertilizer Production Facility Project, the Filyos Port/Industrial Zone Connections - Rail Road Project, BOTAŞ Onshore pipeline and FMS Phase 1, BOTAŞ Onshore pipeline Phase 2, the TP-OTC SGFD Project Phase 2 – OPF – Additional Units. The overall evaluation of such impacts showed a low to negligible contribution (residual impact) of the Project for all the identified components. In the eventuality of additional residual or direct impacts from the beforementioned projects the only elements requiring particular attention have been indicated as those regarding atmospheric emissions, riverine and seawater contamination, and the increase and modifications of traffic. The presence of such potentially criticalities, also affecting sensible components (i.e., habitats, birds, freshwater fauna, etc.), highlights the necessity to properly implement the monitoring measures proposed in this document and to promptly intervene to assess and, when needed, further mitigate in case any contamination or negative interaction with traffic is detected.

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