similarity in lower levels (e.g., ‰39.11 at 19.93 m depth). The density at the surface varies between 28.50 and 28.52 sigma-t. The maximum density was recorded at the sea floor as 28.66 sigma-t at 19.93 m depth.

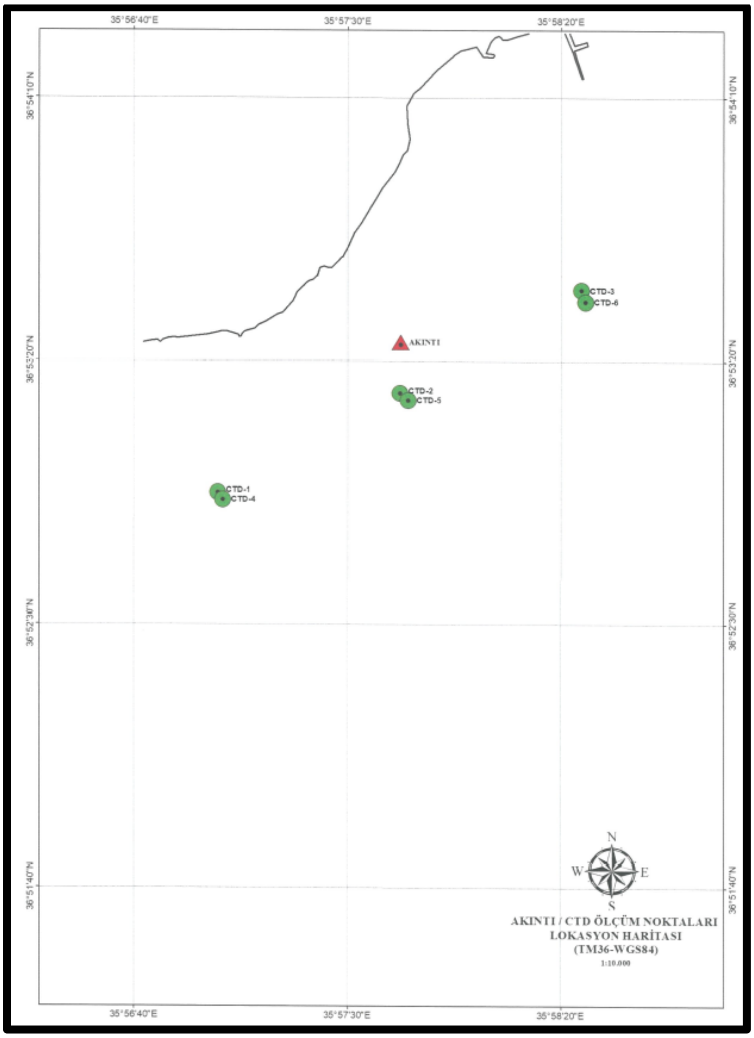

Figure 7-18. CTD Measurement Points (locations indicated with green)

Apart from the hydrographic and oceanographic studies, seawater and sediment samples were collected and analysed within the scope of the EIA study for the CPIR Port Project which also includes the Terminal Facility site which is an associated facility of the Ceyhan PDH-PP Project. The results of the sediment quality analyses are discussed in Chapter 6: Geology, Soils, Sediments, and Contaminated Land. In total, four seawater samples (SWS) were collected and analysed (SWS 1&2 were analysed for general seawater quality in June 2020 and SWS 3&4 for bathing water quality in July 2020). In order to assess the baseline conditions, seawater samples were collected from the shoreline of İncirli beach to the west of the Project site and the shoreline located between Toros Agri Industry and the CPIR Port Project site located to the east of the Jetty site in the associated Terminal Facility. The bathing water quality for SWS 3&4 were analysed in line with Bathing Quality Criteria and Class for coastal waters and transitions presented in Annex I Table 2 of Regulation on Management of

Bathing Water Quality (O.G. date/number: 25.09.2019/30899). The analysis results are presented in Table 7-8 and Table 7-9.

Table 7-8. Seawater Quality

Parameter	Unit	Seawater sample-1 (SWS-1)	Seawater sample-2 (SWS-2)	Measurement Uncertainty	General Quality Criteria (WPCR-Table 4)
Colour	Pt-co	<5	<5	%± 13.2	Natural
pH	-	8.31	8.27	%± 1.11	6.0-9.0
Dissolved oxygen /saturation level	mg/L / %	8.62 / 100.1	8.26/96	%± 2.32	More than 90% of saturation
Floating solids	-	None	None	-	-
Ammonia	mg/L	<0.02	<0.02	%± 13.92	0.02
Suspended solids	mg/L	<10	<10	%± 7.84	30
Biological oxygen demand (BOD)	mg/L	<4	<4	%± 6.05	-
Chlorophyll -a	µg/L	<1	<1	%± 18.7	-
Crude oil and derivatives	mg/L	<0.1	<0.1	%± 17.6	0.003
Phenols	mg/L	<0.001	<0.001	-	0.001
Turbidity	NTU	0.102	0.107	%± 22	Natural
Toxicity	-	<2	<2	%± 11.2	None
Hg	mg/L	<0.001	<0.001	%± 15.3	0.004
As	mg/L	<0.005	<0.005	%± 15.3	0.1
Cd	mg/L	<0.005	<0.005	%± 12.7	0.01
Pb	mg/L	<0.005	<0.005	%± 12.6	0.1
Cu	mg/L	<0.01	<0.01	%± 12.8	0.01
Cr	mg/L	<0.01	<0.01	%± 13.6	0.1
Ni	mg/L	<0.05	<0.05	%± 12.7	0.1
Zn	mg/L	<0.05	<0.05	%± 12.6	0.1

Table 7-9. Bathing Water Quality

Parameter	Unit	Seawater sample-3 (SWS-1)	Seawater sample-4 (SWS-2)	Bathing Quality Criteria and Class for coastal waters and transitions (Annex I Table 2 of RMBWQ***)		
				Excellent	Good	Sufficient
Intestinal enterococci	(cfu/100 ml)	70	20	100*	200*	185**
Escherichia coli	(cfu/100 ml)	0	0	250*	500*	500**

*Depending on an assessment of 95percentile.
** Depending on an assessment of 90percentile.
*** Regulation on Management of Bathing Water Quality (O.G. date/number: 25.09.2019/30899)

As can be seen in Table 7-8 and Table 7-9, the results of the seawater samples are within the limit values presented in Water Pollution Control Regulation and Regulation on Management of Bathing Water Quality.

There are several internationally accepted frameworks that are developed to control and prevent marine pollution including ship-sourced marine pollution to protect the marine environment. These are the Convention for the Protection of the Marine Environment, and the Coastal Region of the Mediterranean; Barcelona Convention (1976); International Convention for the Prevention of Pollution from Ships (MARPOL-73 Convention, as modified by the Protocol (MARPOL-78 Protocol)) (1983); International Convention on the Establishment of an International Fund for Compensation of Oil Pollution (FUND 2003); Protocol on Preparedness, Response and Cooperation to Pollution Incidents by Hazardous and Noxious Substances; and International Convention on Oil Pollution Preparedness, Response, and Cooperation (OPRC 1990). A comprehensive list of the internationally accepted conventions, especially including conventions dealing with ship-sourced marine pollution is presented in *Chapter 3: Institutional and Regulatory Framework* and *Chapter 8: Material Resources and Waste Management*.

7.5 Water Use and Potential Water Supply of the Project and Associated Facilities

The water requirements of the Project including its Associated Facilities during the construction and operation phases are summarised below. Detailed information on water use is provided in Chapter 8 of this document.

During the construction phase:

- Estimated water requirement for construction activities is 2,142 m^3/day;
- Estimated water use for dust suppression is 25 m^3/day;
- Drinking water will be supplied as bottled water or with carboys purchased from an external supplier.

During the operation phase:

- Estimated process water use is approximately 600 m^3/hour;
- 19,000 tons of water will be circulated for cooling.

Related to the raw water supply of the Project, the Project Company is currently consulting with relevant authorities (i.e., DSI and Adana ASKI) and the Management Company, who is responsible for providing all required infrastructure for the projects to be developed within the scope and boundaries of the CPIR. In that respect, the Management Company has issued an official letter dated 12.08.2020, stating that the required 106 MW of electricity, 14,400 m^3/day of raw water, and 11,085 Nm^3/hour of natural gas will be supplied by the Management Company. The Project Company shall follow up with the Management Company for the sources of electricity, raw water, and natural gas and evaluate potential environmental and/or social risks, if any.

According to the official communications of the Management Company with the MoIT regarding the water supply to the CPIR (foreseen as a minimum of 200 L/s for the preliminary stage in the construction phase and 400-450 L/s for the subsequent stages) a water supply feasibility study was conducted by the General Directorate of State Hydraulic Works. Within the scope of a Water Supply Assessment Study among the alternatives evaluated by DSI the use of Aslantaş Reservoir to supply water to the site was identified to be the most feasible. A water supply line is recommended by DSI to be established with a capacity to meet the water demand of the CPIR along with the potential industrial facilities that might be established in the future in the region. The official communications between the Management Company, MoIT, DSI, and the Directorate of Water and Sewer Works of Adana Metropolitan Municipality (ASKİ) on the establishment of the relevant water supply line from the Aslantaş Reservoir to the CPIR continue to date. The procedure for the establishment of a protocol for the financing and construction of the water supply line is still in progress (official correspondence of DSI dated 16.03. 2020 with the official letter number 180662 and official correspondence of the General Directorate of Industrial Regions of MoIT dated 21.04.2020 with the official letter number 1507259).

7.6 Impacts

The significance criteria that were used for assessing impacts on surface water and groundwater resources are established by evaluating the magnitude of the impacts together with the sensitivity/vulnerability/importance of the receptors. Impact significances are determined based on the methodology given in Chapter 4 of this ESIA Report with more detailed descriptions of the impact magnitude types and receptor sensitivities given in the Table 7-10 to Table 7-13 below.

Table 7-10. Magnitude of Impact on Surface Water Resources (including seawater)

Magnitude	Description
Negligible	- Contamination of surface water that is temporary in nature and that does not degrade the existing surface water runoff quality; - Potential short-term localised effects on water quality but likely to be highly transitory (e.g., lasting a matter of hours) and well within natural fluctuations; - No likely alterations to existing drainage regimes and characteristics at any time of year.
Low	- Contamination of surface water that degrades the surface water runoff quality by 10% of the original water quality; - Potential short-term localised effects on water quality but which are likely to return to equilibrium conditions within a short timeframe (e.g., hours or days at most); - There are no known / expected physical (property, agricultural fields, infrastructure, etc.) or sensitive ecological receptors upstream or downstream within the catchment that could be affected by the affected drainage regime.
Moderate	- Contamination of surface water that degrades the existing water quality by 50% of the original water quality but still within original surface water usage classification for use; - Potential localized effects on water quality which are likely to be fairly long-lasting (e.g., weeks or months) and/or give rise to indirect ecological and/or socio-economic impacts; - Known / expected physical (property, agricultural fields, infrastructure etc.) or sensitive ecological receptors upstream or downstream within the catchment that could experience an increase in flood frequency (above baseline conditions) as a result of the Project.

Magnitude	Description
High	- Contamination of surface water that degrades the existing water quality more than 50% of the original water quality or increases the surface water classification usage above its original value; - Potentially severe effects on surface water quality which are likely to be long-lasting (e.g., months or more) or permanent and/or give rise to indirect ecological and/or socio-economic impacts; - Known / expected physical (property, agricultural fields, infrastructure etc.) or sensitive ecological receptors upstream or downstream within the catchment that could experience a "significant" increase in flood frequency (above baseline conditions) as a result of the Project.

Table 7-11. Surface water sensitivity/vulnerability/importance (including seawater)

Value	Description
Low	- Watercourse located in the vicinity does not support diverse aquatic habitat; - Watercourse is already significantly modified from the natural condition in some aspects; - Watercourse with little or no community use; - Watercourse is in Class IV character according to Table 2 of Annex 5 of the Surface Water Quality Management Regulation (SWMR).
Medium	- Watercourse supports diverse populations of aquatic habitats; - Watercourse provides ecosystem services to some extent; - Watercourse is used for local water supply sources, small industrial abstractions, or minor irrigation schemes; - Watercourse is in Class III or Class II character according to Table 2 of Annex 5 of the SWMR.
High	- Watercourse has high quality e.g., in its natural state and with ecological importance; - Watercourse provides vital ecosystem services; - Watercourse is used for urban water supply, major industrial abstractions, or large irrigation supply; - Watercourse is in Class I character according to Table 2 of Annex 5 of the SWMR.

Table 7-12. Magnitude of impact on Groundwater Resources

Magnitude	Description
Negligible	- Discharges into the groundwater environment are expected to be well within statutory limits; - Impacts on existing groundwater environment yield capabilities are negligible.
Low	- Discharges into groundwater are expected to be within (but perhaps close to) statutory limits and will cause background levels to increase but still remain below the generic risk levels for all sites (levels provided in Turkish Regulation on Soil Pollution Control and Point Source Contaminated Sites); - Impacts on existing groundwater environment yield capabilities are small and will not alter usage capability.
Moderate	- Discharges to groundwater bodies are expected to cause breach(s) of statutory limits (over limited periods) and cause background levels to be below the site-specific but above the generic long-term cancer and/or hazard risk levels (provided in Turkish Regulation on Soil Pollution Control and Point Source Contaminated Sites); - Impacts on existing groundwater environment yield capabilities are medium and will alter usage capability so as to affect potential or existing groundwater users.
High	- Discharges to groundwater are likely to cause breaches of statutory discharge limits (over extended periods) and cause background levels above the site-specific, long-term cancer and/or hazard risk levels (provided in Turkish Regulation on Soil Pollution Control and Point Source Contaminated Sites); - Impacts on existing groundwater environment yield capabilities are large and will significantly alter usage capability so as to affect potential or existing groundwater users.

Table 7-13. Groundwater resource sensitivity/vulnerability/importance

Value	Description
Low	- Non-aquifer characteristic (e.g., water-bearing zone with very low permeability) or groundwater in deep aquifers that will not be impacted from project related activities; - Groundwater with low quality unfit for use by the community; - Groundwater that does not provide or provides very little baseflow to surface watercourses or supported habitats.
	- Medium-quality groundwater that could be used by the industry as process water; - Groundwater that provides baseflow to surface watercourses used for water resources with Classification Class III and Class II according to Table 5 of Annex 5 of the SWMR; - Groundwater that is abstracted for industrial purposes or agriculture (i.e., irrigation purposes).
High	- High-quality groundwater that is used for drinking or domestic purposes; - Groundwater that provides baseflow to surface watercourses that have high-quality Classification (Class I according to Table 5 of Annex 5 of the SWMR) or supports a wetland with ecological importance.

7.6.1 Scoping of the Impacts during Construction and Operation

The following points are particularly taken into consideration for the evaluation of the impact magnitudes and sensitivities related to the Project together with its Associated Facilities and environment for the assessment of the Impacts Related to Water Resources and Water Supply:

- There are no surface waters flowing within the Project site however, there is a dry riverbed along the northeast boundary of the Project site;
- The water quality analysis results at the monitoring station (Station ID: CEGİN010) on the Ceyhan River by the MoEU indicated Class IV surface water quality due to aluminium, total coliform, faecal coliform concentrations (MoEU, 2016);
- Since the region is not within 100-year flood risk areas of any major rivers, the risk of flooding is found to be significantly low (Selensu, 2018);
- A site drainage system will be established in the Project site in accordance with the “Drainage and Wastewater Gathering Philosophy” dated 21 November 2019 and “Specification for Drainage” dated 17 February 2020 reports prepared for the Project. The drainage system will be designed and constructed in order to separately collect and manage different types of drainage water including site runoff and drainage from construction and operation sites. Details of the management of the site drainage and the site drainage system are given in *Chapter 8: Material Resources and Waste Management*;
- According to the analysis of the ecological quality status of the coastal water bodies in the Mediterranean Sea the water quality of the inner parts (i.e., close to the coastline) of the İskenderun Bay, neighbouring the Project site is classified as “Good” in 2016 and “Moderate” in 2018, and the offshore water quality as “Very Good” in 2016 and “Good” in 2018 (Marine Quality Bulletin for the Mediterranean Sea in 2018 and Adana

Environmental Status Report, 2018). Hence, the water quality particularly in the inner parts of the bay is susceptible to deterioration due to baseline pollutant loads into the bay which are transmitted to the sea through the discharge of the Ceyhan River;

- Seawater samples collected from the shoreline of İncirli beach to the west of the Project site, and the shoreline located between Toros Agri Industry and the CPIR Port Project site located to the east of the proposed Jetty site of the associated Terminal Facility; and seawater samples collected from the vicinities of the proposed Terminal Facility site, and the Project site were analysed for bathing water quality criteria (as per the Regulation on Management of Bathing Water Quality) and for general water quality criteria (as per the WPCR), respectively. Accordingly, seawater is identified to be of high quality regarding the physiochemical parameters and with "Excellent" quality regarding the bathing water criteria;
- Groundwater was not observed at any of the boreholes in and in the vicinity of the Project site up to 9 m;
- According to the Hydrology and Hydrogeology Assessment Report of the CPIR Port seasonal groundwater discharge may be seen on the Project site. Accordingly, the groundwater table in the region varies between 5 to 75 m; whereas it is envisaged that the level within the Project site varies between 1 to 10 m (Dolfen, 2021). The study indicated the groundwater flow direction at the Project site is to the east towards İskenderun Bay;
- According to the most recent geological/geotechnical site investigation study, Selensu (2020) reports that depending on the ground formation (mainly basalt bedrock), groundwater potential at the site is very low and groundwater level is below the excavation level within the Project site;
- The closest groundwater abstraction wells to the Project site are located approximately 2 km southwest and 3 km northwest of the Project site;
- Currently, it is not planned to drill a new well to extract groundwater for the purposes of the Project, during the construction and operation phases. However, the potential of using groundwater from existing groundwater wells around the Project site during the construction phase of the Project is being consulted with Ceyhan Petrokimya A.Ş., DSI and Adana ASKİ;
- Regarding the energy, and water requirements of the Project, the Management Company of the CPIR has issued an official letter dated 12.08.2020 stating that the required 106 MW of electricity, 14,400 m3/day of raw water, and 11,085 Nm3/hour of natural gas will be supplied by the Management Company. The Project Company shall follow up with the Management Company on the sources of the electricity, raw water, and natural gas and evaluate potential environmental and/or social risks, if any;
- According to the existing construction planning, water required for construction works will be supplied by tanker trucks from the existing municipality line. At the same time,

the Project Company has applied to the DSI about water demand related to the construction works;

- The water requirement during the operation phase will be met from the transmission line that will transmit water from Aslantas Dam (approximately 60 km to the northeast of the Project site) to serve the Industrial facilities in the region including the CPIR Project and the Ceyhan PDH-PP Plant in it. For raw water supply to the CPIR, official communications on the establishment of a Protocol between Management Company, ASKI, and DSI regarding financing and construction of the water supply line from Aslantas Reservoir as recommended by the DSI is still in progress, (official letters of DSI dated 16.03. 2020 with the official letter number 180662 and General Directorate of Industrial Regions of MoIT dated 21.04.2020 with the official letter number 1507259).

7.6.2 Impacts during Construction

Impacts of Construction Activities on Surface Water

Several construction activities may adversely impact surface water resources. These activities include soil movement due to excavations and the presence of stockpiles of exposed soil which may lead to suspended sediment in runoff from work sites. Exposed soils that are dampened to reduce dust emissions as well as water used to wash the wheels of the construction vehicles may also produce surface runoff from the site. Runoff during construction will likely be prominent during rainfall events. Without appropriate management, these activities have the potential to impact the quality of nearby surface waters through increased suspended solids and bottom siltation.

Impacts may also occur as a result of accidental spills from the use of hazardous materials (fuel oil and/or lubricants) as well as construction materials during construction which may contaminate the surface water drainage and cause degradation in water quality. Spills may also occur from the refuelling of equipment during construction.

Impacts of Construction Activities on Ground Water

According to the Geotechnical Investigation Report, groundwater was not observed at any of the borehole locations drilled up to 9 m. However, impacts may still occur as a result of accidental spills from the use of hazardous materials (fuel oil and/or lubricants) as well as construction materials during construction which may migrate off and also infiltrate into the groundwater table causing degradation of the water quality. Spills may also occur from the refuelling of equipment during construction.

Impacts of Construction Activities on Seawater

The daily domestic wastewater generation on site is expected to be 1,500 m^3/day during construction phase. Currently, there is no sewerage infrastructure extending to the proximity of the Project site. Domestic wastewater generated during the construction phase, if not managed properly, may affect the environment adversely. Furthermore, during the construction of the Jetty site of the associated Terminal Facility of the Project impacts may be observed in the case of inadequate environmental management. Table 7-16 and Table 7-15 show the summary of the respective impact magnitudes and related sensitivities during construction phase. Impact significances are determined based on the methodology given in Chapter 4 of this ESIA Report. The assessment of relevant impact significances for the construction phase is given in Table 7-16.

Table 7-14. Construction Phase Impact Magnitudes

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Impacts of Construction Activities on Surface Water	Negative Direct	Definition	Considering potential impacts during the material transport in the construction phase (e.g., material transfer from the borrow pit) the geographical extent of the impact is expected to be regional.	There are no perennial surface waters in the vicinity of the Project site or its associated facilities. Hence, potential impacts might only include contaminated runoff water from the site and contamination related to the potential migration of dust. Hence, such impacts are estimated to be limited to the intermittent incidents during construction works, and mainly limited to increased suspended solid loads.	Impacts on surface waters in the region is not estimated to exceed medium intensity since the potential impact is expected to be mostly limited to sediment transport and intermittent increase in suspended solids content in the case that no measures are taken during construction.	NA	Considering the distance of the perennial surface waters to the Project site the impact is expected to be unlikely.	Due to the potential nature and intensity, the relevant impacts are expected to be reversible in the short term by restoration.
		Score	Regional	Short	Medium	-	Unlikely	Short-term
		Value	3	2	3	-	1	1
	Impact Magnitude (G+D+I+F (or L)) x R		**9**					

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Impacts of Construction Activities on Ground Water	Negative Direct	Definition	Groundwater contamination due to any spills and leaks will be limited to the Project site considering the groundwater flow direction at the site. However, considering the potential impacts such as potential oil spills or leaks from vehicles during the material transport in the construction phase (e.g., material transfer from the borrow pit) geographical extent of the impact is considered to be regional.	The duration of impacts on groundwater within the Project site during the construction phase is expected to be short. Additionally, any potential impacts during the material transfer are expected to be limited to potential discharges or spills of small quantities of materials. Hence, such impacts are deemed to be for a short duration.	Considering the depth of the groundwater on-site (exceeding 5 meters) and potential contaminant transport means (in the east direction towards nearby İskenderun Bay) and the location of the groundwater wells in the region (no wells are located within the contaminant transport area of the Project site) the impact intensity is not expected to exceed medium scale.	-	Depending on the depth of the water table, the geological formation, and groundwater use at the site, impacts are expected to be unlikely and might be of small scale due to any accidental releases during construction activities.	Due to the expected nature and intensity, the relevant impacts, are expected to be reversible in short-term by restoration.
		Score	Regional	Short	Medium	NA	Unlikely	Short-term
		Value	3	2	3	-	1	1
	Impact Magnitude (G+D+I+F (or L)) x R		**9**					

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Impacts of Construction Activities on Seawater	Negative Direct	Definition	Impacts on seawater quality may arise due to contaminant transport as described above or during construction activities of the Terminal Facility. Depending on the potential contaminant dispersion in the marine environment impacts might be observed on the regional scale.	Impacts are expected to be mainly limited to the duration of the construction of the Jetty of the associated Terminal Facility of the Project (i.e., around two years). Other sources of pollution due to contaminant transfer are expected to be intermittent in character and much more limited in scale hence, duration is expected to be medium.	Impacts on the water quality are expected to be mostly related to the increase in suspended solids content during the construction of the Jetty (of associated Terminal Facility). Furthermore, other types of pollution will be on small scales and limited to accidental releases or improper management of wastewater generated during Jetty (of associated Terminal Facility) construction. Hence, intensity is expected to be medium.	-	During the Jetty construction in the associated Terminal Facility, temporary impacts on seawater quality in the construction site are expected. Other potential impacts connected with accidental spills are expected to be unlikely (i.e., unlikely but possible to occur). Hence, taking all types of potential impacts into consideration, during the construction of the Jetty (of associated Terminal Facility) such impacts are deemed to be likely.	In addition to the natural processes, with proper restoration potential impacts during construction is expected to be reversible in the short to medium term.
		Score	Regional	Medium	Medium	NA	Likely	Short/Mid-term
		Value	3	3	3	-	3	2
	Impact Magnitude (G+D+I+F (or L)) x R		**24**					

Table 7-15. Vulnerabilities and Receptor Sensitivity

Potential Receptor	Sensitivity		
	Sensitivity Score	Description of the Sensitivity	Sensitivity Value
Surface water resources	Medium	There are no perennial watercourses that support aquatic habitats or provide ecosystem services in the vicinity of the Project site. There is only a dry riverbed in the close vicinity. Hence, the main issue regarding the surface waters is the surface runoff in the area that might drain through the natural surface drainage lines. Furthermore, according to the Ceyhan Basin Pollution Prevention Action Plan, Ceyhan River water quality at the closest monitoring location is analysed to be Class IV. Hence, the sensitivity is evaluated to be low to medium.	**3**
Groundwater resources	Medium	The groundwater wells closest to the Project site are 2 km away from the Project site and outside of the potential contaminant transfer area of the Project site. Furthermore, in the case of groundwater abstraction for the use in the Project it would be with industrial purposes. Hence, sensitivity is evaluated to be low to medium.	**3**
Seawater	High	- Analysis of seawater in the vicinity of the Project site and its Associated Facilities for physiochemical parameters (General Water Quality Criteria) and for bacteriological parameters (Bathing Water Criteria) indicated high water quality. - On the other hand, ecological analysis of the seawater in İskenderun Bay by MoEUCC indicated good (in 2016) and moderate (in 2018) water quality for the inner parts of the bay. - The coast of the Yumurtalık and İskenderun bays is densely populated by industrial facilities including a Free Trade Zone with heavy industrial facilities - The sensitivity is evaluated as medium to high.	**5**
Flood risk	Low	The region is not within 100-years flood risk areas of any major rivers, the risk of flood is found to be significantly low. According to the Ceyhan Basin Flood Management Plan, Kurtpınarı neighbourhood (especially İncirli), Kurtkulağı, and Sarıçam, and the immediate surroundings of the Project site are not reported to have flood risk.	**1**

Table 7-16. Impact Significances for Construction Phase

Potentail Impact	Impact Magnitude	Sensitivity	Impact Significance		
			Value	Score	Description
Impacts of Construction Activities on Surface Water	9	3	**27**	**Low**	Potential short-term, localised effects might be likely, particularly for the surface runoff from the Project site. However, no significant impacts are expected on the surface water resources or on any freshwater habitats in the region.
Impacts of Construction Activities on Ground Water	9	3	**27**	**Low**	Potential impacts are not expected to create significant impacts on the groundwater quality, particularly regarding potential risks for the groundwater users in the region.
Impacts of Construction Activities on Seawater	24	5	**120**	**Medium**	Potential localised effects on seawater quality are likely, particularly during the construction of the Jetty site which is part of the associated Terminal Facility. Such effects may create indirect ecological and/or socio-economic impacts. However, impacts are expected to be minimised through precautionary and mitigation measures and good management practices during construction.

7.6.3 Impacts during Operation

Impacts of Operation Activities on Surface Waters

During the operation phase, there will be water demand related to general domestic use (food processing, toilets, etc.) which will be limited with the operational workforce. Raw water will be supplied from outside the Project site; therefore, the Project Company is currently consulting with relevant authorities (i.e., DSI, and Adana ASKI) and Management Company, who is responsible for providing all required infrastructure for the projects to be developed within the scope and boundaries of the CPIR.

Impacts on surface water quality may occur as a result of accidental spills from the use of hazardous materials (fuel oil and/or lubricants) as well as materials used during operation which may contaminate the surface water drainage and cause degradation in water quality.

Impacts of Operation Activities on Seawater

Domestic wastewater and wastes (i.e., sewer, packaging wastes, special wastes); hazardous wastes; wastewater other than domestic wastewater; and medical wastes in small quantities will be generated during operation phase of the Project. Poor management of such wastes (e.g., illegal discharges or dumping) particularly in the Jetty site in the associated Terminal Facility may create impacts on seawater. Furthermore, special waste such as waste mineral oils, waste vegetable oils, battery and accumulators can also give rise to adverse impacts to human and environmental health. These wastes must be managed appropriately during operation in line with the regulations and disposed in licensed facilities.

In addition, to the several sources of effluents that will be generated during operation of the Project, there will be liquid effluents from ships/vessels including sewage, ballast water (from oil tankers), bilge water and vessel cleaning wastewater which may create pollution of seawater unless managed properly.

Other potential indirect sources of seawater pollution due to Project might be contaminated land, groundwater or surface runoff that may be discharged/disposed or transferred to the marine environment due to various contaminant transport mechanisms.

Impacts of Operation Activities on Ground Water

As mentioned above, there will be no extraction of groundwater during construction and operation phases of the Project. Hence, no impact is expected on the groundwater resources regarding the quantity or yield. Impacts on groundwater quality may occur as a result of accidental spills from the use of hazardous materials during the operation phase of the Project.

Flood risk

As it is inferred from the studies conducted in the region, the Project site does not fall into the flood risk areas of any creeks. Therefore, associated impacts related with the flood risk of surface waters are considered as minor significance.

Table 7-17 shows the summary of the respective impact magnitudes during operation phase. Impact significances (Table 7-18) are determined based on the methodology given in Chapter 4 of this ESIA Report.

Table 7-17. Operation Phase Impact Magnitudes

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Impacts of Operation Activities on Surface Water	Negative Direct or Indirect	Definition	Considering potential impacts due to project related offsite traffic including product transport during the operation phase, the geographical extent of the impact is considered to be regional.	There are no perennial surface waters in the vicinity of the Project site or its associated facilities. Hence, potential impacts might only include contaminated runoff water from the site and contamination of surface water resources due to accidental releases from the vehicles during the offsite project traffic Such impacts are considered to be limited to small scales and short durations.	Impacts on surface waters in the region will not exceed medium intensity since the potential impact is expected to be mostly limited to Project site runoff, in the case of improper management of wastewater, and/or chemicals, and no measures are taken to prevent accidental spills.	NA	Considering that there are no perennial surface waters in the vicinity of the project site, potential impacts on surface water quality are expected to be mostly indirect or limited to the surface runoff in or in the vicinities of the Project site. Hence, the impact is expected to be unlikely.	Due to the expected nature and intensity, the relevant impacts are expected to be reversible in the short term by restoration.
		Score	Regional	Short	Medium	-	Unlikely	Short-term
		Value	3	2	3	-	1	1
	Impact Magnitude (G+D+I+F (or L)) x R		**9**					

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Impacts of Operation Activities on Ground Water	Negative Direct	Definition	Groundwater contamination due to any spills and leaks will be limited to the Project site considering the groundwater flow direction in the Project site. However, considering the potential impacts such as potential oil spills or leaks from offsite project traffic geographical extent of the impact is estimated to be regional.	The duration of impacts on groundwater within the Project site is expected to be short. On the other hand, any potential impacts due to offsite project traffic and accidental or emergency conditions may have impacts for a duration that can be classified as medium, particularly if contaminated land due to such incidents is not removed, treated/rehabilitated, or disposed properly which may lead contamination of groundwater.	Considering the depth of the groundwater on-site and potential contaminant transport means (in the east direction towards nearby İskenderun Bay), and the location of the groundwater wells in the region (no wells are located within the contaminant transport area of the Project site) the impact intensity is not expected to exceed medium scale.	-	Depending on the depth of the water table, the geological formation, and groundwater use at the site, impacts are expected to be unlikely.	Due to the expected nature and intensity, the relevant impacts, are expected to be reversible in the short/mid-term by restoration, particularly in accidental incidents or emergency conditions that may create direct or indirect contamination of groundwater resources due to off-site project traffic.
		Score	Regional	Medium	Medium	NA	Unlikely	Short/Mid-term
		Value	3	3	3	-	1	2
	Impact Magnitude (G+D+I+F (or L)) x R		**20**					

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Impacts of Operation Activities on Seawater	Negative Direct	Definition	Impacts on seawater quality may arise in case of poor management of operational activities in the Jetty site which is part of the associated Terminal Facility. Furthermore, inadequate handling of wastewater from the Jetty site (of the associated Terminal Facility) or from the vessels such as discharges from the tankers that deliver raw material to the Project. Due to potential contaminant dispersion in the marine environment impacts might be observed on the regional scale.	In the case of inadequate management of wastewater and onsite handling of wastes or chemicals, particularly at the associated Terminal Facility site, impacts are expected to be for a long duration. Impacts may continue for a long time even after the cessation of the operation unless rehabilitation and restoration are done.	Impacts on the seawater quality due to poor management of wastes and wastewater are expected to be on a small to medium scale. Similarly, contaminant transport to the marine environment due to contamination of soil, or groundwater is expected to be on a medium scale due to the in-situ geological and hydrogeological characteristics.	-	During the operation of the associated Terminal Facility site, improper management of wastes and wastewaters as well as improper operational practices that may increase risks of spills, and/or leaks would cause negative impacts on seawater quality and the marine environment.	In addition to the natural processes, with proper restoration potential impacts during construction is expected to be reversible in the short to medium term.
		Score	Regional	Very long	Medium	NA	Likely	Short/Mid-term
		Value	3	5	3	-	3	2
	Impact Magnitude (G+D+I+F (or L)) x R		**28**					

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Flood risk	Negative Direct	Definition	The Project site is outside of 100-year frequency flood risk areas, potential floods with higher intensity are expected to create regional impacts.	Although unlikely, the risk will continue during the operation phase of the project which is approximately 50 years period.	In the case of improper site management activities (e.g., use of inadequate river crossings or construction on dry riverbeds) severe storm events that might be potentially aggravated by climate change impact may create impacts with medium intensity.	-	Based on the flood studies including the Project site and its vicinities such risks are considered to be unlikely.	With proper restoration, potential impacts are expected to be reversible in the short to medium term.
		Score	Regional	Very long	Medium	NA	Unlikely	Short/Mid-term
		Value	3	5	3	-	2	2
	Impact Magnitude (G+D+I+F (or L)) x R		**26**					

Table 7-18. Impact Significances for Operation Phase

Potentail Impact	Impact Magnitude	Sensitivity	Impact Significance		
			Value	Score	Description
Impacts of Operation Activities on Surface Water	9	3	**27**	**Low**	Potential short-term localised effects might be likely particularly for the surface runoff from the Project site however, no significant impacts are expected on the surface water resources or on any freshwater habitats in the region
Impacts of Operation Activities on Ground Water	20	3	**60**	**Low**	Potential impacts are not expected to create a significant impact on the groundwater quality, particularly regarding potential risks for the groundwater users in the region.
Impacts of Operation Activities on Seawater	28	5	**140**	**Medium**	Unless adequate mitigation measures are taken, and good management practices are followed, leaks, spills, or discharges of wastes, chemicals or any hazardous chemicals may create long-term impacts, particularly during the operation of the associated Terminal Facility. However, such impacts are expected to be minimised by proper mitigation measures taken on the Project site by the Project Company, and on the Terminal Facility site by the third-party operating company.
Flood Risk	26	1	**26**	**Low**	There are no known / expected physical (property, agricultural fields, infrastructure, etc.) or sensitive ecological receptors upstream or downstream within the catchment that could be affected by the affected drainage regime.

7.7 Mitigation Measures

To avoid the impacts during the construction and operation phases of the Project mitigation measures will be taken during the activities in the Project site, and Associated Facilities including the Terminal Facility. For the prevention of degradation of the water quality of surface waters, groundwater and seawater adequate waste and wastewater management practices in line with the national and international regulations and guidelines will be followed. In that scope, a Membrane Bioreactor (MBR) wastewater treatment plant (WWTP) will be established at the project site for the domestic wastewater to be generated during the construction phase of the Project. Treated effluent will be discharged to the sea via effluent pumps after it is ensured that the effluent quality meets the national regulatory discharge limits. Hence, there will be no direct discharges to the environment during the construction phase. The details of the WWTP are discussed in *Chapter 8: Material Resources and Waste Management*.

For the operation phase, a wastewater treatment plant will be established at the Project site to treat oil-contaminated wastewater and other contaminated wastewater streams originating from the process, utility and offsite units in order to meet the regulatory limits. The treated stream will be transferred to the treated wastewater pond. Treated effluent will be discharged to the sea via effluent pumps after it is ensured that the effluent quality meets the national regulatory discharge limits. Regarding the discharges, the provisions and limits that are set in the Water Pollution Control Regulation (Table 4 sets limits for general quality criteria for sea water and other relevant threshold limits, Table 14-12 sets limits for Discharge standards for wastewater generated from chemical industry to receiving environment) and guideline values in the IFC's General EHS Guideline 1.3 Wastewater and Ambient Water Quality shall be followed. Wastewater effluents will not be discharged unless the relevant effluent criteria for discharge to environment are met. The further impacts and mitigation measures are discussed in *Chapter 8: Material Resources and Waste Management*. Considering that site drainage plan will be implemented for collection of domestic wastewaters at the Project Site, no direct discharges to the surface waters are expected to occur during the operation phase.

The project design and resource planning include water supply from outside resources. During the construction phase, drinking water will be supplied as bottled water or with carboys purchased from external suppliers. No water abstraction from groundwater or surface water resources is planned for the Project construction phase. Water demand for construction activities and dust suppression will be supplied from the existing municipality line. Even though there are no estimations of a need for groundwater use during the Project, in the case of the need for groundwater extraction, any necessary permits in the scope of relevant legislation will be obtained first. In case of any groundwater use, the groundwater sources in the vicinity of the CPIR Project site as well as their purpose of use shall be assessed. Groundwater flow shall be studied. Hence, potential impacts on aquifers, and groundwater wells at the site shall be assessed and mitigation measures shall be developed. During operation, a closed cooling system will be used to reduce the water demand and prevent wastewater generation. The water demand during the operation phase including process water, start-up water for cooling system, and potable water will be supplied from the Aslantaş Dam through the water transmission line that will serve the Industrial facilities in the region including the CPIR Project and the Project in it.

During the operation of the Project's associated Terminal Facility regarding the in-situ waste management, in order to follow the best management practices, means that will minimise waste production and maximize recycling through the reuse of wastes, will be developed in order to prevent environmental, particularly marine pollution. In addition, the Project Company will provide relevant financial liability insurances to the Turkish Government as required by International and National legislation. The Associated Terminal Facility which will be constructed and operated by a third party is not planned to have a waste reception facility. However, the operating company of the Terminal Facility is expected to make necessary communications and agreements with the waste reception facility to be operated by Adana Metropolitan Municipality. All wastes created within the associated Terminal Facility are expected to be disposed of in accordance with the related legislations and the provisions of MARPOL 73/78 by the operating company of the Terminal Facility. Furthermore, it is expected that necessary measures shall be taken, in order to prevent accidental or intentional disposal of the construction wastes into the sea and spills and leaks oil and petroleum products into the sea, during the construction stage.

Moreover, in order to prevent impacts such as sediment transport, contamination by chemicals or due to storage of construction materials, the construction activities will be carefully managed and monitored (e.g., using designated areas for stockpiled soil, interception channels/drains/ bunds in place around working areas to collect site run-off, etc.) and appropriate pre-emptive measures will be taken against hazardous material spills. With these measures in place, no direct discharges into groundwater resources are expected to occur. Similarly, the operation activities will be carefully managed, and specific measures will be developed as part of the management plans which will integrate into the Environmental and Social Management System (ESMS) of the Project.

In addition to the standard procedures to ensure best management practices on site, detailed Construction and Operation Emergency Preparedness and Response Plans shall be prepared before the construction stage, in accordance with the "Act on Guidelines for Response to Emergencies and Compensation of Losses in Case of Pollution of the Marine Environment from Oil and Other Harmful Substances" and its regulations. In case of an emergency this plan shall be executed as quickly as possible.

Regarding the protection of the dry riverbed in the vicinity of the Project site provisions in the Investigation and Explanation Report of the Adana Ceyhan Energy Specialized Industrial Zone 1/1,000 scaled Implementation Zoning Plan and the requirements identified by DSI through their official correspondences with the CPIR Port within the scope of the CPIR Port EIA study will be followed. In that respect the following requirements will be followed:

- All activities other than maintaining the canal structure or road maintenance, are prohibited on the dry riverbed;
- The provisions of the Water Pollution Control Regulation (Official Gazette (O.G.) date/no: 31.12.2004/25687) and Regulation on the Protection of Drinking and Utility Water Basin (O.G. date/no: 28.10.2017/30224) shall be followed;
- In case of any groundwater use, the groundwater sources in the vicinity of the CPIR Project site as well as their purpose of use shall be assessed. Groundwater flow shall be studied. Hence, potential impacts on aquifers, and groundwater wells at the site shall be assessed and mitigation measures shall be proposed;
- Due to the lithological characteristics and potential groundwater sources of the CPIR Port project site, necessary mitigation measures shall be undertaken against spills in order to prevent risks related to groundwater contamination;

- In the case of the use of any springs in the vicinity of the Project site (if available), necessary mitigation measures shall be taken to protect the quality of the spring water;
- Necessary applications concerning permits and official consultations shall be made to the relevant authority if wastewater generated from onsite activities is required to be discharged to the receiving environment after treatment.

Additionally, even though the flood risk in the Project site is significantly low, several mitigation measures and precautions against flooding and water use will be followed in line with the official correspondences by DSI. The requirements given in the relevant official correspondences by DSI are as follows:

- If river crossing is planned to be applied on dry or flowing streams within and in the vicinity of the CPIR Port project site, necessary study shall be undertaken in line with the provisions of the Regulation concerning Disaster on Engineering Structures along Roadways and the related construction activities should only start after the approval of the 6th Regional Directorate of DSI is granted on the hydraulic structures;
- The minimum size of culverts which is applied in the flood control facilities, is 2mx2m;
- Any necessary works shall be made under the control of 6th Regional Directorate of DSI, to ensure that the culverts are not get clogged by materials dragged by runoff (e.g., tree branches etc.).

In addition to the aforementioned mitigation measures which target to ensure the general management of the construction and operation activities to minimise potential impacts to surface water and groundwater the following specific mitigation measures will also be taken during the construction phase:

- Good construction site practices (i.e., measures as described below such as using designated areas for storing materials, regular inspections at construction sites, training of construction workers, placement of sediment traps and/or oil/water, etc.) will be adopted to minimize risks of water pollution;
- Stockpiles of soil will be stored as needed at the designated temporary Excavated Material Storage Area that is located in the north and northeast of the Project site. Additionally, the quality of the excavation materials and fill materials (i.e., brought from outer sources) shall be checked;
- Measures such as the use of hydroseeding (seed water spraying), steel grid wire mesh systems, and/or erosion felts (polyester nets, for bevel control and prevention of erosion) will be taken in bevels and slopes to prevent transport of debris and sediment from bare soil surfaces to downstream areas, to improve the site drainage conditions, and to improve construction site ground condition for the preparation of the Project site, and to ensure the ground and slope stability;

- Supporting mechanical soil protection measures (terraces, trenches, ditches, etc.) shall be designed and established in detail for each slope, where deemed necessary. Thus, any possible sedimentation will be prevented;
- Storage areas for hazardous materials and wastes which will be stored in the field will be designed to provide secondary protection/containment;
- In order to prevent groundwater contamination in case of a spill, spill kits will be present in the areas where the liquid materials are stored. The drainage systems of the areas where these materials are stored will be designed so as to prevent spills and leaks from reaching the stormwater system;
- It will be ensured that the personnel responsible for the management of hazardous materials and wastes have the necessary and appropriate training;
- Construction activities will be regularly inspected on site;
- Construction workers and relevant staff will be trained related to the implementation of good construction site practices and spill response and prevention measures;
- No fuelling of vehicles or equipment will take place within excavated areas. Fuelling shall only be carried out in the designated areas away from surface drainage pathways discharging outside the site;
- No hazardous materials will be stored in excavated areas and all handling of hazardous materials will take place under special supervision;
- Suitably sized impervious bunds or other containment will be installed where hazardous materials are handled (such as fuel storage and loading areas, and hazardous material storage area) to prevent hazardous materials to contaminate the site drainage.

The following mitigation measures will need to be implemented in line with the IFC's General EHS Guidelines during both construction and operation phases:

- All staff and subcontractors will be required to report any incidents, and these will be subject to investigation, and remedial and preventive actions will be taken as needed;
- Regular periodic integrity testing for hazardous material storage equipment (i.e., storage tanks and piping systems) will be conducted and appropriate leak detection systems will be in place;
- Drummed hazardous materials with a total volume equal to or greater than 1,000 L will be stored in areas with impervious surfaces that are sloped or provided with berms to contain a minimum of 25 % of the total storage volume. Drip trays will be used for fuelling mobile equipment;
- Any spillage from handling of fuel and liquids will be immediately contained on site and the contaminated soil will be removed from the site for suitable treatment and/or disposal;

- Periodical reconciliation of tank contents shall be conducted, and visible portions of tanks and piping shall be inspected for leaks;
- Double-walled, composite, or specially coated storage and piping systems shall be used particularly in the use of underground storage tanks and underground piping. If double-walled systems are used, they should provide a means of detecting leaks between the two walls;
- The mitigation measures discussed in Chapter 8: Material Resources and Waste Management will be implemented. The mitigation measures will be specific to the management of wastes including storage, transport and disposal of waste materials generated during construction and operation. Appropriate spill response kits including absorbent materials will be readily available on site. These will be kept in designated areas with specific instructions for their use. Site staff will be trained on the use of spill kits;
- Hazardous material inventories on site will be reduced through inventory management in order to reduce or eliminate potential releases during accidental incidents or emergency conditions.
- Spill response will take place as quickly as possible. Contaminated materials will be collected and sent to appropriate disposal facilities;
- A Hazardous Material Management Program including spill prevention and control plans shall be prepared and implemented;
- Construction and Operation Emergency Preparedness and Response Plans should be developed to ensure the mitigation of spills from hazardous materials during the construction and operation of the Project.

7.8 Residual Impacts

Assuming that mitigation measures mentioned above and those mentioned in relevant chapters (i.e., *Chapter 6: Geology, Soils and Contaminated Land,* and *Chapter 8: Material Resources and Waste Management*) are implemented and good site practices are adopted, the residual impacts on the surface water and groundwater is estimated to be negligible. Similarly, the Flood Risk is estimated to be negligible by adequate design and construction of the Project structures as well as by the establishment of a sufficient site drainage system. Regarding the potential impacts on seawater quality, with the use of pre-emptive measures against accidents and emergency conditions and by the application of good environmental management practices, residual impacts are expected to be low. Further minimisation of the impacts to negligible is considered to be possible by efficient Construction and Operation Emergency Preparedness and Response Plans that will ensure a fast and efficient response to any incidents that may create contamination and continuous monitoring of the seawater quality. The Project Company will develop and strictly implement Construction and Operation Emergency Preparedness and Response Plans against environmental accidents and emergency incidents. Furthermore, development and implementation of an Construction and Operation Emergency Preparedness and Response Plans is expected from the operating company of the Terminal Facility to ensure effective and timely response to potential incidents at the Terminal Facility. Additionally, an onsite Monitoring Plan will be used as part of the ESMS of the Project.

The summary of the residual impact magnitudes and significances for construction and operation phases are shown in Table 7-19 to Table 7-22.

Table 7-19. Construction Phase Residual Impact Magnitudes

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Impacts of Construction Activities on Surface Water	Negative Direct	Definition	On the condition that appropriate pre-emptive measures are taken including the offsite project traffic for the material delivery for construction, the geographical extent of the impact is expected to be limited to the Project site and small-scale accidental incidents.	Proper waste and wastewater management and good environmental management practices will ensure that the potential impacts will be limited to a short duration.	Considering that there are no perennial surface waters in the vicinity of the project site by the application of the mitigation measures the intensity of the potential impacts is expected to be negligible.	NA	Potential impacts on surface water quality during the construction phase are expected to be unlikely by the use of appropriate mitigation measures.	Due to the expected nature and intensity, the relevant impacts are expected to be reversible in the short term by restoration.
		Score	Project site	Short	Negligible	-	Unlikely	Short-term
		Value	1	2	1	-	1	1
	Impact Magnitude (G+D+I+F (or L)) x R		**5**					

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Impacts of Construction Activities on Ground Water	Negative Direct	Definition	On the condition that appropriate pre-emptive measures are taken potential impacts on groundwater is expected to be limited to the Project site.	Proper onsite management of construction materials and chemicals, waste, and wastewater and by following good environmental management practices potential impacts will be limited to short duration.	Considering the depth of the groundwater on-site and potential contaminant transport direction after taking the proper mitigation measures the impact intensity is expected to be negligible.	-	Potential impacts on groundwater quality during the construction phase are expected to be unlikely by the use of appropriate mitigation measures.	Due to the expected nature and intensity, the relevant impacts are expected to be reversible in short-term by natural processes or by limited restoration works.
		Score	Project site	Short	Negligible	NA	Unlikely	Short-term
		Value	1	2	1	-	1	1
	Impact Magnitude (G+D+I+F (or L)) x R		**5**					

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Impacts of Construction Activities on Seawater	Negative Direct	Definition	Proper waste and wastewater management, and environmental best management practices during the construction of the Terminal Facility are expected to minimise the impacts. However, depending on the potential contaminant dispersion in the marine environment impacts might still be observed on the local scale.	After the application of the mitigation measures, potential impacts due to accidental incidents or impacts during the construction of the Jetty site of the associated Terminal Facility such as increased suspended solids concentrations are expected to be mainly limited to intermittent incidents for the duration of the construction and very localised. Hence, such impacts are expected to be observed for a short duration.	Such impacts will be minimized by preventive and responsive mitigation measures. Hence, the residual impacts are expected to be of small intensity.	-	During the Jetty construction in the associated Terminal Facility, temporary and intermittent impacts on seawater quality such as increased suspended solids or turbidity may still be observed. Although other impacts combined with discharges or spills are deemed to be unlikely. Hence, considering various potential impacts, small intensity impacts are evaluated to be likely.	Due to the expected nature and intensity, the relevant impacts are expected to be reversible in short term by natural processes or by limited restoration works.
		Score	Local	Short	Small	NA	Likely	Short-term
		Value	2	1	2	-	3	1
	Impact Magnitude (G+D+I+F (or L)) x R		**8**					

Table 7-20. Construction Phase Residual Impact Significances

Potentail Impact	Impact Magnitude	Sensitivity	Impact Significance		
			Value	Score	Description
Impacts of Construction Activities on Surface Water	5	3	**15**	**Negligible**	With the application of a sound ESMS which includes pre-emptive and responsive mitigation measures as well as continuous environmental monitoring, no significant impacts are expected on surface water resources, combined habitats, or users. Hence, potential impacts are deemed to be 'imperceptible' or is indistinguishable from natural background variations.
Impacts of Construction Activities on Ground Water	5	3	**15**	**Negligible**	With the application of a sound ESMS which includes pre-emptive and responsive mitigation measures as well as continuous environmental monitoring no significant impacts are expected on groundwater resources, or its users. Hence, potential impacts are deemed to be 'imperceptible' or is indistinguishable from natural background variations.
Impacts of Construction Activities on Seawater	8	5	**40**	**Low**	With good environmental management practices during the construction phase, and the application of a sound and efficient EAP and emergency action system potential impacts that are expected to be reduced to a low significance level may be further controlled and managed to be minimised to negligible.

Table 7-21. Operation Phase Residual Impact Magnitudes

Potential Impact	Impact Type		Nature of Impacts (Magnitude designations)					
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Impacts of Operation Activities on Surface Water	Negative Direct or Indirect	Definition	On the condition that appropriate pre-emptive measures are taken during all activities including the offsite project traffic, the geographical extent of the impact is expected to be limited to the Project site due to small-scale accidental incidents.	Proper waste and wastewater management, and good environmental management practices will ensure that the potential impacts will be limited to a short duration.	Considering that there are no perennial surface waters in the vicinity of the project site by the application of the mitigation measures, the intensity of the potential impacts is expected to be negligible.	NA	Potential impacts on surface water quality during the construction phase are expected to be unlikely by the use of appropriate mitigation measures.	Due to the expected nature and intensity, the relevant impacts are expected to be reversible in the short term by restoration.
		Score	Project site	Short	Negligible	-	Unlikely	Short-term
		Value	1	2	1	-	1	1
	Impact Magnitude (G+D+I+F (or L)) x R		**5**					
Impacts of Operation Activities on Ground Water	Negative Direct	Definition	On the condition that appropriate pre-emptive measures are taken, potential impacts on groundwater are expected to be limited to the Project site.	By proper onsite management of construction materials and chemicals, waste, and wastewater and by following good environmental management practices, potential impacts will be limited to a short duration.	Considering the depth of the groundwater on-site and potential contaminant transport direction, after taking the proper mitigation measures, the impact intensity is expected to be low.	-	Depending on the depth of the water table, the geological formation, and groundwater use at the site, impacts are expected to be unlikely.	Due to the expected nature and intensity, the relevant impacts, are expected to be reversible in short term by restoration.
		Score	Project site	Short	Low	NA	Unlikely	Short-term

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
		Value	1	1	2	-	1	1
	Impact Magnitude (G+D+I+F (or L)) x R		**5**					
Impacts of Operation Activities on Seawater	Negative Direct	Definition	Proper waste and wastewater management and best management practices during the operation of the Terminal Facility are expected to minimise the impacts. However, depending on the potential contaminant dispersion in the marine environment impacts might still be observed on the local scale.	After the application of the mitigation measures, potential impacts due to accidental incidents within the Project site or associated Terminal Facility are expected to be intermittent in character. Hence, such impacts that may occur as a result of accidental incidents are expected to continue for not more than 1-year duration.	Such impacts will be minimised by preventive and responsive mitigation measures. Hence, the residual impacts are expected to be on a small scale.	-	During operation of the associated Terminal Facility, although unlikely, accidental releases might still occur.	In addition to the natural processes, with proper restoration potential impacts during construction are expected to be reversible in the short to medium term.
		Score	Local	Short	Low	NA	Unlikely	Short/Mid-term
		Value	2	2	2	-	1	2
	Impact Magnitude (G+D+I+F (or L)) x R		**14**					
Flood risk	Negative Direct	Definition	With the establishment of an efficient stormwater drainage system on site and by following the measures required by DSI, Flood risk is expected to be limited to a local scale.	The Project site is not located in a flood risk area. Additionally, further measures such as the establishment of a sufficient site drainage system are expected to reduce such impacts to a short duration even for high-intensity storm events.	With the use of mitigation measures, such impacts are expected to be of low intensity.	-	There are no surface waters in the vicinity of the Project site with a 100-year flood risk.	With proper restoration, potential impacts are expected to be reversible in the short term.

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
		Score	Local	Very short	Low	NA	Unlikely	Short-term
		Value	2	1	2	-	2	1
	Impact Magnitude (G+D+I+F (or L)) x R		**7**					

Table 7-22. Operation Phase Residual Impact Significances

Potentail Impact	Impact Magnitude	Sensitivity	Impact Significance		
			Value	Score	Description
Impacts of Operation Activities on Surface Water	5	3	**15**	**Negligible**	With the application of a sound ESMS which includes pre-emptive and responsive mitigation measures as well as continuous environmental monitoring, no significant impacts are expected on surface water resources, combined habitats, or users. Hence, potential impacts are deemed to be 'imperceptible' or is indistinguishable from natural background variations.
Impacts of Operation Activities on Ground Water	5	3	**15**	**Negligible**	With the application of a sound ESMS which includes pre-emptive and responsive mitigation measures as well as continuous environmental monitoring, no significant impacts are expected on groundwater resources or its users. Hence, potential impacts are deemed to be 'imperceptible' or is indistinguishable from natural background variations.
Impacts of Operation Activities on Seawater	14	5	**70**	**Low**	With good environmental management practices during the operation phase, and the application of a sound and efficient EAP and emergency action system, potential impacts that are expected to be reduced to a low significance level may be further controlled and managed to be minimised to negligible.
Flood Risk	7	1	**7**	**Negligible**	The project will not create any significant alterations to existing drainage regimes and characteristics at any time of year. Furthermore, with an efficient site drainage system, and the design and construction of the Project elements to follow the best practices, the potential flood risk to the Project's functionality is considered to be negligible.

CEYHAN PROPANE DEHYDROGENATION - POLYPROPYLENE PRODUCTION PROJECT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT

(CHAPTER-8)

FEBRUARY 2023

ANKARA

CEYHAN PROPANE DEHYDROGENATION - POLYPROPYLENE PRODUCTION PROJECT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT

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ABBREVIATIONS

Adana ASKİ	Adana Water and Sewerage Administration
BAT	Best Available Techniques
BOD	Biochemical Oxygen Demand
BREF	Best Available Techniques (BAT) Reference Document
CDS	Closed Drain Systems
Ceyhan PDH-PP Project / Project	Ceyhan Propane Dehydrogenation - Polypropylene Production Facility Project
Ceyhan Petrokimya A.Ş. or Management Company	Ceyhan Petrokimya Endüstri Bölgesi Yönetim A.Ş.
Ceyhan PP A.Ş. or Project Company	Ceyhan Polipropilen Üretim A.Ş.
COD	Chemical Oxygen Demand
CPIR	Ceyhan Petrochemical Industrial Region
CPIR Port	Raw Material Supply, Storage and Port Facility Project
DSI	State Hydraulic Works
E&S	Environmental and Social
EBRD	European Bank for Reconstruction and Development
EHS	Environmental Health and Safety
ESIA	Environmental and Social Impact Assessment
EU	European Union
FFB	First Flush Basin
HVAC	Heating, Ventilation and Air Conditioning
IFC	International Finance Corporation
KKDIK	Turkish Regulation on the Registration, Evaluation, Authorization and Restriction of Chemicals
LPG	Liquefied Petroleum Gas
MoEUCC	Ministry of Environment, Urbanization and Climate Change
NFPA	National Fire Protection Association
NOS	Non-oily sewer system
O.G.	Official Gazette
OWS	Oily Water Sewer
POCS	Possibly Oily Contaminated Sewer
RO	Reverse Osmosis
SDS	Safety Data Sheets
SS	Sanitary Sewer
SWDF	Solid Waste Disposal Facility
TBD	To be determined
Terminal Facility	Jetty and Propane Storage Tank
TUIK	Turkish Statistical Institute
U&O	Utilities and off-site
VOC	Volatile Organic Carbon

8 MATERIAL RESOURCES AND WASTE MANAGEMENT

8.1 Introduction

This chapter consists of the description of the material resources that will be required for the construction and operation of the Project and associated facility, the definition of the waste management baseline conditions, and the types of wastes that will be generated by the Project and associated facility during the construction and operation phases as well as discussion on the potential impacts related to the use of material resources and generated wastes during construction and operation phases of the Project and associated facility. The assessment indicates that water usage and energy efficiency will be important issues in terms of the use of material resources during the operation phase. Furthermore, the following potential issues related to waste management are identified:

- Potential impacts on the environment due to inadequate solid and liquid waste management during construction and operation phases;
- Potential health and safety impacts on the workers and employees due to inadequate waste management during construction and operation phases;
- Potential Environmental, Health, and Safety (EHS) impacts on the community due to inadequate waste disposal practices during construction and operation phases.

The study area covers the Project site and associated facility as well as the whole Adana province for the identification of the supply chain of material resources as well as the waste management facilities and practices which are important regarding the treatment, management and disposal of wastes generated during various phases of the Project.

8.2 Legal Context

8.2.1 National and International Standards for Waste and Chemical Management

All waste management activities such as collection, storage, transport, and disposal during the construction and operation phases of the Project are required to be in full compliance with the regulatory framework. The Turkish regulations that govern the wastes to be generated during the construction and operation of the Project are as follows:

- Environmental Law (No: 2872)
  (Official Gazette date/no: 11.08.1983/18132);
- *Regulation on Environmental Permits and Licenses*
  (Official Gazette date/no: 10.09.2014/29115);
- *Waste Management Regulation*
  (Official Gazette date/no: 02.04.2015/29314);
- *Regulation on Waste Incineration*

(Official Gazette date/no: 06.10.2010/27721);

- *Regulation on Control of Excavated Soil, Construction and Demolition Wastes* (Official Gazette date/no: 18.03.2004/25406);
- *Medical Waste Control Regulation* (Official Gazette date/no: 25.01.2017/29959);
- *Regulation on Management of Waste Oil* (Official Gazette date/no: 21.12.2019/30985);
- *Packaging Waste Control Regulation* (Official Gazette date/no: 27.12.2017/30283);
- *Regulation on Control of Waste Batteries and Accumulators* (Official Gazette date/no: 31.08.2004/25569);
- *Regulation on Control of Waste Vegetable Oils* (Official Gazette date/no: 06.06.2015/29378);
- *Regulation on Control of Waste Electrical and Electronic Equipment* (Official Gazette date/no: 22.05.2012/28300);
- *Circular* (2020/19) on Reception of Wastes from Ships (Date: 08.07.2020)
- *Regulation on Reception of Wastes from Ships and Waste Control* (Official Gazette date/no: 26.12.2004/25682);
- *Zero Waste Regulation* (Official Gazette date/no: 12.07.2019/30829);
- *Regulation on Control of End-of-Life Tires* (Official Gazette date/no: 25.11.2006/26357);
- *Communiqué on Recycling of Certain Non-hazardous Wastes* (Official Gazette date/no: 17.06.2011/27967);
- *Communiqué on Road Transportation of Wastes* (Official Gazette date/no: 20.03.2015/29301);
- *Regulation on Aquaculture* (Official Gazette date/no: 10.03.1995/22223).

All chemical and hazardous substance management practices during the construction and operation phases of the Project are required to be in full compliance with the regulatory framework. The Turkish regulations that govern the consumables to be used during the construction and operation of the Project are as follows:

- *Regulation on Safety Data Sheets for Hazardous Substances and Mixtures* (Official Gazette date/no: 13.12.2014/29204);
- *Regulation on Registration, Evaluation, Permitting, and Restrictions of Chemicals* (Official Gazette date/no: 23.06.2017/30105);
- *Regulation on the Persistent Organic Pollutants* (Official Gazette date/no: 14.11.2018/30595);
- *Regulation on the Classification, Labelling and Packaging of Hazardous Substances and Mixtures*

(Official Gazette date/no: 11.12.2013/28848);

- *Regulation on Road Transportation of Dangerous Goods* (Official Gazette date/no: 24.04.2019/30754);
- *Regulation on Fluorinated Greenhouse Gases* (Official Gazette date/no: 04.01.2018/30291);
- *Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals* (Official Gazette date/no: 23.6.2017/30105).

In addition to the abovementioned Turkish regulations, the following international conventions are required to be followed during the operation of the Associated Terminal Facility for marine pollution prevention:

- International Convention for the Prevention of Pollution from Ships (MARPOL-73 Convention), as modified by the Protocol (MARPOL-78 Protocol) (1983) (Ratification date: 24 June 1990);
- Annexes to the MARPOL; Annex I, Annex II and Annex V (Ratification date: 24 June 1990); Annex III and Annex IV (Ratification date: 14 January 2015); MARPOL 1997 Protocol – Annex VI (Ratification date: 4 February 2014);
- International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM, 2004) (Ratification date: 14 October 2014);
- International Convention on Civil Liability for Bunker Oil Pollution Damage (BUNKERS, 2001) (Ratification date: 26 February 2013);
- International Convention on the Establishment of an International Fund for Compensation of Oil Pollution (FUND 1992) (Ratification date: 17 August 2002);
- The 2003 Protocol to the International Convention on the Establishment of an International Fund for Compensation of Oil Pollution (FUND 2003) (Ratification date: 25 November 2011);
- International Convention on Oil Pollution Preparedness, Response and Cooperation (OPRC 1990) (Ratification date: 11 June 2003);
- Protocol on Preparedness, Response and Cooperation to Pollution Incidents by Hazardous and Noxious Substances (OPRC-HNS 2000), (Ratification date: 27 June 2013);
- International Convention on Civil Liability for Oil Pollution Damage (CLC 1992) (Ratification date: 27 July 2001);
- International Convention on Salvage (SALVAGE 1989), (Ratification date: 24 May 2014)**;**
- The Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean, Barcelona Convention (1976) (Ratification date: 06.04.1981);
    - Dumping Protocol (from ships and aircraft)
    - Prevention and Emergency Protocol (pollution from ships and emergency situations)
    - Land-based Sources and Activities Protocol

- Specially Protected Areas and Biological Diversity Protocol
- Offshore Protocol (pollution from exploration and exploitation)
- Hazardous Wastes Protocol
- Protocol on Integrated Coastal Zone Management (ICZM).

The Project waste management practices will also need to be compliant with the following European Bank for Reconstruction and Development (EBRD) and International Finance Corporation (IFC) Guidelines and Reference Document by EU (European IPPC Bureau):

- Best Available Techniques (BAT) Reference Document (BREF) for Common Wastewater and Waste Gas Treatment/Management Systems in the Chemical Sector (2016);
- IFC EHS General Guidelines (2007);
- IFC EHS Guidelines for Large Volume Petroleum-based Organic Chemicals Manufacturing (2007);
- IFC EHS Guidelines for Petroleum-based Polymers Manufacturing (2007);
- EBRD Sub-sectoral Environmental and Social Guidelines for Manufacture of Chemicals and Manufacture of Plastics and Synthetics (2014).

The Turkish regulatory framework requirements and the conditions set in the Equator Principles, IFC, and EBRD guidance documents provide inherent mitigation measures against the impacts resulting from waste generation. These conditions were reviewed and discussed in Section 8.9.

8.3 Water Use

Construction

There will be drinking and potable water consumption by construction workers during the construction activities. The average daily water consumption per person is expected to be around 208 L/day per capita based on TUIK data (2018) resulting in a total daily water requirement of 936 m^3 (according to the construction plans, the maximum number of workers is approximately 4,500 at the site during the construction phase of the Project and associated Terminal Facility). In addition, water will be used for various construction activities including dust suppression, wetting of backfill material, equipment cleaning and site clean-up. The water demand due to construction activities can be anticipated as 60-70% of the construction/worker requirement based on case studies (Wrap UK, 2011). Hence, based on this assumption an additional 561 m^3/day of water consumption is estimated for the construction activities. Accordingly, the total daily water requirement for the construction activities is estimated to be approximately 1,497 m^3.

The water required for the construction works is planned to be supplied by tanker trucks from the existing municipality line and the drinking water will be supplied as bottled water or with carboys purchased from an external supplier. No groundwater abstraction is planned for the Project water supply during the construction and operation phases. On the other hand, as reported by the Project Company, the potential use of other possible existing water sources is currently being consulted with the Management Company, State Hydraulic Works (DSI), and Adana Water and Sewerage Administration (Adana ASKİ).

Operation

Raw water will be supplied from outside of the Project site. The supply of water and energy to the facility in the CPIR Premises is under the responsibility of the CPIR Management Company. Regarding this, the Management Company has issued an official letter dated 12.08.2020 stating that the required 106 MW of electricic power capacity, 14,400 m^3 /day of raw water, and for the start-up of the operation11,085 Nm^3/hour of natural gas will be supplied by the Management Company. The Project Company shall follow up with the Management Company for the sources of the electricity, raw water, and natural gas and evaluate potential environmental and/or social risks, if any. Related to the water supply from the source outside of the Project site the Management Company is currently consulting with relevant authorities (i.e., DSI, and Adana ASKI).

The raw water supplied from outside of the Project site will be first transferred into the raw water intake pond (Figure 8-1) in the Project site for subsequent preliminary treatment, storage and then the distribution of raw water to various project units with different water quality and quantity requirements. The raw water unit will be established as part of the Project to provide service water of suitable quality through preliminary treatment by a Package Water Treatment Unit (including sand and multimedia filter units) and Biocide Injection Package. Treated water will be transferred to the service water tank which supplies inflow to potable water, process water, and firewater handling and distribution units.

The potable water system of the Project will provide further treatment of water from the service tank to obtain potable water quality in line with the drinking water quality criteria defined by the Regulation on Water Intended for Human Consumption (Parameters and Limit Values in Annex 1 of the Regulation). Potable water from the potable water storage tank will be sent to buildings and offices and to the units for safety shower water, utility and offsite units. Drinking water will be supplied from service water through the drinking water system. Estimated service water requirement of each project component (units) is presented in *Chapter 2: Project Description including Alternatives*. The total design capacity of the service water system will be 563 t/h. Additionally, a demineralized water system that consists of a Reverse Osmosis (RO) package, polishing package, demineralized water storage and distribution facilities, and a cooling water system (recirculating type) will be established as part of the Project for the process water treatment and use.

The service water tank will be designed also to supply water to the firewater system. The maximum firewater demand was calculated for all Project units by dividing the water need of 14 separate fire zones identified in the Project site and Associated Terminal Facility for emergency action. Accordingly, the maximum firewater demands of various fire zones identified in the Project site are given in Table 8-1.

Table 8-1. Maximum firewater demand at the Project site and Associated Facility

Fire Zone	Project Units	Max. firewater demand (m^3/hr)
Project site		
Fire Zone 1A/B/C	PDH plant – A/B/C	1170
Fire Zone 2A	PP plant -polymerisation	1170
Fire Zone 2B	PP plant - extrusion	544
Fire Zone 3	Product warehouse	690
Fire Zone 5	Propylene tanks	1900
Fire Zone 6	Nitrogen generation package/ instrument and plant air unit	136
Fire Zone 7	Utility area (Water treatment, steam, condensate, and boiler feed water, cooling tower, firewater unit)	136
Fire Zone 8	WWTP	136
Fire Zone 9	Fuel gas area	353
Fire Zone 10	Solvent tank	337
Fire Zone 11	Control building	136
Fire Zone 12	Building area (admin building, canteen, fire station, workshop and warehouse, laboratory, chemical storage)	195
Fire Zone 13	Trestle	136
Terminal Facility (Associated Facility)		
Fire Zone 4	Propane tank	867
Fire Zone 14	Jetty	690

The overall water balance diagram of the Project is presented in Figure 8-1 below. During the operation phase, there will be potable water consumption due to domestic purposes (food processing, toilets, etc.) which will be limited to the consumption by the operational workforce and operational use. Daily water consumption for domestic use is 208 L/day per capita as explained above. Based on the number of employees during the operation phase, daily average water consumption by the personnel is estimated to be 66.8 m^3 at peak.

Box-1 Water Supply for CPIR

A water supply feasibility study, regarding the water supply to the CPIR was conducted by the General Directorate of State Hydraulic Works (DSI) as the request of the Management Company with the MoIT. According to the Water Supply Assessment Study, among the alternatives evaluated by the DSI the use of Aslantaş Reservoir to supply water to the site was identified to be the most feasible. A Water Transmission Line was recommended by DSI to be established with a capacity to meet the water demand of CPIR along with other potential industrial facilities that are exists or planned in the region. For the realisation of the relevant Water Transmission Line from Aslantaş Reservoir to the CPIR, the official communications between the Management Company, MoIT, DSI, and Directorate of Water and Sewer Works of Adana Metropolitan Municipality (ASKİ) continue to date. The procedure for the establishment of a protocol for the financing and construction of the water supply line is still in progress (official letter of DSI dated 16.03. 2020 with the official letter number 180662 and official letter of General Directorate of Industrial Regions of MoIT dated 21.04.2020 with the official letter number 1507259).

According to the information provided by the Management Company at the time of preparation of this draft final report, Water Transmission Line Project and relevant protocol processes are currently on going.

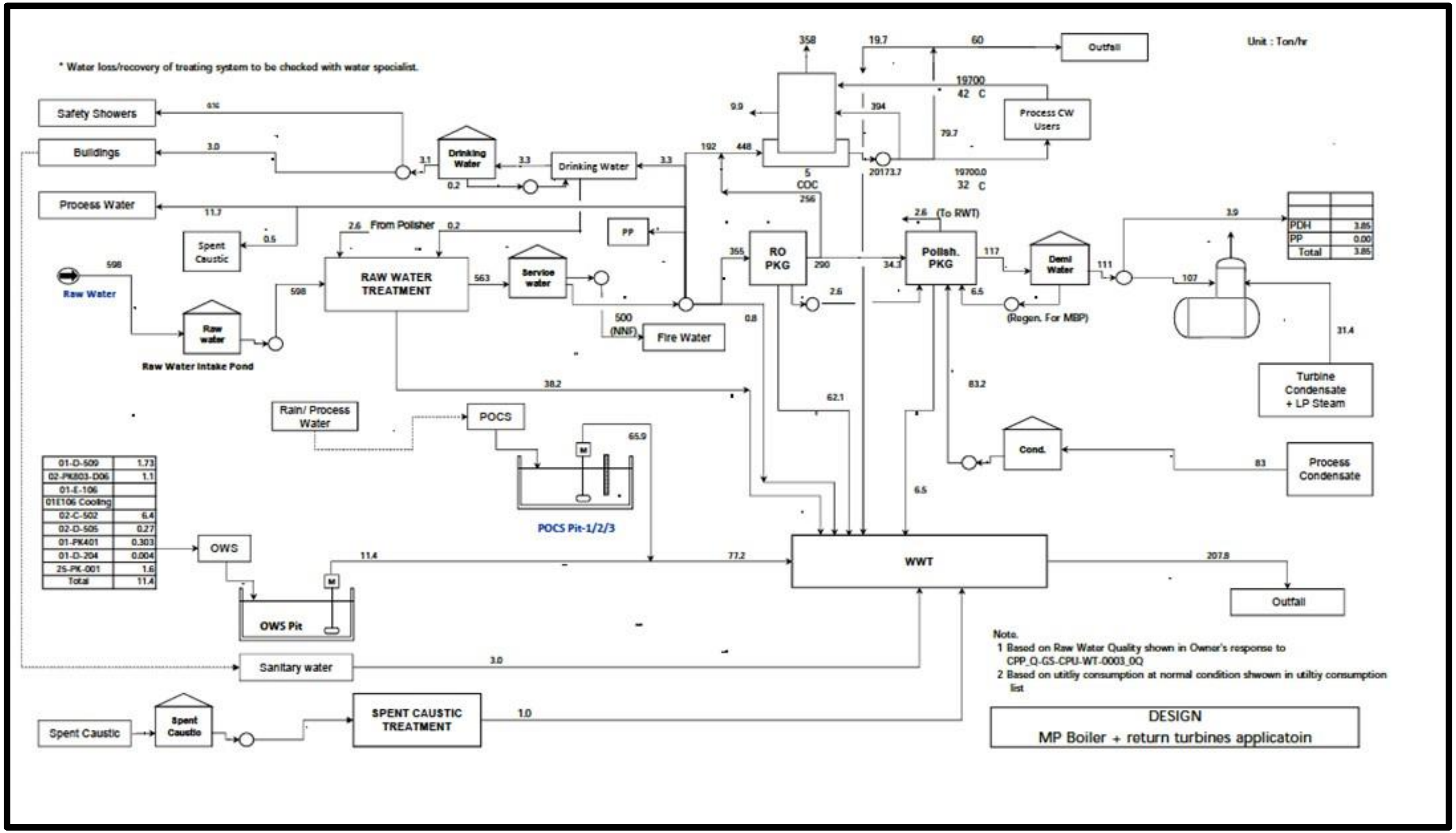

Figure 8-1. Overall Water Balance Diagram – Design

8.4 Material Resources and Management

8.4.1 The Project

<u>Construction</u>

As it is explained in Chaper 2 Project Description, the construction works to be carried out within the scope of the project basically consist of four stages:

- Field preparation works;
- Civil works
- Steel structures
- Mechanical installation, piping, electrical installation, and instrumentation.

All these stages, material required for construction works either supplied form local and regional sources (i.e. water and electricity etc.) and producers (i.e. ready mixed concrete and gravel etc.) or national suppliers (in country) and international suppliers, which will construct special equipment's and units.

Gravel Supply

The construction material required for the Project will be transported to the site via existing roads by selected suppliers. No borrow pits or quarries will be operated by the Project contractor. Therefore, there are no adverse impacts anticipated from the extraction of raw materials or production of finished materials that will be attributable directly to the Project. The material such as gravel and sand that will be required for construction will be supplied from the material excavated from the Project site during the site preparation and foundation excavations of the buildings and from licensed borrow pits in the region. Depending on the characterisation of the excavation material, it is assumed that approximately 500,000 m^3 of material will be provided from licensed borrow pits. Currently, there are no plans for supply of such construction materials through marine ways during construction phase. Potential sand and gravel producers are provided in Figure 8-2.

Concrete Supply

Project Company will not build any concrete batching plant installed within the scope of the Project. The ready-mixed concrete will be supplied from local suppliers. Potential readymix concrete suppliers are located between 5 km - 30 km distances. The study shows that production capacity of these suppliers sufficient to maintain required amount for the civil works. Location of these suppliers are provided in Figure 8-3 below. Existing roads will be used for the transportation of the readymix concrete.

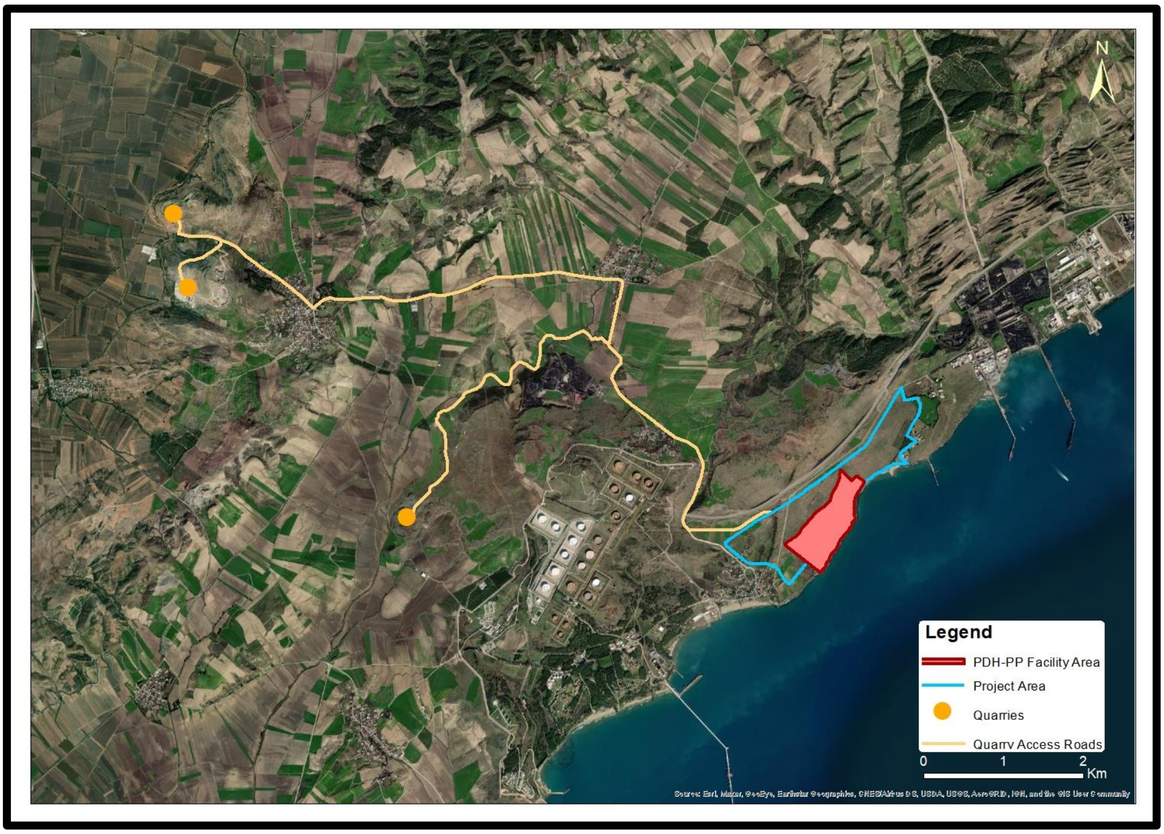

Figure 8-2. Quarry Access Roads

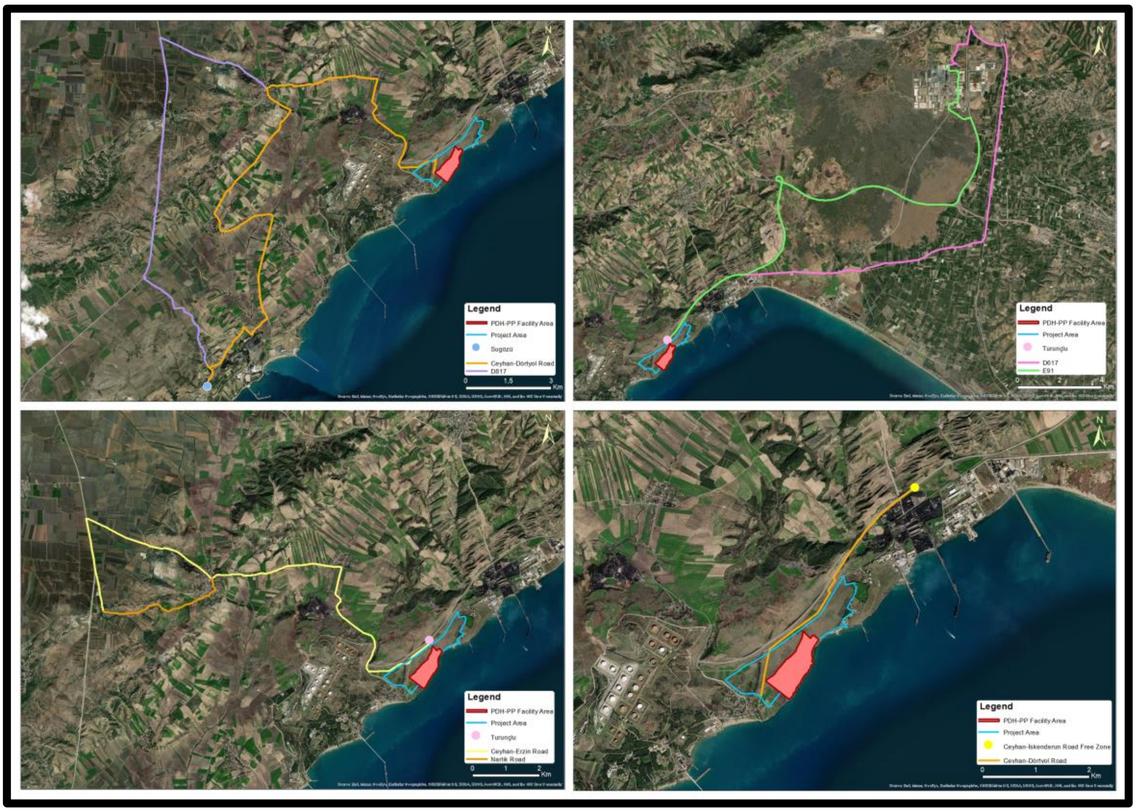

Figure 8-3. Location of Concrete Suppliers

Excavated Material

The site preparation works will start with soil striping in the Project site at the construction areas. It is calculated that 25,000 m^3 of topsoil will be removed and stockpiled in the temporary Excavated Material storage area (see Figure 8-4) during the site preparation works. The topsoil and excavated material shall be stored separately to end of the Project and will be used in landscaping works. It is anticipated that approximately 4,457,000 m^3 of excavation materials will be generated. A portion of the excavated material will be used as backfilling material (100,000 m^3) on the Project site for the construction. As it indicated in the National EIA The remaining 4,357,000 m^3 will be transferred to licensed disposal/storage sites. According to the consultation with the Directorate of Environmental Protection and Control, Waste Management Department (Adana Metropolitan Municipality) during the social survey conducted on 10-12nd February 2020, the Adana Metropolitan Municipality states that it will assess and propose suitable excavation waste disposal areas in the case of such a need from the industrial facilities in the region, including the Project. Upon the official request by the Ceyhan Petrokimya Endüstri Bölgesi Yönetim A.Ş. (CPIR Management Company) to the Adana Metropolitan Municipality for the determination of the locations of the alternative disposal sites and granting of relevant waste acceptance approval, the Adana Metropolitan Municipality advised that necessary application should be made to Waste Management Department of the Adana Metropolitan Municipality after the determination of the final volume of excavation material. As reported by the Ceyhan Polipropilen Üretim A.Ş. (the Project Company), there are a total of 13 alternative excavation waste disposal sites in Adana province as confirmed by the Municipality, which are shown in Figure 8-7 in Section 8.5.2.

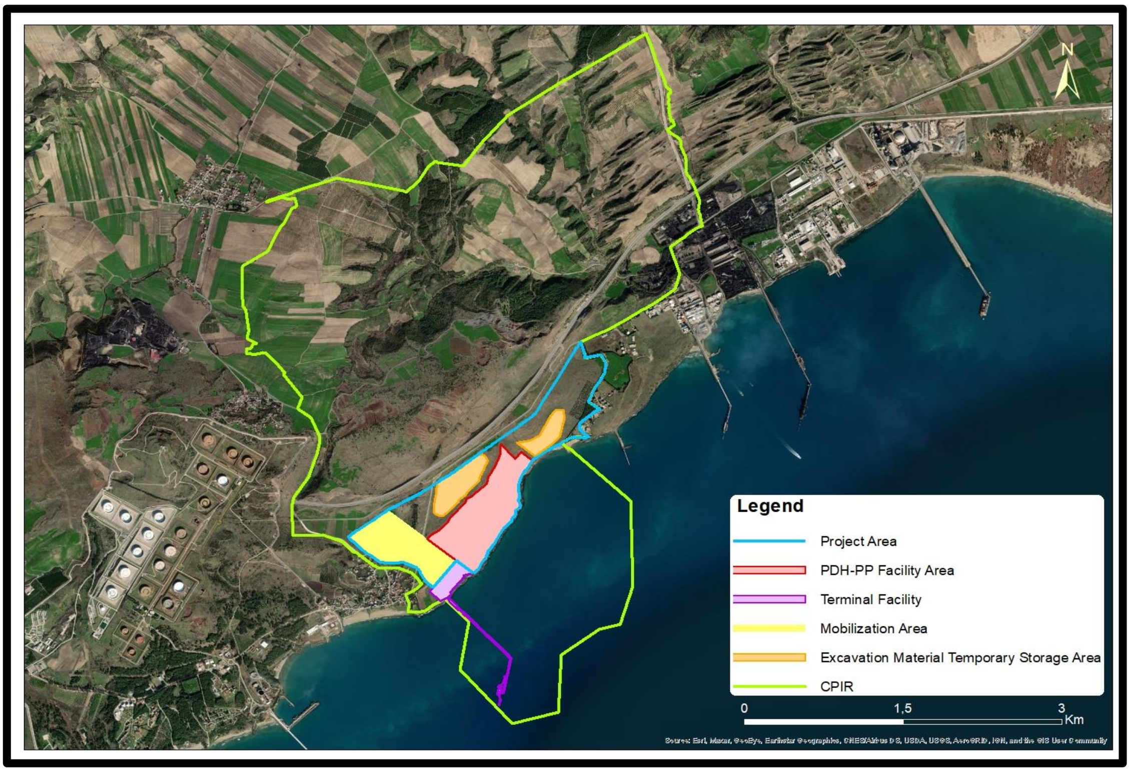

Figure 8-4. Location of the Temporary Excavated Storage Area

CPIR Port Company has also requested excavated material in order to use as backfilling material in the marine section of the CPIR Port Project. Initial assessment regarding characteristics of the excavated material indicates that the material is suitable as backfilling material. The use of excavated material is considered as best practice in terms of waste minimization and resource efficiency. On the other hand, in order to use the material, CPIR Port Management Company must provide necessary permit and consents to use the excavated material. Backfilling of the CPIR Port will be performed under the responsibility of the CPIR Port Management. Impacts of the backfilling operation is assessed as cumulative impact assessment in Chapter 20.

Other Materials

Various types of materials such as steel and steel structures, construction chemicals, vehicles and machinery will be used during construction phase as described in *Chapter 2: Project Description Including Alternatives* and will all be sourced locally to the extent possible from existing suppliers. However, during the construction phase certain equipment parts and process units of the PDH-PP Plant including Propylene-Propane Splitter, Deethanizer Stripper, Loop Reactor, and Reactor are planned to be transferred through the Sanko Port located approximately 9 km southeast of the Project site.

During the detailed design and procurement stage, the contractor will be responsible for identifying sources for construction materials, and equipment and will be required to consider environmental and social impacts in selecting materials to be used for the Project.

Operation

The materials and feedstocks that are estimated to be used during the operation phase of the Project are summarised in Table 8-2.

Table 8-2. Materials (consumables) and feedstocks

Unit	Consumables/ feedstock	Unit	Amount	Frequency	Storage Condition
PDH	Oleflex Catalyst	m^3	296.7	For one complete charge only, catalyst life cycle is 4 years. Daily use is 20 kg/day	TBD
	Activated Alumina	m^3	881.6	210.8 m^3 Once a year	TBD
	Hydrogen	Nm^3	14,560	Commissioning & Start-up only Initial requirement id 14,560 Nm^3 Future start-up requirement is 11,851 Nm^3	Temporary
	Dimethyl Disulfide	kg	66,000	for initial start-up + 2~3 months of operation at design rate, Hourly consumption 26 kg/h in a day.	Storage Vessel
	Caustic	kg	102,000	Once every week	Storage Tank
	Chlorine	kg	39,190	for 180 days of operation	Cylinder

Unit	Consumables/ feedstock	Unit	Amount	Frequency	Storage Condition
PP	Catalysts	t/y	102.4	Catalyst, Donor and TEAL	TBD
	Additives	t/y	506.3	Average. TBD	TBD
	Pre-blends	t/y	1,183.5	Average. TBD	TBD
	Liquid Additive	t/y	8.0		
	Atmer 163	ton	2.4	Initial Filling	TBD
U&O*	Antiscalant (100%)	kg/d	52	-	Storage tank
	Sodium bisulfite (SBS) (30%)	kg/d	209	-	Storage tank
	Sulfuric Acid (98%)	kg/d	808		Storage tank (RO PKG)
	Caustic Soda (50%)	kg/d	1047		Storage tank (RO PKG)
	Sulfuric Acid (98%)	kg/week	2923	-	Storage tank (Polishing PKG
	Caustic Soda (50%)	kg/week	4089	-	Storage tank (Polishing PKG)
	Sulfuric Acid (98%)	kg/d	263	-	Storage tank (WWTP)
	Caustic Soda (50%)	kg/d	644	-	Storage tank (WWTP)
	Alum (7.5%)	kg/d	1339	-	Storage tank (WWTP)
	A-Polymer (35%)	kg/d	34	-	Chemical storage area (WWTP)
	C-Polymer (50%)	kg/d	3	-	Chemical storage area (WWTP)
	Biocide	kg/d	8.0		
	Scale Inhibitor	kg/d	50		
	Corrosion Inhibitor	kg/d	50		
	Oxygen Scavenger	kg/d	4		
	Neutralizing Amine	kg/d	12		
	Phosphate	kg/d	6		
	Fresh Solvent	m^3	360.6 (for initial inventory)	83 m^3 (for two weeks operational makeup)	Storage Tank
	Propane	mt/h	69.45	Continuous	Storage Tank
	Propylene	mt/h	58	Continuous	Storage Tank

**U&O stands for utilities and off-site. Other than the consumables listed above, biocide, dosing chemicals, oxygen scavenger, neutralizing amine, phosphate, sulfuric acid and natural gas will be utilized; however, the amounts are not certain at this stage.*
TBD: to be determined

For all of the consumables presented above, the Project Company will ensure that each consumable is stored and handled in line with the provisions stated in the material safety data sheets (MSDS). As per the Turkish Regulation on *Safety Data Sheets Regarding Hazardous Substances and Mixtures* (Official Gazette (O.G.) Date/Number: 13.12.2014/29204), the MSDS of a hazardous substance/mixture needs to be prepared if the product is classified as hazardous and/or it contains any substance having an occupational exposure limit in the formulation. Additionally, as of 01.06.2016, all MSDSs need to be prepared according to the provisions of the *Regulation on Safety Data Sheets Regarding Hazardous Substances and Mixtures* which is linked only to the *Regulation on the Classification, Labelling and Packaging of Hazardous Substances and Mixtures* (O.G. Date/Number: 11.12.2013/28848) in terms of classification of substances/mixtures. *The Regulation on the Registration, Evaluation, Authorization, and Restriction of Chemicals* (KKDIK) (O.G. Date/Number: 23.06.2017/30105) aims to regulate the administrative and technical procedures, and principles regarding the registration, evaluation, authorization, and restriction of chemicals, to ensure a high level of protection of human health, and the environment, including the promotion of alternative methods for assessment of hazards of substances while enhancing competitiveness and innovation. The important issues that need to be considered as per the abovementioned regulations are presented in Annex-B.

The main inputs to the Project are electricity and natural gas, which will be supplied from the national grid and the main supply line, respectively. Estimated annual electrical demand of the Project is calculated as 667 GWh. There will be two utility boilers (two boilers to cover design and one for maintenance) in the Project. Moreover, there will be a steam and condensate system in the Project. This system will be independent and require a boiler feed water system, electrical power, chemicals, fuel gas and instrument air. Fuel gas will be used in PDH heaters, flare, and utility boilers. In response to any deficit in the fuel gas balance, natural gas import facility is designed with appropriate flexibility and operating range. Natural gas will be used only for the start-up of the boilers.

8.4.2 Associated Terminal Facility including Jetty Site

Construction

The Jetty site of the associated Terminal Facility, which will be used for receiving propane to be delivered to the Project site during the operation phase, will have a total length of 1.2 km with two unloading arms. The list of materials required during the construction of the Jetty and causeway is presented in Table 8-3.

Table 8-3. Material used during the construction of Jetty and causeway

Units	Substances	Amount	Unit
Jetty	Steel for piles	1,658.7	tons
	Concrete for pile cap	52	m^3
	Concrete for pile plugs	98.2	m^3

Units	Substances	Amount	Unit
	Concrete for cross beams	649.2	m^3
	Concrete for long beams	551.6	m^3
	Steel for piperack	944	tons
	Concrete for road	498.54	m^3
	Rock sockets	10	-
Causeway	Rock for quarry run	~524,134.9	m^3
	Rock size 60-300	141,198.4	m^3
	Rock size 300-1000	103,699.6	m^3
	Concrete for cubes	19,207.4	m^3
	Steel for piperack	1,032.5	tons
	Concrete for roadway	1,246.35	m^3

Operation

Only propane will be delivered to the Project site via sea shipment. During the operation phase of the Project, it is planned that two vessels will deliver propane to the Project site per month. Propane delivered by the vessels will be stored in the propane storage tanks in the Associated Terminal Facility. The total propane storage capacity of the propane tanks at the Terminal Facility is 106,500 m^3, where the net capacity is 93,700 m^3.

8.5 Overview of Waste Management of Adana Province

The waste generation, ongoing disposal practices, and review of the waste disposal facilities in Adana province are discussed in this section. Information on baseline conditions and wastes that will be generated during the construction and operation phases of the Project has been identified through the following sources:

- Adana Environmental Status Report (2018-2019);
- Official website of Adana Metropolitan Municipality (www.adana.bel.tr);
- Official website of Adana ASKİ (http://www.adana-aski.gov.tr);
- Official website of MoEUCC (http://www.csb.gov.tr);
- Official website of ITC Invest Trading & Consulting AG (http://www.itcturkiye.com/en).

8.5.1 Waste Management in Adana Province

Wastes that are generated in Adana province include solid wastes, domestic wastewater, excavation wastes, hazardous wastes (including medical waste), non-hazardous wastes, packaging wastes, waste mineral oil, waste batteries and accumulators, waste vegetable oil, end-of-life tires and electrical and electronic wastes. The types of wastes together with the volume and generation rates (to the extent information is available) and disposal locations are discussed below.

According to the Metropolitan Municipality Law No.5216, the responsibility of collecting the domestic solid wastes and transferring to the disposal facility / transfer stations are in the responsibility of the district municipalities, and the responsibility of the transportation from the transfer stations to the disposal facility and their disposal are in the responsibility of the Metropolitan Municipality. According to the Adana Province 2019 Environmental Status Report, domestic waste generated in Adana is disposed of in the Integrated Solid Waste Disposal Facility. The facility, which has a Class II regular storage license, receives an average of 2000 tons/day of domestic solid waste from 15 central districts in Adana. The facility has a segregation unit consisting of 3 lines for mixed wastes. Wastes are segregated as organic and packaging wastes according to their type.

Solid wastes: Adana Environmental Status Report (2019) reports that an average of 1,858 tons/day of domestic solid waste is generated and brought to Adana Metropolitan Municipality Integrated Solid Waste Disposal Facility from all of the 15 district municipalities within the boundaries of Adana. The facility receives domestic wastes from the 15 district municipalities, domestic wastes from commercial sources that are subject to segregation, composting and sanitary landfilling, and medical wastes from hospitals as well as other healthcare facilities. The facility had previously been operated as an open dump; however, the landfill site was then rehabilitated in early 2011. There is only one sanitary Integrated Solid Waste Disposal Facility in Adana. The total capacity of the landfill site is 7,175,888 m^3. Currently, 1,134,608 m^3 of the total capacity is occupied by solid wastes. The sanitary landfill site capacity was designed to serve the province until 2041. The facility is located approximately 52 km to the northwest of the Project site. Detailed information about the facility is provided in Section 8.5.2 of this Chapter.

Domestic wastewater: The domestic wastewater generated in Adana province is treated in four WWTPs, namely Seyhan WWTP (west Adana), Yüreğir WWTP (east Adana), Ceyhan WWTP and Karaisalı WWTP. There are also two WWTPs which are operated and managed by Adana Hacı Sabancı Organized Industrial Zone and TAYSEB. Details about the WWTPs are provided in Section 8.3.2.

Excavation wastes: Management of construction and excavation wastes generated in the municipal area is the responsibility of Adana Metropolitan Municipality. According to the Adana Environmental Status Report (2019), the volume of excavation wastes generated in Adana is reported as 708,236.6 m^3 in 2019. Additionally, 1,675,568 m^3 of excavation materials are reused for filling/rehabilitation purposes. As it is reported by the representatives of Adana Metropolitan Municipality, there are a number of identified waste disposal sites in Adana.

Hazardous wastes: According to the information obtained from MoEUCC (data retrieved from the official website of MoEUCC[1]), the mass of hazardous waste generated in Adana was 26,761 tons in 2019. These wastes are either sent to recycling or disposal facilities. Licensed facilities are announced on the official website of MoEUCC[2].

Non-hazardous waste: According to the Adana Environmental Status Report (2019), non-hazardous wastes are either sent to licensed non-hazardous waste collection and sorting, recovery (licensed from provincial directorates) or recycling facilities (MoEU, 2019). There are a total of 22 licensed non-hazardous waste collection and sorting and 13 non-hazardous waste recovery facilities in Adana. A total of 220,391 tons of non-hazardous waste was collected in Adana in 2018[3].

Medical wastes: In 2018, a total of 3,084,679 tons of medical waste were generated in Adana and 89,865 tons of medical wastes were generated in Ceyhan. There is a medical waste sterilization facility (operated by ITC Invest Trading and Consulting with a capacity of 9 tons/day) in Adana.

Packaging wastes: According to the Adana Environmental Status Report (2019), a total of 132,969 tons of packaging waste was collected and 51.632 tons of it were recycled in Adana in 2018, based on the information retrieved from the Packaging Waste Information System administered by MoEUCC. There is a total of 14 packaging waste collection-separation and 52 packaging waste recycling facilities in Adana.

Waste mineral oil: According to the Adana Environmental Status Report (2019), a total of 380 tons of waste engine oil and 407 tons of waste industrial oil were collected in Adana in 2018.

Waste batteries and accumulators: According to the Adana Environmental Status Report (2019), a total of 607 tons of waste accumulators were collected and 604 tons of these waste accumulators were recovered in Adana in 2018.

Waste vegetable oil: There are four licensed and one with temporary operation permit vegetable oil interim storage facilities in Adana. Currently, there is no vegetable oil recycling facility in Adana as reported in the Adana Environmental Status Report (2019). In 2018, a total of 140 tons of waste vegetable oil were collected in Adana.

[1] Hazardous Waste Statistics, 2019, MoEU (https://ced.csb.gov.tr/tehlikeli-atik-istatistikleri-bulteni-i-82615)

[2] https://cygm.csb.gov.tr/yetkilendirmeler-ve-lisanslar-i-534

[3] Non-hazardous Waste Statistics, 2018, MoEU
https://webdosya.csb.gov.tr/db/ced/icerikler/2018_yili_tehlikesiz_atik_istatistikleri_bulteni-20200320100459.pdf)

End-of-life tires: According to the Adana Environmental Status Report (2019), the mass of recovered end-of-life tires was 1,101 tons in Adana in 2018. There are three end-of-life tire recovery facilities in Adana.

Zero Waste Management: According to the Adana Environmental Status Report (2019), 64,081 tons of waste (paper, cartons, plastic, battery, vegetable waste oil and mixed wastes) were collected in Adana within the scope of the zero waste management program in 2019. The number of firms/institutions taking part in the zero waste management program is 1,551 including schools, institutions/firms and hospitals in Adana.

Wastes from ships/vessels: As reported by the representatives of Adana Metropolitan Municipality, a waste reception facility, which is under construction, will be established in Gölovası, Yumurtalık by Gizem Denizcilik Akaryakıt Pazarlama Nakliyat Ticaret Ltd. Şti. (Gizem Denizcilik). The facility is located approximately 6 km to the west of the Project site. A Project Introduction File for the proposed waste reception facility was prepared and published in April 2019. As stated in the Project Introduction File, there are six ports/marine terminals with waste reception facilities within the administration zone of BOTAŞ and Karataş Port Authorities (namely İskenderun Enerji, Sanko Petrokimya, BOTAŞ Ceyhan Terminal, BOTAŞ Gölovası Port, TOROS Agri-Industry, Akdeniz Gemi İnşa San ve Tic A.Ş.). The waste reception facility will be receiving the following wastes within the scope of the Marpol 73/78: bilge water, sludge, waste oil (within scope of Annex I), sewage (within the scope of Annex IV), and garbage (within the scope of Annex V). The design capacities of the units are as follows; bilge water (82.4 m^3/day); sludge (100 m^3/day); waste oil (41.6 m^3/day); slop (1,800 m^3/day); sewage (51.5 m^3/day); solid waste (6.18 m^3/day). The facility has been designed based on a mechanical lifetime of 29 years. Project Introduction File reports that the facility might be upgraded and rehabilitated considering the recent technological developments and thus the lifetime of the facility might be extended, if deemed necessary. During the operation of the Associated Terminal Facility, the operator company of the Terminal Facility will be expected to make agreement to the aforementioned licensed facility for the final disposal of the wastes and wastewaters from the vessels.

8.5.2 Waste Disposal and Treatment Facilities

Types of waste treatment/handling facilities for the management of waste streams generated in Adana province and its vicinity are as follows:

- Adana Integrated Solid Waste Disposal Facility under the responsibility of Adana Metropolitan Municipality;
- Solid Waste Transfer Stations in districts of Adana province including Ceyhan district (in total 16 facilities);
- Authorized disposal areas for excavation materials and construction wastes (in total five sites);

- Licensed Packaging Waste Collection & Sorting and Recycling Facilities (in total 63 facilities);
- Hazardous Waste Recycling Facilities (in total seven facilities);
- Non-Hazardous Waste Recycling Facilities (in total 60 facilities);
- Cement production facilities in Adana province for disposal of solid wastes and sludges;
- Waste Oil Recycling Facilities (in total two facilities);
- A medical waste sterilization facility within the boundaries of Adana Integrated Solid Waste Disposal Facility;
- End-of-Life Tires Recycling Facilities (in total 3 facilities);
- Seyhan WWTP, Yüreğir WWTP, Ceyhan WWTP and Karaisalı WWTP;
- Waste Receiving Facilities (from vessels) at the region (e.g., Adana Toros Tarim Sanayi ve Ticaret A.Ş., Adana Botaş Petrol İşletmeleri, İskenderun Enerji Üretim ve Tic. A.Ş., Sanko Petrokimya Mamülleri San. ve Tic. A.Ş., Bil Ceyhan Haydar Aliyev Deniz Terminali, Akdeniz Gemi İnşa San. vee Tic. A.Ş., Sönmez Çimento Liman and Adana Metropolitan Municipality).

Adana Integrated Solid Waste Disposal Facility (SWDF)

The municipal solid waste generated in Adana province is disposed of in the Integrated SWDF located in Sofulu, Sarıçam district, Adana (at the northeast of Adana city centre) which covers a 110 ha area. The facility receives domestic wastes from the 15 district municipalities, domestic wastes from commercial sources, which are subject to separation, composting and sanitary landfilling, and medical wastes from hospitals as well as other healthcare facilities. The facility had previously been operated as an open dump; however, the landfill site was then rehabilitated in early 2011. There is only one sanitary integrated Solid Waste Disposal Facility in Adana. The total capacity of the landfill site is 7,175,888 m^3. Currently, 1,134,608 m^3 of the total capacity is occupied by solid wastes. The sanitary landfill site is designed to serve the province until 2041. The facility is located approximately 52 km to the northwest of the Project site. In addition to the sanitary landfill site, the integrated facility is composed of mechanical separation, and bio-methanisation system, energy production facility, and medical waste sterilization facility (with a capacity of 9 tons/day).

Landfill gas is collected through vertical and horizontal active gas collection systems installed in the sanitary landfill site and sent to the methane recovery unit. The energy production facility has a 15.6 MW installed capacity and there are two gas storage tanks (each having capacity of 16,000 m^3) to store the generated gas. Currently, the facility is producing electricity sufficient to power around 50,000 households.

A total of 12 solid waste transfer stations are established in remote districts of Adana including the Ceyhan district which is approximately 22 km to the Project site. Ceyhan Municipality is responsible for the collection and transportation of municipal solid waste for the region where the Project site is located. The locations and general view of the facilities are shown in Figure 8-5 and Figure 8-6.

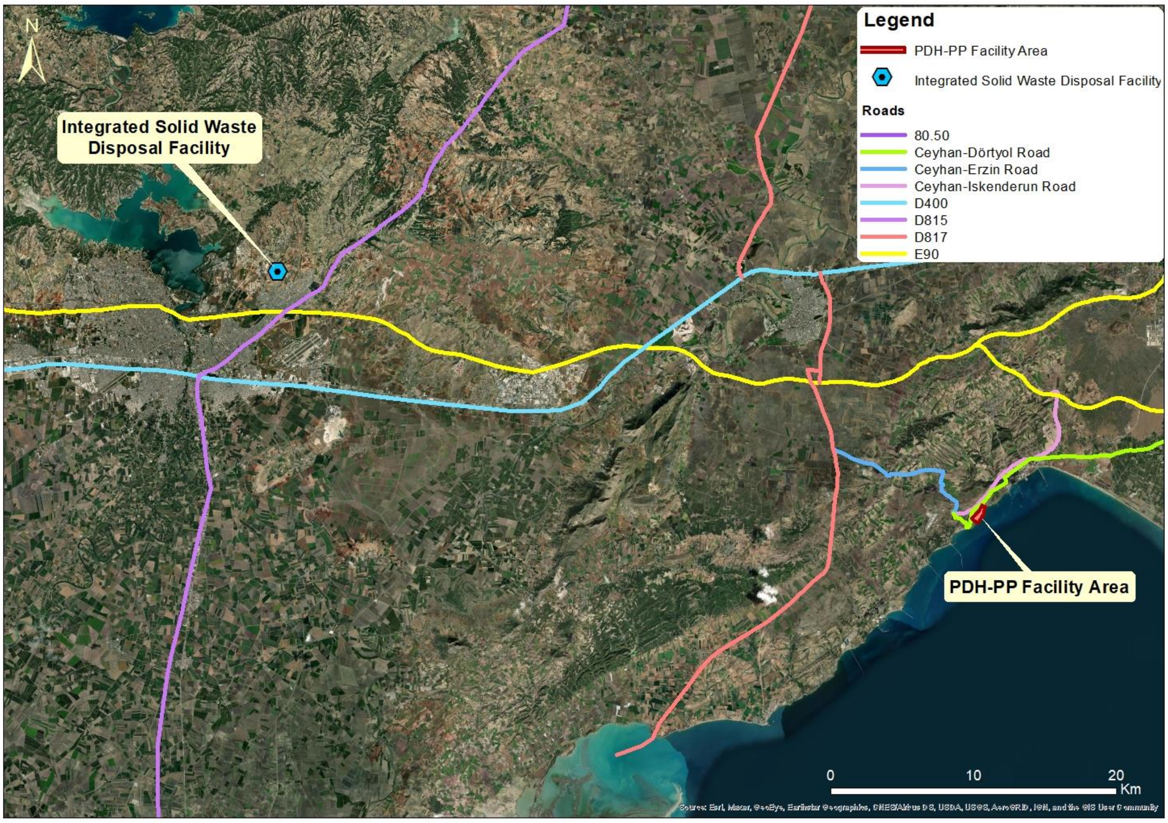

Figure 8-5. The location of the Adana Integrated Solid Waste Disposal Facility[4]

[4] http://www.itcturkiye.com/tr/adana/11922

Figure 8-6. Aerial view of the Adana Integrated Solid Waste Disposal Facility[4]

Licensed excavated waste disposal areas

The excavation wastes as well as construction and demolition wastes are disposed of in licensed disposal areas in Adana province. Adana Ulaşım A.Ş. has been responsible for the operation of the excavation waste disposal sites in Adana[5]. It was stated by representatives of the Directorate of Environmental Protection and Control, Waste Management (Adana Metropolitan Municipality)[6] that after the final volume the excess of the excavation material, which will not be used for backfilling, is determined by the Project Company, Adana Metropolitan Municipality will be able to provide suitable locations for disposal of excavation and construction wastes. Reportedly, there are suitable excavation waste disposal site alternatives in the region and therefore existing storage capacity of these areas will be sufficient for the disposal of the excavation wastes generated by the Project. Upon the official request by the Ceyhan Petrokimya A.Ş., the Municipality informed that a relevant application should be made to the Waste Management Department of the Municipality after the determination of the final volume of the waste. There are a total of 13 alternative excavation waste disposal sites in Adana province as confirmed by the Municipality. The locations of these 13 facilities are shown in Figure 8-7.

[5] Official website of Adana Metropolitan Municipality (http://sifiratik.adana.bel.tr/category/hafriyat/).

[6] During the social survey conducted within the scope of the ESIA study on 10-12nd February 2020

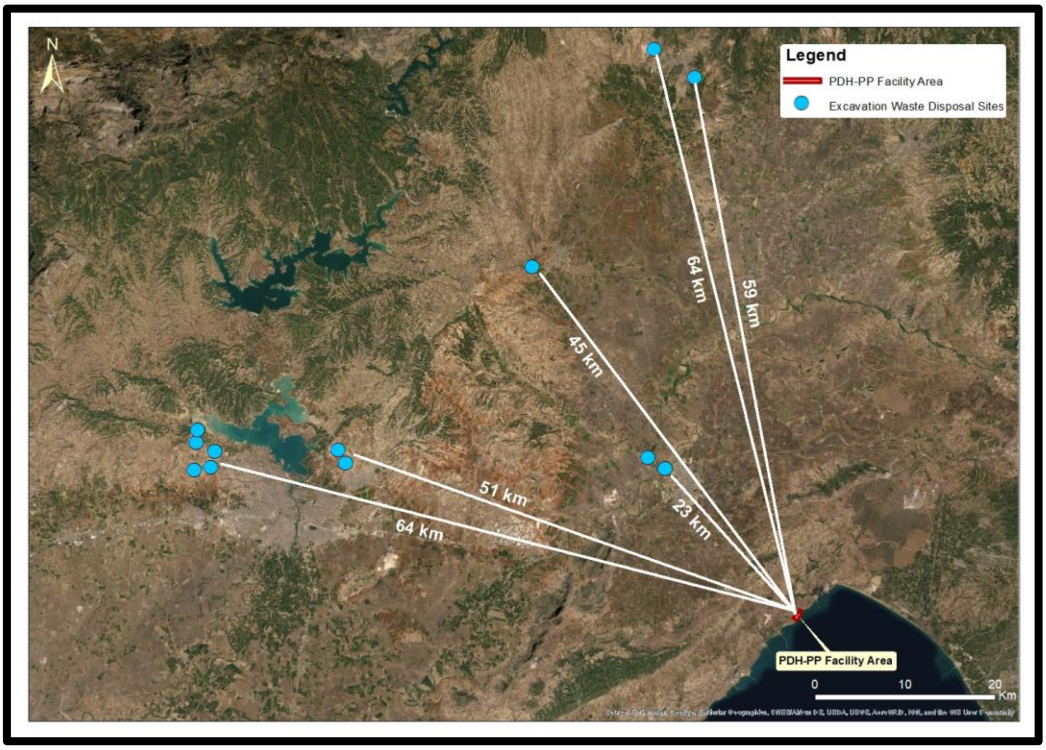

Figure 8-7. The locations of the Licensed Excavation Waste Disposal Sites in Adana Province

Wastewater Treatment Plants

The details of the main WWTPs in Adana are discussed in this section. There are several wastewater treatment plants within Adana ASKİ's jurisdiction that treat domestic wastewater generated in districts of Adana. The locations of the WWTPs are shown in Figure 8-8.

Figure 8-8. The location of WWTPs in Adana

Seyhan WWTP (or west Adana WWTP) and Yüreğir WWTP (or east Adana WWTP) have been operational since June 2004 and June 2003, respectively. The designs of the Seyhan and Yüreğir WWTPs include a capacity expansion in 2025 for a daily flowrate of 311,973 m^3/day and 170,952 m^3/day, respectively. Initially, Seyhan WWTP was designed for biological treatment whereas Yüreğir WWTP was designed for physical treatment, which was later upgraded to a biological treatment system with the addition of a number of units. The existing capacity of the Seyhan WWTP is 227,346 m^3/day. The effluent stream of the facility is discharged into the Seyhan River. The biogas power station produces 40% of the energy demand of the WWTP with the biogas generated in anaerobic digestion units[7]. A view of the Seyhan WWTP is given in Figure 8-9.

Figure 8-9. Aerial view of the Seyhan WWTP (Source: Official website of Adana ASKI)

The current capacity of the Yüreğir WWTP is 128,208 m^3/day. The effluent stream of the facility is discharged into the Seyhan River. The biogas power station produces 60% of the energy demand of the WWTP with the biogas generated in anaerobic digestion units[8]. A view of the Yüreğir WWTP is given in Figure 8-10.

Figure 8-10. Yüreğir WWTP (Source: Official website of Adana ASKI)

[7] Official website of Adana Aski (http://www.adana-aski.gov.tr/images/At%c4%b1k%20Su%20Ar%C4%B1tma%20Tesisleri%20-%20Adana%20Su%20ve%20Kanalizasyon%20%C4%B0daresi.pdf).
[8] Official website of Adana Aski (http://www.adana-aski.gov.tr/images/At%c4%b1k%20Su%20Ar%C4%B1tma%20Tesisleri%20-%20Adana%20Su%20ve%20Kanalizasyon%20%C4%B0daresi.pdf).

Ceyhan WWTP is located in the Kelemeti neighbourhood of the Ceyhan District and has a surface area of 77,000 m^2. The WWTP has been operational since March 2015. The design of the Ceyhan WWTP includes an extension in 2025 in the 1st Stage and 2040 in the 2nd Stage. With the capacity extensions the WWTP will have a capacity of 34,896 m^3/day for the year 2025 and 46,272 m^3/day for the year 2040. The effluent stream of the facility is discharged into the Ceyhan River. The biogas power station produces most of the energy demand of the WWTP with the biogas generated in anaerobic digestion units. A view of the Ceyhan WWTP is given in Figure 8-11.

Figure 8-11. Aerial view of the Ceyhan WWTP (Source: Official website of Adana ASKI)

Karaisalı WWTP has a surface area of 7,000 m^2. The existing capacity of the WWTP is 1,200 m^3/day (10,000 equivalent population). The effluent stream of the facility is discharged into Üçürge Creek. A view of the Karaisalı WWTP is given in Figure 8-12.

Figure 8-12. Aerial view of the Karaisalı WWTP (Source: Official website of Adana ASKI)

8.6 Waste Generation and Management during the Construction Phase

The types of wastes that will be generated during the construction phase are domestic wastes, domestic wastewater, packaging wastes, excavation wastes, medical wastes, hazardous wastes, and special wastes. The list of these wastes together with proposed management practices and relevant risks related to the load on existing management facilities are given in Table 8-9.

Domestic Waste: Based on TUIK data of average solid waste generation in Turkey, 1.16 kg/day of domestic waste is estimated to be generated per capita. Accordingly, in total 5,220 kg of daily domestic waste generation (assuming the maximum number of workers is 4,500) is expected at the peak of the construction phase. Domestic waste will be stored in waste containers and will be collected by the district municipality garbage trucks. The size and number of containers are be considered to be suitable for adequate and effective waste collection/management on-site before and during construction activities.

Sanitary Wastewater

As explained in Section 8.2 above, the total daily domestic wastewater generation during the construction phase of the Project is estimated to be 1,260 m^3 (according to the Constrcution plans, maximum number of workers is approximately 4,500 at the site during the construction phase of the Project and associated Terminal Facility). Currently, there is no sewerage infrastructure extending to the proximity of the Project site. Currently for the construction, domestic wastewater will be collected in impermeable underground septic tanks and necessary agreements will be made with the municipality to collect the wastewater with vacuum trucks.A Membrane Bioreactor (MBR) wastewater treatment plant (WWTP) will be established at the Project site for the domestic wastewater to be generated during the construction phase of the Project. Treated effluent will be discharged to the sea via effluent pumps after it is ensured that the effluent quality meets the national regulatory discharge limits. The standards according to the national legislation for discharges into sewer systems are provided in Table 8-4 below.

Table 8-4. Water Pollution Control Regulation Admissible Limit Values for Discharge to Sanitary Sewer Systems*

Parameter	Sewer systems ending up into WWTP that provides complete treatment before discharge to environment	Sewer systems ending up into Facilities that provides treatment for deep sea discharge
Temperature (˚C)	40	40
pH	6.5-10.0	6.0-10.0
Total suspended solids(mg/L)	500	350
Oil and grease (mg/L)	250	50
Petroleum derivatives (mg/L)	50	10
Chemical oxygen demand (COD) (mg/L)	4000	600
Biochemical oxygen demand (BOD_5) (mg/L)	-	400
Sulphate ($SO_4^=$) (mg/L)	1700	1700

Parameter	Sewer systems ending up into WWTP that provides complete treatment before discharge to environment	Sewer systems ending up into Facilities that provides treatment for deep sea discharge
Total Sulphur (S) (mg/L)	2	2
Phenol (mg/L)	20	10
Free Chlorine (mg/L)	5	5
Total nitrogen (N) (mg/L)	-	40
Total phosphorous (P) (mg/L)	-	10
Arsenic (As) (mg/L)	3	10
Total cyanide (Total CN^-) (mg/L)	10	10
Total lead (Pb) (mg/L)	3	3
Total cadmium (Cd) (mg/L)	2	2
Total chromium (Cr) (mg/L)	5	5
Total mercury (Hg) (mg/L)	0.2	0.2
Total copper (Cu) (mg/L)	2	2
Total nickel (Ni) (mg/L)	5	5
Total zinc (Zn) (mg/L)	10	10
Total tin (Sn) (mg/L)	5	5
Total silver (Ag) (mg/L)	5	5
Cl^- (Chloride) (mg/L)	10000	-

*Water Pollution Control Regulation (WPCR), Table 25

A WWTP will be established at the Project site for the domestic wastewater to be generated during the construction phase of the Project. . Depending on the number of workers accommodated at construction camp, unit will be installed stagewise. Each stage of WWTP will have a capacity of 300 m3/day, which corresponds to 1,200 workers. WWTP will be designed as MBR to treat domestic wastewater originating from campsite in order to meet the regulatory limits. The MBR is a suspended growth-activated sludge system that utilizes microporous membranes for solid/liquid separation instead of secondary clarifiers. It represents a decisive step forward concerning effluent quality by delivering a hygienically pure effluent and by exhibiting a very high operational reliability. Illustrated flow diagram of MBR system is given in Figure 8-13 and sample view of a package unit is given in Figure 8-14.

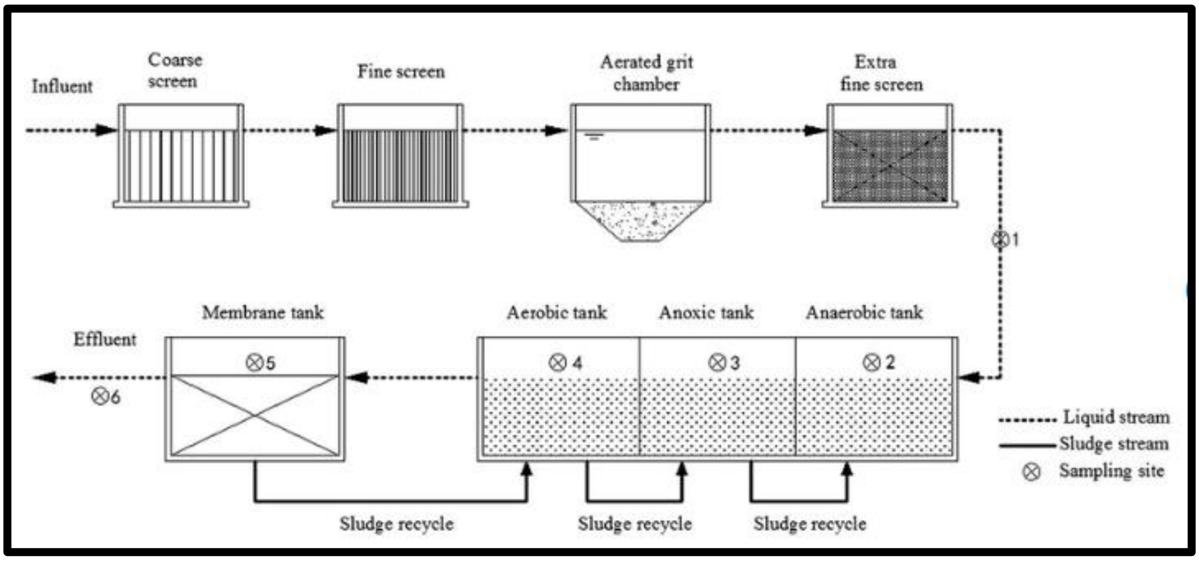

Figure 8-13. Typical Flow Diagram of MBR Process

The treated wastewater will be discharged into the sea by obtaining the required permits and licenses. Once the wastewater quality meets the national regulatory limits, then discharged to the sea via effluent pumps. The limits stipulated in WPCR, IFC Guidelines and Project Standards in Table 8-5.

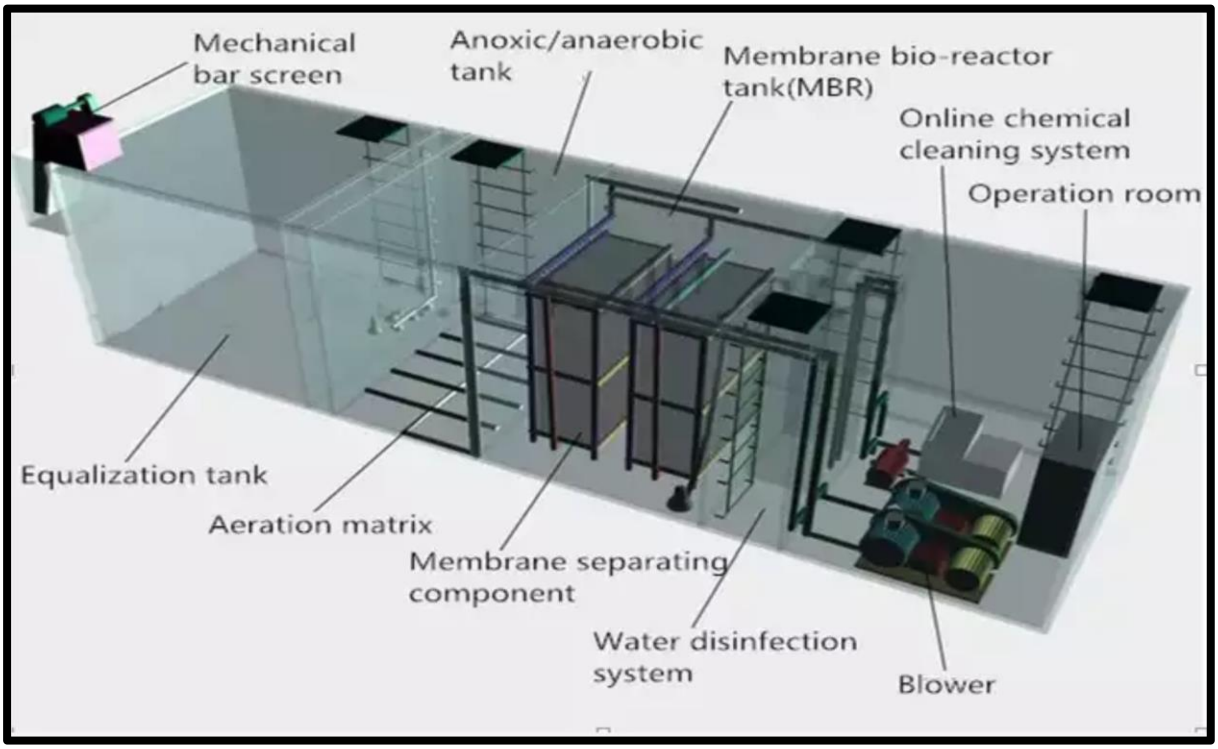

Figure 8-14. Illustration of a Package MBR Unit

Table 8-5. Limits Given in WPCR and IFC Guidelines and Required Design Values.

Parameter	Unit	WPCR Table 21.2 (Population 84 – 2,000) Composite Sample		IFC Guideline Values	Project Standard
		2 hours	24 hours		
pH	NA	6-9	6-9	6-9	6-9
Biochemical Oxygen Demand (BOD)	mg/L	50	45	30	< 20
Chemical Oxygen Demand (COD)	mg/L	180	120	125	< 60
Total Nitrogen	mg/l	-	-	10	< 10
Total Phosphorous	mg/l	-	-	2	< 2
Oil and Grease	mg/l	-	-	10	< 10
Suspended Solids (AKM)	mg/L	70	45	50	< 1
Total Coliform Bacteria	MPN / 100 ml	-	-	400	400

The waste water treatment system is designed according to waste water that coming from toilets, washbasins, showers, etc. It is assumed that any other kind of wastewater such as garden drainage, pool water, storm water or waste water from kitchens are not fed to the system. Design parameters of the MBR WWTP system is provided in Table 8-9, Table 8-10, and Table 8-11.

Table 8-6. Assumed Raw Water Parameters

Assumed Raw Water Parameters		
Parameter	**Unit**	**Values**
Biological Oxygen Demand (BOD5)	mg/L	350
Chemical Oxygen Demand (COD)	mg/L	600
Total Suspended Solids (TSS)	mg/L	150
Total Kjeldahl Nitrogen	mg/L	45
Total Nitrogen	mg/L	42
Total Phosphorus	mg/L	5
Oil & Grease	mg/L	<3
pH	-	6-9
Temperature	ºC	20-25

Table 8-7. MBR System Design Criteria & Approximate MBR Product Water Parameters

MBR System Design Criteria & Approximate MBR Product Water Parameters	
MBR Product Water Flowrate	3 x 12,5 m3/h
MBR Product Water TSS	< 1 mg/L
MBR Product Water BOD	< 20 mg/L
MBR Product Water COD	< 60 mg/L
MBR Product Water Total Nitrogen	< 10 mg/L
MBR Product Water Total Phosphorus	< 2 mg/L

Table 8-8. Equipment Technical Data / Sidestream MBR System

Equipment Technical Data / Sidestream MBR System				
Equipment Description	Technical Data			
	Quantity	Capacity		Others
1.1 PRE-TREATMENT SYSTEM EQUIPMENTS				
LIFT PUMP				
Lift Pumps	4 (3 Servis / 1 Shelf Spare)	12.5	m3/h @ 1 bar	Submersible Sewage Pump with grinder blade / Cast Iron
COARSE SCREEN				
Coarse Screen	1 Duty	40	m3/h	Basket type, manuel cleaning, Galvanized
1.2 BIOREACTOR & MBR SYSTEM EQUIPMENTS				
BIOREACTOR EQUIPMENTS				
Alum Dosage Unit (with pump & accessories)	3 Duty	20	L/h @ 5 bar	-
Anoxic Tank Mixer	3 x 3 Duty	-		-
Blower	3 x 2 Duty	575	m3/h @ 475 mbar	-
Diffuser	3 x 119 Duty	-		Disc Type
Drum Screen	3 Duty	-		Mesh size: 1-2 mm
MBR SYSTEM EQUIPMENTS				
MBR System	3 Duty	12.5	m3/h	SideStream
MBR Feed Pumps (Frequency Control)	3 Duty	228	m3/h @ 0,5 bar	304 Stainless Steel
MBR Modules	3 Duty	330	m2	Maximum Temperature 40ºC
MBR Permeate Water Pump (Frequency Control)	3 Duty	21.5	m3/h @ 1 bar	Centrifugal Sewage Pump / SS 304
MBR Backwash Pump (Frequency Control)	3 Duty	100	m3/h @ 1,5 bar	Centrifugal Sewage Pump / SS 304
Sludge Pump	3 Duty	6.5	m3/h @ 1 bar	Centrifugal Sewage Pump / SS 304
Intrumentation	3 Set	-		Manometers, flowmeters, level switches
Skid	3 Duty	-		304 Stainless Steel
Piping	3 Set	-		PVC
Blower (Air Scour)	3 x 2 Duty	90	m3/h @ 475 mbar	-
Compressor (Instrumentation)	3 Duty	200	lt/min @ 7 bar	-
Chlorine Dosage Unit (with pump & accessories)	3 Duty	150	L/h @ 5 bar	-
Acid Dosage Unit (with pump & accessories)	3 Duty	800	L/h @ 5 bar	
Control Panel	3 Duty	-		S7 200 Series PLC + Operator Panel
Equalization & Lifting Tank	1 Duty	350	m3	Concrete
Anoxic Tank	3 Duty	50	m3	Concrete
Aerobic Tank	3 Duty	200	m3	Concrete
Drain Pit	1 Duty	15	m3	Concrete
Backwash & Clean Water Tank	1 Duty	15	m3	Concrete
Sludge Collecting Tank	1 Duty	30	m3	Concrete
Drainage Pump	1 Duty	2	m3/h @ 1 bar	Submersible Sewage Pump with grinder blade / Cast Iron

All the permits regarding, treatment facility project approval and discharge permit will be provided by the Project Company before the erection of the WWTU's. At present, discharge location is not defined yet. After finalization of the decision on discharge location, the Project Company must perform an Environmental Social Site assessment regarding necessary baseline measurements at discharge location. Besides, existing sea water characterisation measurements are considered sufficient to make assessment of the alternativePortable toilets will also be located at construction site for daily use of construction works. These toilets will have wastewater storage tanks, which will be regularly emptied by vacum trucks. Collected wastewater from these portable toilets will be transferred to the WWTU.

Packaging Waste: Packaging waste such as paper and cardboard, metal, plastic and glass materials, and mixed packing wastes will be collected separately in dedicated waste bins. The bins will be located at certain points of the site and periodically collected by an authorized packaging waste collection company. The packaging wastes will be recycled and recovered in accordance with the Turkish Regulation on Packaging Waste Control.

Excavation Wastes: The excavated material will be temporarily stored in the temporary Excavated Material Storage Area located to the northwest and northeast of the Project site within the CPIR boundaries. A significant part of the excavated soil/material that will arise from the foundation excavation works during the pre-construction phase of the Project will be reused for various purposes within the CPIR boundaries (i.e., landscaping in the Project site, building and marine construction backfilling in the CPIR Port).

As reported by Ceyhan PP A.Ş., it is anticipated that approximately 4,457,000 m^3 of excavation materials will be produced, a part of which will be used for backfilling (100,000 m^3) on the Project site. In addition, 4,357,000 m^3 will be used as filling material in the marine section of the CPIR Port Project. Depending on the characterisation of the excavation material, it is assumed that approximately 500,000 m^3 of material will be provided from licensed borrow pits. The excavation wastes will be managed in line with the Regulation on Control of Excavation, Construction, and Demolishing Wastes.

Medical Wastes: Medical wastes will be generated in trace amounts during the construction phase due to medical care of minor cuts and first aid activities. Medical wastes will be stored in special containers and designated areas in line with the Medical Wastes Control Regulation, to be collected by authorized trucks and sent to licensed facilities.

Hazardous Wastes: Several type of hazardous wastes will be produced during the operation of the Project. These hazardous wastes are:

- Wate mineral oils (i.e. engine, gear, and other equipment lubricating oils etc.);
- Waste printing toner containing hazardous substances;
- Pressurized tubes;
- Hazardous insulation materials;
- Paint residues (i.e. epoxy paint, epoxy and polyurethane thinner etc.);
- Membranes;

- Packaging containing residues of, or contaminated by dangerous substances;
- Absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, and protective clothing contaminated by hazardous substances;
- Fluorescent tubes, and other mercury-containing wastes.

The hazardous wastes will be separately collected in dedicated containers on-site and will be stored at the dedicated area which will be placed on concrete ground with effective emergency drainage (i.e., an inclined canal connected to a dead pit). All hazardous waste containers will be labelled with relevant waste codes and waste types. Hazardous wastes will be sent to the licensed hazardous waste recycling and/or disposal facilities according to their types and the facility license specifications.

Special Wastes: Each special waste will be managed according to the relevant regulations, such as:

- Waste mineral oils will be collected in barrels/drums and will be delivered to the licensed facilities according to the Regulation on Waste Oils Management.
- Waste batteries will be separately collected in a battery box. The collected waste batteries will be sent to TAP (i.e., the authorized waste battery collector) to be disposed of at the licensed facility.
- Waste accumulators will be delivered to the supplier. There will be no need to store the waste accumulators on-site. These wastes will be managed in line with the Regulation on Waste Batteries and Accumulators Control Regulation.

Non-hazardous Wastes: Metal and wood scrap materials will be produced during the construction phase of the Project. Radiographic test (films) under photographic films and paper (including other than silver and silver compounds) might be generated during radiographic testing of pipes. Non-hazardous wastes will be managed in line with Waste Management Regulation.

***Wastes from construction vessels*:** There is no information with respect to waste types and amounts from vessels at this stage. However, in the scope of the Project, dumping of any liquid and solid material into the sea will not be allowed during the construction phase. Measures are expected to be taken by the vessel owners to prevent any construction waste falling into the sea and/or leaks or spills of oil and petroleum products. The details of the measures that will be taken are to be provided and relevant information will be submitted to the MoEUCC before the construction phase by vessel owners if requested. The waste reception facility of the Adana Metropolitan Municipality is anticipated to be in operation as of 2021[9] . Therefore, the Project Company will make necessary communications and liaisons with the Municipality regarding the management of wastes from construction vessels.

[9] Adana Metropolitan Municipality (AMM), 2020. Strategic Plan 2020-2024, Adana. https://www.adana.bel.tr/panel/uploads/stratejikplani_v/files/2020-2024-adana-buyuksehir-belediyesi-stratejik-plani.pdf

Table 8-9. Waste characteristics and disposal methods during the construction activities

Waste Class	Waste Type	Waste Code	Characteristics	Governing Regulation	Proposed Management	Disposal Method	Potential Impacts	Risks
Domestic Waste	Solid Waste	20 03 01	Non-hazardous-household waste from the camp sites (estimated as 5,220 kg/day).	Waste Management Regulation (OG Date/Number: 02.04.2015/29314).	Impermeable and sealed waste containers.	Adana SWDF through the transfer centre in the Ceyhan district.	Soil, Groundwater and Surface Water / Marine Pollution; Over capacity problem for waste disposal (collection and disposal); Public health risks; Visual pollution.	Low Risk. Planned disposal facility is already in use and has adequate capacity to receive waste.
	Domestic Wastewater	20 03 01	Generated by workers at the campsites and during construction activities (estimated as 1,500 m^3/day).	Water Pollution Control Regulation (OG Date/Number: 31.12.2004/25687).	Currently, collection in an on-site septic tank that will be periodically emptied by vacuum trucks for disposal to the municipal wastewater collection line. A Membrane Bioreactor (MBR) wastewater treatment plant (WWTP) will be established at the Project site for the domestic wastewater to be generated during the construction phase of the Project.	Currently, the domestic wastewater to be generated during the construction phase of the Project will be collected in impermeable, underground septic tanks and necessary agreements will be made with the municipality for the collection via vacuum trucks After the construction of WWTP is completed, treated effluent will be discharged to the sea via effluent pumps after it is ensured that the effluent quality meets the national regulatory discharge limits.	Surface Water / Marine Pollution; Public health risks.	Low Risk. Planned disposal facility is licensed and have sufficient capacity.
Excavation Waste	Excavated material- Non contaminated	17 05 04	Non contaminated natural soil material due to levelling and excavation for foundations	Regulation on Control of Excavated Soil, Construction and Demolition Wastes (OG Date/Number: 18.03.2004/25406)	Temporary piling on ground within construction site with appropriate measures against dust generation and surface runoff	Excavated material will be used as backfilling material (4,357,000 m^3) for CPIR port and (100,000 m^3) for Ceyhan PDH- PP construction.	Soil pollution; Dust generation; Sediment transport; Visual pollution.	Low Risk. Main target is the use of all excavation material as backfilling material. If the excavation material is not fully

Waste Class	Waste Type	Waste Code	Characteristics	Governing Regulation	Proposed Management	Disposal Method	Potential Impacts	Risks
			(estimated to be 4,457,000 m^3)					used, the excess amount will be sent to licensed disposal sites. There are areas designated by the municipality for the disposal of the excavation waste.
Packaging waste	Recyclable metal and plastic waste	15 01 01 (paper, cardboard, cardboard waste) 15 01 02 (plastic) 15 01 04 (metal) 15 01 07 (glass) 15 01 06 (mixed packaging)	Non-hazardous waste that will include certain plastic materials from packaging of products brought to the site; Non-hazardous metal wastes shall be disposed separately for reuse and recycling.	Packaging Waste Control Regulation (OG Date/Number: 27.12.2017/30283); Communiqué on Recycling of Certain Non-hazardous Wastes (OG Date/Number: 17.06.2011/27967).	Impermeable and sealed waste containers.	Licensed facilities for packaging waste collection announced in the official website of the MoEUCC (https://cygm.csb.gov.tr/yetkilendirmeler-ve-lisanslar-i-534).	Soil pollution; Visual pollution.	Low Risk. Packaging waste transport and disposal/ recycling are common practices that are well regulated by the MoEUCC and there are several facilities in the province to collect the packaging waste.
Special Waste	Waste oils	13 01 … 13 02 … Code to be defined based on type of waste oil	Hazardous materials-generated from maintenance and use of construction equipment.	Waste Oil Control Regulation (OG Date/Number: 21.12.2019/30985).	Waste oils will be separated and stored based on the waste oil category.	Licensed waste oil recycling facilities announced in the official website of the MoEUCC (https://cygm.csb.gov.tr/yetkilendirmeler-ve-lisanslar-i-534).	Soil, Groundwater and Surface Water / Marine Contamination / Pollution.	Low Risk. Waste oil collection, transport and disposal/ recycling are common practices that are well regulated by the MoEUCC.
	Waste Batteries; Waste Accumulators	20 01 33* 16 06 02 16 06 04 16 06 05	From construction equipment used at the site.	Regulation on Control of Waste Batteries and Accumulators (OG Date/Number: 31.08.2004/25569).	Stored in special containers and areas in line with the regulations. Waste batteries to be delivered to TAP and waste accumulators to dealers.	To be collected by TAP to be recycled in a licensed facility.	Soil, Groundwater and Surface Water / Marine Contamination / Pollution.	Low Risk, since this is an established practice and the waste batteries and accumulators will not represent a large increase in the existing waste stream.
Hazardous waste	Contaminated/oily fabrics and filters, waste	08 03 17 20 01 21	Hazardous wastes can mainly be generated during the	Waste Management Regulation (OG	Hazardous wastes will be separated from other types of	Licensed waste recycling and disposal facilities including the ones announced in official	Soil, Groundwater, and Surface	Low Risk. Project Company shall establish a well-

Waste Class	Waste Type	Waste Code	Characteristics	Governing Regulation	Proposed Management	Disposal Method	Potential Impacts	Risks
	mineral oils, contaminated packaging material, toner cartridges, paint residue (epoxy paint, epoxy and polyurethane thinner), fluorescent tubes, absorbents, cleaning cloths and filters, hazardous insulation materials, pressurized tubes, other used chemicals and similar.	15 02 02 17 06 03 17 06 04 15 01 10 15 01 11 17 05 03	maintenance of vehicles and mechanical works undertaken during the construction phase of the Project.	Date/Number: 02.04.2015/29314).	wastes generated on the site and stored based on the relevant waste code. Wastes shall be temporarily stored for a maximum of 6 months on the site on a designated area and labelled with relevant signs. These areas will have an impermeable ground and be covered to prevent any spills or leaks of hazardous wastes and contact with storm/runoff water. The area will be connected to a dead pit through an inclined canal for emergency spills.	website of MoEUCC (https://cygm.csb.gov.tr/yetkilendirmeler-ve-lisanslar-i-534).	Water / Marine Contamination / Pollution; Labour and Community Health Hazard	structured designated storage area. Hazardous waste collection, transport and disposal are common practices that are well regulated by the MoEUCC.
Medical Waste	Infectious waste (waste suspected to contain pathogens (e.g., bacteria, viruses, parasites, or fungi) in sufficient concentration or quantity to cause disease in susceptible hosts.); Sharps: (needles, scalpels, blades, knives, infusion sets,	18 01 …* 18 02 …*	Generated at infirmary.	Medical Waste Control Regulation (OG Date/Number: 25.01.2017/29959).	Stored in special containers and areas in line with the regulations. Medical waste to be collected by licensed trucks.	Medical waste gasification facility operated by the ITC.	Labour Health Hazard; Community Health Hazard.	Low Risk since the total volume of wastes will be limited and Project Company shall manage medical wastes separately. The medical waste gasification unit in Adana is operational and has sufficient capacity.

Waste Class	Waste Type	Waste Code	Characteristics	Governing Regulation	Proposed Management	Disposal Method	Potential Impacts	Risks
	saws, broken glass, and nails etc.).							
Non-hazardous waste	Metal, Wood	15 01 03 17 02 01 20 01 40	Generated from the main construction activities.	Regulation on Control of the Excavated Soil, Construction, and Demolition Wastes (OG Date/ Number: 18.03.2004/25406); and Communiqué on Recycling of Certain Non-hazardous Wastes (OG Date/Number: 17.06.2011/27967).	Separately collected and sent to licensed recycling facilities.		Soil and Marine Pollution; Visual pollution	Low risk due to proper management.
	Radiographic test (films) under photographic films and paper (including other than silver and silver compounds).	09 01 07	Possible to be generated during radiographic testing of pipes.	Waste Management Regulation (OG Date/Number: 02.04.2015/29314).	Separately collected and sent to licensed recycling facilities.		Soil, Groundwater and Surface Water / Marine Contamination / Pollution; Labour Health Hazard; Community Health Hazard.	Low risk due to proper management.

8.7 Waste Generation and Management during the Operation Phase

8.7.1 Ceyhan PDH-PP Project

For the operation phase of the Project, waste types, estimated waste volumes and potential disposal methods and locations are assessed in this section. The waste categories that will be generated during the operation phase include domestic wastes such as domestic wastewater, packaging wastes, special wastes; hazardous wastes, wastewater other than domestic wastewater, and small volumes of medical waste. Municipal wastes can be generated from offices, and maintenance functions and these may include packaging wastes, office-originated hazardous wastes, and special wastes.

Each of these classifications has a separate waste code and suitable disposal method in accordance with Turkish regulations. In addition to the national legislative requirements, management practices are provided in the IFC EHS Guidelines for Petroleum-based Polymers Manufacturing, EBRD Sub-sectoral Environmental, and Social Guidelines: Manufacture of Plastic and Synthetics, and relevant European Union (EU) Directives.

As stated in the EHS Guidelines for Petroleum-based Polymers Manufacturing (2007), storage and handling of hazardous and non-hazardous wastes should be conducted following waste management practices described in IFC General EHS Guidelines.

Of specific importance for the operation of the units, the liquid and solid wastes that will be potentially generated during the operation phase of the Project are described below.

Domestic waste: According to the TUIK data on an estimated daily per capita waste generation of 1.16 kg, the domestic waste (solid waste) generation rate at the Project site is calculated as 372.4 kg/day. Solid domestic waste will be stored in waste containers and will be collected by the district municipality trucks for further disposal in Adana SWDF.

Domestic wastewater: Domestic wastewater generation is calculated as 66.8 m^3/day for 321 people based on the assumption of daily per capita generation of 208 L. Currently, there is no sewerage infrastructure extending to the proximity of the Project site. There will be a separate sanitary sewer system to be established at the Project site for the operation phase. The domestic wastewater will be transferred to the WWTP through this system.

Industrial wastewater/process wastewater: Non-oily sewer (NOS), possibly oily contaminated sewer (POCS), oily water sewer (OWS), and sanitary sewer (SS) systems will be established at the Project site in line with the drainage scheme given in “Drainage and Wastewater Gathering Philosophy” dated 12 June 2020, and “Specification for Drainage” dated 23 April 2020 prepared for the Ceyhan PDH-PP Facility by the Project Company. All the wastewater generated from the process components within the Project site will be collected in accordance with the provisions of the “Drainage and Wastewater Gathering Philosophy”, and

"Specification for Drainage", and will be treated in the Project WWTP, which will be established in accordance with the drainage scheme (shown in Figure 8-15)

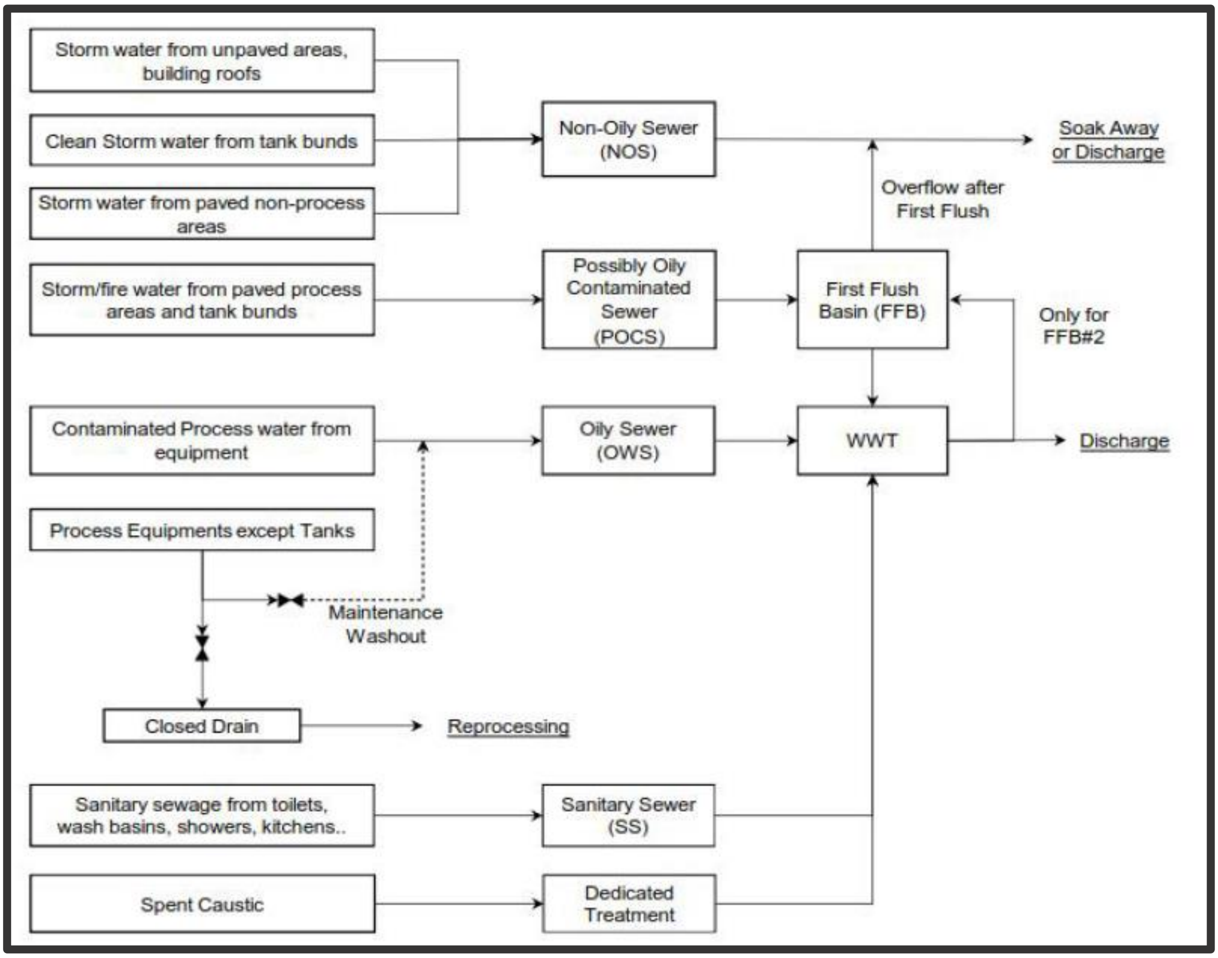

Figure 8-15. Storm and wastewater management flowsheet

Additionally, there will be a separate drainage system for spent caustic. There will also be closed drain systems (CDS) on-site, where wastewater from process lines is collected in dedicated process drums to be re-processed in the Plant. All wastewater to be collected from the drainage systems except the non-oily sewer system (uncontaminated stormwater) will be sent to the treatment units/plants in the Facility. The types of wastewater to be collected separately in each drainage system and disposal mechanisms are explained below.

Non-oily sewer (NOS) system will be established to collect surface run-off (from non-contaminated areas), tank bund clean water, building roofs, Heating, Ventilation and Air Conditioning (HVAC) room floor drainage, and to discharge to the receiving environment in line the with the national regulatory requirements.

Potential oily contaminated sewer (POCS) system will be established to collect wastewater from the process paved area (including rainwater, and fire-fighting water), loading areas, utilities area, parking lots, tank bund water (in case there is a spill). POCS will be collected in the inlet chamber and First Flush Basin (FFB).

Oily Water Sewer (OWS) system will be established to collect oily water from equipment and pump drain hubs, equipment drains, tank bottom drains, neutralised effluents from the laboratory system, seal water from the flare stack, boiler blowdown from the process area, surface water around lube oil skid and send the effluents to the sumps located on the plant. OWS will be thereafter pumped to the WWTP.

Sanitary Sewer (SS) System will be established to collect wastewater from domestic sources (i.e., toilets, showers, etc.), buildings, warehouses, canteen. Sanitary wastewater will be sent directly to the aeration basin within the WWTP. The sludge generated in the WWTP will be sent for ultimate disposal by vacuum trucks to the licensed disposal facilities.

The Project WWTP will provide treatment of the effluents in compliance with the national and international discharge criteria. As a general rule, the stricter criteria will be adapted as the Project Standard to be followed during all activities. In that respect, the effluent standards for Project WWTP are given in Figure 8-7 below. The for the discharge of the process water effluents after the treatment the discharge criteria are given in Table 8-11.

Table 8-10. Allowable Effluent Limits for Discharge to Environment

Parameter	WPCR Discharge Criteria for Domestic Watewater**	IFC General EHS Guidelines*	Project Standard
Biochemical Oxygen Demand (BOD_5) (mg/L)	45	30	30
Chemical Oxygen Demand (COD) (mg/L)	120	125	120
Total suspended solids (mg/L)	45	50	45
pH	6-9	6-9	6-9
Total Nitrogen (mg/L)	-	10	10
Total Phosphorous (mg/L)	-	2	2
Oil and grease (mg/L)	-	10	10
Total coliform bacteria (MPN/ 100 ml)***	-	400	400

*IFC General EHS Guideline (2007), 1.3 Wastewater and Ambient Water Quality, Table 1.3.1 Indicative Values for Treated Sanitary Sewage Discharges
** Water Pollution Control Regulation, Table 21.1 (threshold values for 24-hr composite effluent sample)
*** MPN: Most Probable Number

Table 8-11. Allowable Effluent Limits for Wastewaters from Manufacturing of Petroleum-based Polymers

Parametre	WPCR Effluent Discharge Criteria (2-hr composite sample)**	WPCR Effluent Discharge Criteria (24-hr composite sample)**	IFC General EHS Guidelines*	Project Standard
Biochemical Oxygen Demand (BOD_5) (mg/L)			25	25
Chemical Oxygen Demand (COD) (mg/L)	250	100	150	100
Total suspended solids (mg/L)	65	45	30	30
pH	6-9	6-9	6-9	6-9
Total Nitrogen (mg/L)	-	-	10	10
Total Phosphorous (mg/L)	2.5	1	2	1
Oil and grease (mg/L)	25	10	10	10
Temperature increase (°C)			=3	=3
Cadmium (mg/L)			0.1	0.1
Chromium (total) (mg/L)			0.5	0.5
Chromium (hexavalent) (mg/L)			0.1	0.1
Copper (mg/L)			0.5	0.5
Zinc (mg/L)			2	2
Lead (mg/L)			0.5	0.5
Nickel (mg/L)			0.5	0.5
Mercury (mg/L)			0.01	0.01
Phenol (mg/L)			0.5	0.5
Benzene (mg/L)			0.05	0.05
Vinyl Chloride (mg/L)			0.05	0.05
Adsorbable Organic Halogens (mg/L)			0.3	0.3
Toxicity			To be determined on a case specific basis	-
Toxicity, Fish bioassay analysis (Toxicity Dilution Factor)	6	3	-	3

*IFC Sectoral Guideline, Environmental, Health and Safety Guidelines for Petroleum-based Polymers Manufacturing (2007), Table 2 Effluents Guidelines
** Water Pollution Control Regulation, Table 14.8:Chemicals Sector, Processing and Manufacturing of Plastic Materials (threshold values for 2-hr and 24-hr composite effluent samples)

A detailed flowsheet of the wastewater treatment planning of the Project is given in Figure 8-16. The Project company is also working on the wastewater reuse options for the operation stage.

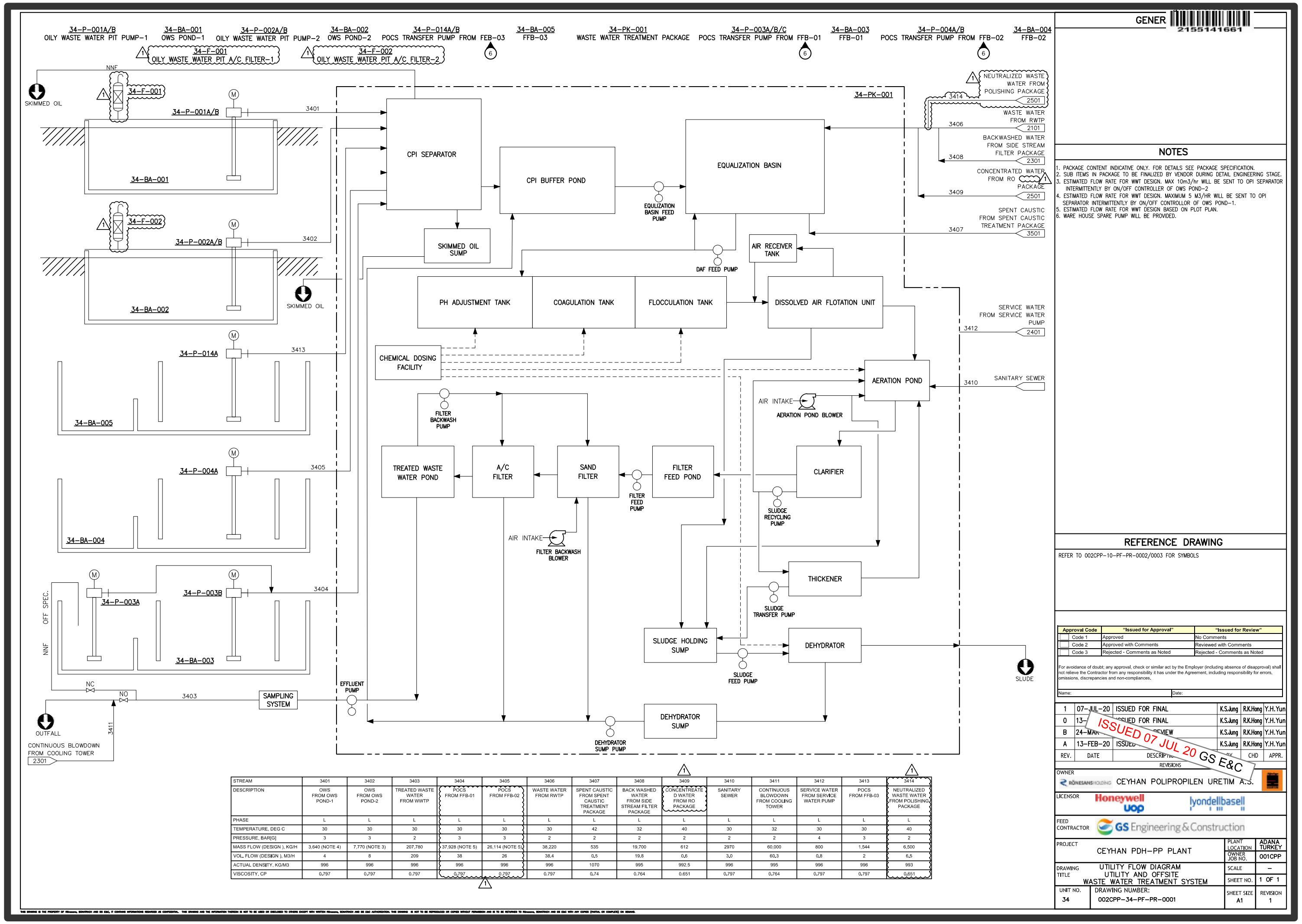

Figure 8-16. A detailed flowsheet of the wastewater treatment planning of the Project

The sanitary sewage in the unloading platform of the Jetty in the Associated Terminal Facility which will be under the responsibility of the relevant operating company is expected to be collected in an isolated septic tank within the marine operator building and drained out regularly by a vacuum truck. Accordingly, sanitary sewage from the jetty area will be provided with a macerating pump with a grinder in a lifting station.

In addition to the drainage systems mentioned above, there will be miscellaneous drainage inside the units in the Facility (i.e., drains from laboratories, mechanical rooms, stormwater drainage in the polymer unit, drainage around chemical handling equipment). Miscellaneous drainage from the polymer unit will be provided manually. On the other hand, if there will be wastewater generated in the chemical handling equipment, there shall be a piping and manual valve which will be opened once the fluid inside the spill-wall is mostly storm water. If the fluid is identified as contaminated, it will be drained to OWS or removed with a vacuum truck.

A wastewater treatment plant (WWTP) will be installed on the Project site with a capacity of 208 m^3/hr. The WWTP will be designed to treat oil-contaminated wastewater and other contaminated wastewater streams originating from process, utility and offsite units in order to meet the regulatory limits. The WWTP will consist of an oil separation unit, equalization basin, coagulation and dissolved air flotation, biological treatment unit, sludge dewatering unit, filtering facility (using sand and activated carbon), treated wastewater pond, and required chemical dosing system. The treated stream will be sent to the treated wastewater pond and if the wastewater quality meets the national regulatory limits, then discharged to the sea via effluent pumps.

The fire water used in emergency situations might get contaminated which would require special treatment prior to being discharged. Therefore, the discharge of used fire water will be taken into consideration during the design stage of the water discharge plan of the site in both the construction and operation phases of the Project and associated Terminal Facility.

Hazardous waste: Hazardous waste types which are generated in the PDH-PP and their associated units consist of reagents, spent catalyst, and catalyst dust and fines, molecular sieves, waste oil, filter bags or cartridges, metallic cartridges, metallic drums, resin, activated alumina, skimmed oil, and sludge from WWTP. The estimations regarding type of the hazardous wastes to be generated during the operation of Project are presented in Table 8-13.

All hazardous waste must be separately collected. The hazardous waste containers must be labelled, and necessary information should be written on the labels. Hazardous waste will be stored at dedicated areas and will be sent to the licensed recycling and/or disposal facilities with licensed transporters.

Packaging Waste: Similar to the construction phase of the Project, packaging waste such as paper and cardboard, metal, plastic, and glass materials will be collected separately from other types of waste in dedicated waste bins during the operation phase. The bins will be located at certain points of the site and periodically emptied by the authorized packaging waste collection company. Accordingly, the packaging waste materials will be recycled and recovered in accordance with the Turkish waste management and control regulations.

Special Waste: Waste battery and waste accumulators are expected to be produced as special waste during the maintenance activities of the Project. Each type of special waste will be collected separately and managed according to the relevant Turkish Legislation.

Medical Waste: Medical waste will be generated in trace amounts during the operation phase due to medical care for minor cuts and first aid activities. Medical wastes will be stored in special containers and areas in line with the regulations and will be collected by licensed trucks and sent to licensed facilities.

Non-hazardous Waste: Metal, wood, and plastic scrap materials will be produced during the operation phase of the Project from maintenance activities. Additionally, spent resins will be generated at the deionized water generation unit. These resins are classified as non-hazardous waste under Turkish Environmental Legislation. Non-hazardous waste materials will also be stored in dedicated areas and will be sent to licensed recycling and/or disposal facilities.

Record keeping will be maintained for different types of waste quantities and the third-party facilities where handling and recycling/disposal of the waste is undertaken. The estimations regarding the quantities of different types of waste to be generated during the operation phase of the Project are presented in Table 8-12.

Table 8-12. Potential waste types to be generated during operation phase of the Project

Type	Unit/Source	Type of Waste	Quantity	Frequency
Liquid	PP/ Laboratories	Concentrated reagent	80 kg (average)	4 drums/day
Liquid	PP/ Waste oil treating drum	Exhaust oil	2 to 3 drums (200 L each)	Once in a month
Liquid	PP/ Oil hydraulic guard	Exhaust oil	180 kg	Once in a month
Liquid	PP/ Waste oil collector	Exhaust oil	0.5 L /day	Once in every 3 or 6 days
Liquid	WWTP	Treated wastewater	192 m^3/h	Continuous
Liquid	WWTP	Skimmed oil	5.2 kg/h	Continuous
Solid	PP/Propylene dryer	Molecular Sieves	-	Once in many years (> 2)
Solid	PP	Polyethylene Bags	-	Once a year
Solid	PP	Metallic drums	-	Once a year
Solid	PP	PP Filtering Bags or Cartridges, Metallic Cartridges	-	Once in 2 years

Type	Unit/Source	Type of Waste	Quantity	Frequency
Solid	PDH	Oleflex Spent Catalyst	283 m^3	Every 3 to 4 years
Solid	PDH	SHP Spent Catalyst	11.6 m^3	Every 3 years
Solid	PDH/Chloride treater	Activated Alumina	200.8 m^3	Every 1 year
Solid	PDH/Reactor effluent driers	Activated Alumina	426 m^3	Every 3 years
Solid	PDH/Feed guard beds	Resin	46.4 m^3	Every 3 years
Solid	PDH/Feed driers	Molecular Sieves	24.5 m^3	Every 3 years
Solid	PDH/Mercury removal bed	Molecular Sieves	23.3 m^3	Every 5 years
Solid	PDH	Oleflex Catalyst Dust and Fines	33 kg/day	Daily
Solid	WWTP	Sludge	0.6 kg/h	Intermittently

Other than the abovementioned types of waste, it is noteworthy to mention that polypropylene pellets and powders will be generated at the PP unit during the operation of the Project. The total volumes of the pellets and powders are given below:

- Polypropylene powder generated at blowdown drums: Desultory discharge after emergency shut down; approximately 55 tons. These solids are planned to be sold and therefore are not considered waste.
- Polypropylene powder and solid additives from suction systems in PP unit: Max 10-15 kg/day once a week. These solids are planned to be sold and therefore are not considered waste.
- Polypropylene pellet from PP unit: Up to 500 kg/day continuously. These solids are planned to be sold; therefore, are not considered waste.
- Polymer scrapes from PP unit (desultory at start-up): Scraps and off-grade pellets at start-up; 200 to 600 kg for each start-up for each extruder. These solids are planned to be sold; therefore, are not considered waste.
- Wet pellet and powder from cutting water drum and wastewater basin: Up to 50 kg/day and up to 60 kg/day, respectively. These solids are planned to be sold; therefore, are not considered waste.

According to the IFC EHS Guideline for Petroleum-based Polymers Manufacturing (2007), solid polymer waste can be produced during normal plant operation, change in running hours, start-up, maintenance and emergency shutdowns of polymer processing equipment. Necessary pollution prevention and mitigation measures are described in Section 8.7 of this chapter.

Table 8-13 below (developed based on the information provided in national legislation, IFC EHS Guideline for Petroleum-based Polymers Manufacturing (2007) and EBRD Sub-sector Environmental and Social (E&S) Guidelines for Manufacture of Plastics and Synthetics (2014)) provide guidelines for wastes anticipated to be generated during the operation phase of the Project. Table 8-13 also provides waste classifications according to the waste codes, best practice disposal methods defined in the IFC Guideline, and disposal method that is planned to be used for the Project.

8.7.2 Associated Terminal Facility including Jetty Site

Wastes originating from the Associated Terminal Facility will mainly include hazardous wastes associated with maintenance operations. Moreover, wastes originating from ships/vessels within the scope of the International Convention for the Prevention of Pollution from Ships (MARPOL-73 Convention and modified MARPOL-78 Protocol) may include mineral-based hydraulic oils, and engine, gear and lubricating oils, bilge oils and oily sludges. The Project will not have any waste reception facility.

O&M company of the associated Terminal Facility is expected to make necessary communications and agreements with the licenced waste reception facilities. O&M Company will developed, its own waste management plan and implement that plan.

In the scope of the Project, dumping of any liquid and solid material to the sea will not be allowed in the operation phase. Furthermore, it is expected that measures will be taken in order to prevent any waste falling into sea and/or spill or leakage of oil and petroleum products by the vessel owners.

Ballast[10] water is used to provide stability and maneuverability during a voyage when ships are not carrying cargo or not carrying heavy enough cargo. Therefore, ballast water discharge is mainly concern of unloaded empty marine vessels (before or during loading operation). Terminal Fecility is used as propane supply for the Project. Due to that reason, ballast water discharge is not expected. Ballast water receiving facility is not included in the design of Terminal Facility.

In relation to waste gases, Hazid/Hazop and Flameout Scenario Modelling is presented in Chapter 15 Community Health and Safety (subsection 15.3.3).

[10] Ballast water discharge is not allowed without authorization of the port authority. Authorization can be provided if the ballast water quality is accepted by the Port authority. Turkey is part of the International Convention for the Control and Management of Ships' Ballast Water and Sediments (2017). In accordance to the convention all marine vessels, which are cariying international cargo, should have Ballast Water Management Plan and should notify port authorities 6 (six) hour before ballast operation.

Table 8-13. Waste characteristics and disposal methods for Project site during the operation phase of the Project

Waste Class	Type of waste	Waste Code	Governing Regulation	Summary of generic storage, treatment and disposal options / notes	Waste Transporter / Waste Management Facility	Potential Impacts	Risks
Domestic Waste	Solid Waste (estimated as 372.4 kg/day based on the number of employees (321 at peak) during the operation phase of the Project).	20 03 01	Waste Management Regulation (OG Date/Number: 02.04.2015/29314) International Convention for the Prevention of Pollution from Ships (MARPOL-73 Convention and modified MARPOL-78 Protocol).	**Waste Segregation Strategy:** Collect separately, do not mix with other types of waste. Use domestic waste bins within the buildings and combine the inside waste into the outside domestic waste container for Municipality collection. **Disposal:** Dispose of in Municipality Solid Waste Sanitary Landfills (SWSL). **Recycling/Composting:** If applicable, separate food waste for further composting. In addition to the abovementioned strategy, Annex V of MARPOL-73 Convention and modified MARPOL-78 Protocol: Prevention of Pollution by Garbage from Ships prohibit the discharge of all garbage into the sea, except as provided otherwise.	Adana SWSL and licensed waste reception facility of the nearest coastal facility.	Contamination of receiving environment; Visual pollution; Landfill use.	Low Risk. The disposal facility is already in use and has sufficient capacity to receive the Project's wastes. Additionally, it is expected that the operator company of the Associated Terminal Facility will make necessary communications and agreements with the waste reception facility for the Facility.
	Wastewater (estimated as 66.8 m^3/day for 321 people at peak during the operation phase)	20 03 01	Water Pollution Control Regulation (OG Date/Number: 31.12.2004/25687).	**Wastewater Management Strategy:** Shall be separately collected and not be mixed with other types of wastewater expected from the Project.	Wastewater treatment as described in Section 8.5.2 above.	Contamination of receiving environment; Public health risk.	Low Risk.

Waste Class	Type of waste	Waste Code	Governing Regulation	Summary of generic storage, treatment and disposal options / notes	Waste Transporter / Waste Management Facility	Potential Impacts	Risks
Wastewater other than domestic wastewater	Wastewater and drainage water from the Project site drainage system including Non-oily sewer (NOS), possibly oily contaminated sewer (POCS), oily water sewer (OWS).	NA	Water Pollution Control Regulation (OG Date/Number: 31.12.2004/25687).	**Wastewater Management Strategy:** All wastewater types will be collected separately by the dedicated collection system in line with the drainage scheme given in "Drainage and Wastewater Gathering Philosophy", and "Specification for Drainage" documents of the Project and will be treated in the Project WWTP.	Wastewater treatment as described in Section 8.5.2 above.	Contamination of receiving environment; Public health risk.	Low Risk.
Medical Waste	**Infectious waste:** Includes waste suspected to contain pathogens (e.g., bacteria, viruses, parasites, or fungi) in sufficient concentration or quantity to cause disease in susceptible hosts.	18 01 03* 18 02 02*	Medical Waste Control Regulation (OG Date/Number: 25.01.2017/ 29959).	**Waste Segregation Strategy:** Yellow or red coloured bags / containers, marked "infectious" with international infectious symbol. Strong, leak proof plastic bags, or containers which can be autoclaved.	ITC Gasification Facility. Licensed Hazardous Waste Transportation Company and Licensed Hazardous Waste Recycling –Disposal Facility.	Hazardous contamination of receiving environment; Hazardous substance exposure; Public health risks.	Low Risk. Medical waste to be generated will be in trace quantity.
	Sharps: Includes needles, scalpels, blades, knives, infusion sets, saws, broken glass, and nails etc.	18 01 01* 18 02 01*		**Waste Segregation Strategy:** Yellow or red colour code, marked "Sharps". Rigid, impermeable, puncture-proof container (e.g., steel or hard plastic) with cover. Sharp containers should be placed in a sealed, yellow bag			

Waste Class	Type of waste	Waste Code	Governing Regulation	Summary of generic storage, treatment and disposal options / notes	Waste Transporter / Waste Management Facility	Potential Impacts	Risks
				labelled "infectious waste".			
Hazardous Waste	**Wastes from the manufacturing, formulation, supply and use of plastics, synthetic rubber and artificial fibers.** **Saturated Filter Beds:** originated from solution polymerization processes, from removal of spent polymerization catalysts, from the polymer solution or in a number of deodorization or clarification operations. Sludges from in-situ WWTP including hazardous substances	07 02 ..	Waste Management Regulation (OG Date/Number: 02.04.2015/29314).	**Waste Management Strategy for saturated filter beds:** -Recondition and reuse solvents (distillation on site or off site) and catalysts, where possible; -Ensure appropriate containment is used during the temporary waste storage and transport; -Specialised companies should undertake off-site management in order to avoid contamination by leachates; Minimizing purification agents through inline regeneration and extended lifetime, proper containment during temporary storage and transport, and off-site management by specialized companies for the management of filter beds. **Waste Management Strategy for Sludges:** Sludge from a wastewater treatment plant needs to be evaluated on a case-by-case basis to establish whether it constitutes a hazardous or a non-	Licensed Hazardous Waste Transportation Company and Licensed Hazardous Waste Recycling –Disposal Facility.	Hazardous contamination of receiving environment; Hazardous substance exposure.	Low Risk. Hazardous waste collection, transport and disposal are common practices that are well regulated by the MoEUCC.

Waste Class	Type of waste	Waste Code	Governing Regulation	Summary of generic storage, treatment and disposal options / notes	Waste Transporter / Waste Management Facility	Potential Impacts	Risks
				hazardous waste and managed accordingly.			
	Spent catalysts: including spent catalysts containing hazardous transition metals, or hazardous transition metal compounds, spent catalysts contaminated with hazardous substances, spent liquids used as catalysts, etc.	16 08 ..		**Waste Management Strategy:** Appropriate on-site management, including submerging pyrophoric spent catalysts in water during temporary storage and transport until they can reach the final point of treatment to avoid uncontrolled exothermic reactions; Return to the manufacturer for regeneration, or off-site management by licensed companies that can either recover the heavy or precious metals, through recovery and recycling processes whenever possible, or manage spent catalysts according to hazardous and non-hazardous waste management recommendations presented in the IFC General EHS Guidelines; Catalysts that contain platinum or palladium will be sent to a noble metal recovery facility.	Licensed Hazardous Waste Transportation Company, and Licensed Hazardous Waste Recycling –Disposal Facility.	Hazardous contamination of receiving environment; Hazardous substance exposure.	Low Risk. Spent catalysts can contain nickel, platinum, palladium, and copper depending on the process. The catalysts will be replaced and treated for recovery of the metal content in every three years.
	Pressurized containers: Include containers /	16 05 ..		**Waste Management Strategy:** Pressurized containers should be	Licensed Hazardous Waste Transportation Company, and Licensed Hazardous Waste Recycling –Disposal Facility.	Hazardous landfill use;	Low Risk. Hazardous waste collection, transport and disposal are common practices

Waste Class	Type of waste	Waste Code	Governing Regulation	Summary of generic storage, treatment and disposal options / notes	Waste Transporter / Waste Management Facility	Potential Impacts	Risks
	cartridges / cylinders for nitrous oxide, ethylene oxide, oxygen, nitrogen, carbon dioxide, compressed air and other gases. Gases in pressure containers and discarded chemicals.			separately collected from general waste. **Treatment:** - Recycling and reuse; or - Crushing followed by landfill; - Incineration is not an option due to explosion risks; - Halogenated agents in liquid form should be disposed of as chemical waste, as described above.		Contamination of receiving environment; Visual pollution.	that are well regulated by the MoEUCC.
	Fluorescent Lamp	20 01 21*		**Waste Segregation Strategy:** Separately collect in cardboard boxes to avoid being broken. **Disposal:** Crushing in dedicated drums.	Licensed Hazardous Waste Transportation Company / IZAYDAS	Hazardous contamination of receiving environment; Visual pollution.	Low Risk.
	Contaminated PPE, contaminated fabrics and filters: Absorbents, filter materials, wiping cloths, protective clothing contaminated by hazardous substances.	15 02 02*			Licensed Hazardous Waste Transportation Company, and Licensed Hazardous Waste Recycling –Disposal Facility.	Hazardous contamination of receiving environments; Visual pollution.	Low Risk. Hazardous waste collection, transport and disposal are common practices that are well regulated by the MoEUCC.
	Waste mineral oils	13 01 ..* 13 02 ..* 13 03 ..* 13 04 ..*	Waste Oil Control Regulation (OG Date/Number: 21.12.2019/30985).	**Waste Segregation Strategy:** Separately collect different groups of waste oils in line with	Licensed Waste Transportation Company / Licensed Waste Oil Recycling Facility or Licensed Disposal Facility.	Hazardous contamination of receiving environment;	Low Risk. Special waste collection, transport and recycling /disposal are common

Waste Class	Type of waste	Waste Code	Governing Regulation	Summary of generic storage, treatment and disposal options / notes	Waste Transporter / Waste Management Facility	Potential Impacts	Risks
		13 05 ..* 13 07 ..*		the groups (A and B) identified in Annex-1 of the Waste Management Regulation.		Hazardous substance exposure.	practices that are well regulated by the MoEUCC and by the related licensed facilities.
	Wastes from waste management facilities, off-site wastewater treatment plants and the preparation of water intended for human consumption and water for industrial use: (Sludge from water/wastewater treatment other than domestic)	19 08 .. 19 09 ..	Waste Management Regulation (OG Date/Number: 02.04.2015/29314).	**Waste Management Strategy:** Sludge from a waste treatment plant needs to be evaluated on a case-by-case basis to establish whether it constitutes a hazardous or a non-hazardous waste and managed accordingly.	Licensed Hazardous Waste Transportation Company, and Licensed Hazardous waste Recycling –Disposal Facility.	Hazardous contamination of receiving environment; Hazardous substance exposure.	Low Risk. Hazardous waste collection, transport and disposal are common practices that are well regulated by the MoEUCC.
Special Waste	**Waste vegetable oils**	20 01 25	Regulation on Control of Waste Vegetable Oils (OG Date/Number: 06.06.2015/ 29378).	**Waste Segregation Strategy:** Collect in plastic drums. **Treatment:** Recycling to produce biodiesel fuel.	Licensed Waste Transportation Company / Licensed Recycling Facility.	Contamination of receiving environment	Low Risk. Special waste collection, transport and recycling /disposal are common practices that are well regulated by the MoEUCC, and by the related licensed facilities.
	Waste accumulators	16 06 01*	Regulation on Control of Waste Batteries and Accumulators (OG Date/Number: 31.08.2004/25569).	**Waste Segregation Strategy:** Separately store in hazardous waste storage area up to 90 days on-site. **Treatment:** Recycling of the plastic, lead and acid solutions.	Licensed Waste Transportation Company / Return of the waste accumulators back to the supplier.	Hazardous contamination of receiving environment.	
	Waste batteries	20 01 33*		**Waste Segregation Strategy:** Separately collect in battery box.	Licensed Waste Transportation Company / Return of the waste batteries to TAP.	Hazardous	

Waste Class	Type of waste	Waste Code	Governing Regulation	Summary of generic storage, treatment and disposal options / notes	Waste Transporter / Waste Management Facility	Potential Impacts	Risks
				Disposal: Sanitary landfilling by TAP.		contamination of receiving environment.	
Packaging Waste	**Metal, Glass or Plastic packaging waste**: Generated from packaging of products brought to the site that will include certain plastic, glass and metal. Polyethylene bags /Paper bags with traces of polymer additives and stabilizers (estimated to be generated once a year).	15 01 04 (metal) 15 01 07 (glass) 15 01 02 (plastic) 15 01 10* (Contaminated)	Packaging Waste Control Regulation (OG Date/Number: 27.12.2017/30283).	**Waste Management Strategy:** Collect in impermeable and sealed waste containers. **Waste Segregation Strategy:** Separately collect in containers. **Recycling:** Packaging waste collection and segregation facility **Recovery:** Packaging waste recovery facility	Licensed Packaging Waste Collection and Segregation Facility, and Licensed Packaging Waste Recovery Facility	Contamination of receiving environment; Visual pollution.	Low Risk. Licensed facilities are already in use and have adequate capacity to receive waste.
Non-hazardous Waste	**Metal Scrap** **Wood scrap** **Plastic scrap**	20 01 40 17 02 01 17 02 03	Communiqué on Recycling of Certain Non-hazardous Wastes (OG Date/Number: 17.06.2011/27967).	**Waste Segregation Strategy:** Stored in dedicated impermeable base storage area **Recycling:** Sent to licensed recycling facility	Licensed Waste Transportation Company / Licensed Recycling facility.	Contamination of receiving environment; Visual pollution.	Low Risk. Non-hazardous waste collection, transport, and recycling are common practices that are well regulated by the MoEUCC, and by the related licensed facilities.
	Spent Resin	19 09 05	Waste Management Regulation (OG Date/Number: 02.04.2015/29314).	**Waste Management Strategy:** Sent to licensed facility.	Licensed Waste Transportation Company / Licensed Recycling or Disposal Facility.	Contamination of receiving environment; Visual pollution.	Low risk

8.8 Impacts

Non-compliance with waste storage, transport and final disposal conditions required by the Turkish regulatory framework constitutes a major impact. The existing Turkish regulatory framework has been set to be in line with the existing EU Waste Legislative framework. As detailed in above sections the Turkish regulatory framework is in place for assigning specific waste codes to each of the waste stream to be generated in the construction and operation phases. Furthermore, the waste disposal infrastructure for domestic, hazardous, non-hazardous, special and wastewater streams are available and operational in Adana. The impacts of the generated wastes can be considered negligible if the Project complies with the applicable regulations during construction and operation and ensures final disposal of waste streams in licensed facilities.

In addition, the Project is unlikely to cause significant impacts on waste generation from the region (considering the available handling and deposition capacity of the current facility) because the Project will place only limited demand on the Integrated Solid Waste Disposal Facility in Adana and there is no issue with the landfill capacity.

Potential impacts to occur during handling and transportation of chemicals both during construction and operation phases of the Project and potential impacts due to chemical hazards during operation of the facility are discussed in *Chapter 16: Labour and Working Conditions*. Similarly, impacts from transportation of wastes are discussed in *Chapter 11: Traffic Impact* along with the potential impacts of transport of materials and goods to and from the Project site.

8.8.1 Impacts During Construction

Wastes likely to be generated during the construction phase of the Project will include domestic wastes and wastewater, packaging wastes, excavation wastes, medical wastes and hazardous wastes. If not handled adequately, and disposed of in an appropriate manner, the generation of these wastes can give rise to major impacts. All wastes generated during the construction phase will be managed in line with the Waste Management Plan (WMP) to be prepared by the Project Company. and the Turkish regulatory framework:

- Excavated soil has the potential to cause local nuisance due to dust generation during the construction phase. Furthermore, transport of sediments and debris might be an issue if not managed properly. The Project Company is planning to reuse the excavated materials on-site for landscaping purposes and as backfill material. Additionally, part of the excavated material potantiall be used for backfilling in the CPIR Port Project, if necessary pemits provided by the CPIR Port Management. Backfilling operation will be performed under the responsibility of the CPIR Port Management Company;
- Any oil and/or chemical spills during maintenance activities in the course of the construction phase of the Project may create health and safety impacts as well as

environmental impacts (i.e., contamination of soil, groundwater, surface water and marine environment). Related impacts may vary from minor to major significance depending on the size of spills, the properties of the environment where the spill has occurred and the response time to the incident. Relevant mitigation measures are also detailed in *Chapter 6: Geology, Soils, Sediments and Contaminated Land*, and *Chapter 7: Hydrology and Hydrogeology*;

- Domestic solid waste, especially the organic waste from food preparation or residues attract vermin and other disease vectors. This may create risks on workers' and community health. Also, if not managed properly, the solid wastes may generate irritant odour in and around the Project site. The domestic waste will need to be appropriately collected, stored and disposed of in accordance with the regulatory framework;
- If not managed properly, waste mineral oils, battery and accumulators can also give rise to adverse impacts to human and environmental health. These wastes must be managed appropriately during construction in line with the regulations and disposed in licensed facilities;
- Medical waste will be generated at trace amounts during construction phase due to medical care for minor cuts and first aid activities. Generation of medical waste is expected to be in small volumes; however, significant impacts might occur such as transmission of infectious diseases, if these wastes are not managed properly;
- Domestic wastewater generated during construction phase, if not managed properly, may affect the environment adversely. The daily domestic wastewater discharge is expected to be 1,260 m3/day. Currently there is no sewerage infrastructure extending to the proximity of the Project site. . An MBR WWTP will be established at the Project site for the domestic wastewater to be generated during the construction phase of the Project. If the WWTP is not managed properly, the environment may be affected adversely.

Impacts during the construction phase of the Project are divided into three classes. One of them is supply of raw materials, the second is waste generation and management which encompasses all the wastes generated during construction activities and their handling, haulage and disposals, and the last one is wastewater generation and management. Table 8-14 to show the summary of the above-mentioned assessment results including the assessment for Impact Magnitudes, Receptor Sensitivities and Vulnerabilities and the respective Impact Significances, respectively. Impact significances are determined based on the methodology given in Chapter 4 of this ESIA Report.

Table 8-14. Construction Phase Impact Magnitudes

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Supply of Materials	Negative Direct	Definition	The impacts regarding the material supply will be on a regional scale.	Without the application of a sound EMS, and efficient material and energy use practices, impacts are considered to continue during the construction phase of the Project (i.e., around 4 years)	Impacts are expected to cause tangible changes in the environment and social elements.		Improper management of material supply may have impacts on the local resources and suppliers.	It may take over a year for the initial condition of the material supply and resources to be restored after the cessation of the impact with restoration activities.
		Score	Regional	Long	Medium	-	Likely	Mid-term
		Value	3	4	3	-	3	3
	Impact Magnitude (G+D+I+F (or L)) x R		**39**					

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Waste Generation and Management	Negative Direct	Definition	Regarding the location of the licensed waste management facilities (e.g., impact on capacity of the facilities) and considering potential contaminant dispersion in the case that improper discarges to the marine environment impacts are evaluated to be regional.	Without a sound EMS and WMP in use impacts are considered to continue during the construction phase of the Project (i.e., around 4 years	Without mitigation measures and environmentally adequate practices national regulations and requirements by international guidelines regarding the waste disposal will be violated. Furthermore, impacts such as increase in public health risks, environmental contamination, and similar might create stresses on local environment and community.	-	Unless proper waste management practices are followed impacts such as increase in public health risks, environmental contamination, and similar are expected to be likely.	Unless adequate waste management practices are followed, impacts on environment are expected to be reversible only after proper restoration within one to five years after the cessation of the construction phase.
		Score	Regional	Long	High	NA	Likely	Mid-term
		Value	3	4	4	-	3	3
	Impact Magnitude (G+D+I+F (or L)) x R		**42**					

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Wastewater Generation and Management	Negative Direct	Definition	Regarding the location of the licensed waste management facilities (e.g., impact on capacity of the facilities) and considering potential contaminant dispersion in the case that improper discarges to the marine environment impacts are evaluated to be regional.	Without a sound EMS and WMP in use, impacts are considered to continue during the construction phase of the Project (i.e., around 4 years	Without mitigation measures and environmentally adequate practices, requirements by national regulations and international guidelines will be violated. Furthermore, impacts such as increase in public health risks, environmental contamination, and similar might create stresses on local environment and community.		Unless proper wastewater management practices are followed impacts such as increase in public health risks, environmental contamination, and similar are expected to be likely.	Unless adequate waste management practices are followed, impacts on environment are expected to be reversible only after proper restoration within one to five years after the cessation of the construction phase.
		Score	Regional	Long	High	NA	Likely	Mid-term
		Value	3	4	4	-	3	3
	Impact Magnitude (G+D+I+F (or L)) x R		**42**					

Table 8-15. Vulnerabilities and Receptor Sensitivity

Potential Receptor	Sensitivity		
	Sensitivity Score	Description of the Sensitivity	Sensitivity Value
Regarding waste and wastewater management: **Environmental resources including:** **-Surface water resources,** **-Groundwater resources,** **-Marine environment,** **-Soil, etc.**	**High**	- There are no perennial watercourses that support aquatic habitats or provide ecosystem services in the vicinity of the Project site; - The groundwater wells closest to the Project site are 2 km away from the Project site and outside of the potential contaminant transfer area of the Project site; - Analysis of seawater in the vicinity of the Project site and its Associated Facilities for physiochemical parameters (General Water Quality Criteria) and for bacteriological parameters (Bathing Water Criteria) indicated high water quality; - The land in the Project site is mainly composed of very compact soil/clay or soft rock which represents low permeability; - The sediment quality at the Project site is classified as good relying on the sediment analysis indicating concentrations below the limit values set in Annex-1 of Regulation on Environmental Management of Dredging Materials for potential contaminants; - The area is designated for land use with industrial purposes, and energy generation. Hence, a broad assessment of the baseline conditions of the environmental resources marine environment including marine sediments is considered to be the most vulnerable and with high sensitivity. Furthermore, although the site is designated for industrial purposes and already under medium anthropogenic impact potential cumulative impacts due to the Project is considered to add to the vulnerability to local contamination levels.	**5**
Regarding waste and wastewater management: **Socio-economic resources including:** **- Local residents and residential areas in the vicinity,** **- Land use around the Project site, etc.**	**High**	- The area is designated for land use with industrial purposes, and energy generation; - The land of the CPIR where the Project site is planned to be located is already expropriated by the MoIT to be allocated for the use of industrial purposes; - The closest settlement is the Kurtpınarı neighbourhood (1,900 inhabitants) with its two localities: İncirli (approximately 50 m to the site) and Karatepe (2.2 km to the site). The Kurtpınarı neighbourhood centre is located to the northwest at approximately 3.5 km. Hence, a broad assessment of the socio-economic resources indicates that İncirli Neighbourhood located in the environ of the Project site will be highly vulnerable to the potential impacts regarding the public health, economic, safety risks, etc.	**5**

Potential Receptor	Sensitivity		
	Sensitivity Score	Description of the Sensitivity	Sensitivity Value
Regarding supply and materials: **Local and Regional material resources and suppliers**	**Medium**	Several resources will be supplied from local resources during the construction. These include: - The ready-mixed concrete will be supplied from local suppliers; - Part of the material for construction will be supplied from a local licensed borrow pit.; - Sanko Port will be used for the delivery of the heavy equipment and process units; - Utility requirements such as potable water will be supplied from the existing water line through tanker trucks; - Other materials, various types of vehicles and machinery will be sourced locally to the extent possible from existing suppliers. Other resources such as water supply during the operation phase, etc. will be sourced from regional resources. The vulnerability of such resources and suppliers in the case of poor material use and resource management is expected to be medium considering availability of alternative resources in the region as well as diverse facilities within the supply and demand cycle available in the region.	**3**

Table 8-16. Construction Phase Impact Significances

Potentail Impact	Impact Magnitude	Sensitivity	Impact Significance		
			Value	Score	Description
Supply of Materials	39	3	**117**	**Medium**	The potential impact is expected to be detectable, particularly by local resources and suppliers and potentially also by the users of these resources and supplies. However, through good material management practices and mitigation measures including Project design with the selection of alternatives in line with the best management practices such impacts are estimated to be reduced to a level that is as low as reasonably practicable.
Waste Generation and Management	42	5	**210**	**High**	In the case of poor practices and improper management of wastes and wastewater from the site, both environmental and socio-economic elements are expected to be severely impacted. Furthermore, these may create a breach of regulations, and exceedance the limits identified by national regulations and international guidelines. However, such impacts can be prevented by following best management practices in line with BAT documents and ensuring compliance with the requirements of the legislative

Potentail Impact	Impact Magnitude	Sensitivity	Impact Significance		
			Value	Score	Description
					framework and international guidelines and standards.
Wastewater Generation and Management	42	5	**210**	**High**	In the case of poor practices and improper management of wastes and wastewater from the site, both environmental and socio-economic elements are expected to be severely impacted. Furthermore, these may create a breach of regulations, and exceedance the limits identified by national regulations and international guidelines. However, such impacts can be prevented by following best management practices in line with BAT documents and ensuring compliance with the requirements of the legislative framework and international guidelines and standards.

8.8.2 Impacts During Operation

For the operation phase, domestic wastewater generation is calculated as 66.8 m^3/day for 321 people (based on the peak workforce during the operation phase and assumption for water consumption as 208 L/capita/day). At the project site non-oily sewer (NOS), possibly oily contaminated sewer (POCS), oily water sewer (OWS) and sanitary sewer (SS) systems will be established to collect and treat the wastewater to be generated at the Project site. Domestic wastewater generated onsite will be collected by SS system and treated by onsite WWTP. Sanitary wastewater will be sent directly to the aeration basin within the WWTP.

Wastes likely to be generated during the operation phase of the Project will include domestic wastes and wastewater, wastewater other than domestic wastewater, hazardous waste, special waste, packaging wastes, medical wastes and non-hazardous wastes. If not handled and disposed of in an appropriate manner, the generation of these wastes can give rise to major impacts:

- The domestic waste that will be generated in the Project is expected to be 372.4 kg/day which is a negligible increase in comparison to the average of 2,000 tons/day waste collected and disposed of in Adana;
- If not managed properly, special waste such as waste mineral oils, waste vegetable oils, battery and accumulators can also give rise to adverse impacts to human and environmental health. These wastes must be managed appropriately during operation in line with the regulations and disposed in licensed facilities;
- Hazardous waste has the potential for pollution of soil, surface water and groundwater as well as the marine environment like other waste classes; however, the

consequences of inadequate management of hazardous waste are more serious than pollution by other waste classes. Direct contact with hazardous components or uptake of those components such as heavy metals through the food chain may cause significant impacts to human and environmental health. Hazardous waste types which are expected from the PDH-PP units and their associated units consist of reagents, spent catalyst and catalyst dust and fines, molecular sieves, waste oil, filtering bags or cartridges, metallic cartridges, metallic drums, resin, activated alumina, skimmed oil and sludge from WWTP.

Pestisice use is also another important hazardous chemical management isue during the operation of the Project. In that respect:

- The Project Company should incorporate pesticide use and management within the Working with Dangerous Chemicals Procedure. When pest management activities include the use of chemical pesticides is necessary within the scope of the Project, the Project Company will select chemical pesticides that are low in human toxicity, that are known to be effective against the target species, and that have minimal effects on non-target species and the environment.
- The Project Company will design its pesticide application regime to (i) avoid damage to natural enemies of the target pest, and where avoidance is not possible, minimize, and (ii) avoid the risks associated with the development of resistance in pests and vectors, and where avoidance is not possible minimize. In addition, pesticides will be handled, stored, applied, and disposed of in accordance with the Food and Agriculture Organization's International Code of Conduct on the Distribution and Use of Pesticides or other GIIP.
- Project Company will not purchase, store, use, manufacture, or trade in products that fall in WHO Recommended Classification of Pesticides by Hazard Class Ia (extremely hazardous); or Ib (highly hazardous).
- REC will not purchase, store, use, manufacture or trade in Class II (moderately hazardous) pesticides, unless the project has appropriate controls on manufacture, procurement, or distribution and/or use of these chemicals. These chemicals should not be accessible to personnel without proper training, equipment, and facilities to handle, store, apply, and dispose of these products properly.

In addition to such potential impacts from the Project site and operations, certain impacts might arise from the operation of the Associated Terminal Facility. These will include domestic wastes generated at the Terminal Facility and wastes from the raw material delivering vessels. In that respect, the issues and relevant actions that will be under the responsibility of the operating company of the Terminal Facility are described below:

- The sanitary sewage in the unloading platform of the Jetty in the Associated Terminal Facility will be collected in an isolated septic tank within the marine operator building and drained out regularly by a vacuum truck. Sanitary sewage from the Jetty area will be provided with a macerating pump with grinder in a lifting station;

- Additionally, wastes originating from marine operations will include hazardous wastes associated with maintenance operations. Moreover, wastes originating from ships/vessels within the scope of International Convention for the Prevention of Pollution from Ships (MARPOL-73 Convention and modified MARPOL-78 Protocol) may include mineral-based hydraulic oils, and engine, gear and lubricating oils, bilge oils and oily sludges. The hazardous wastes that have been identified need to be disposed at the appropriate licensed facilities. The Project will not have any waste reception facility in the Facility premises. However, the Terminal Facility's operating company will make necessary communications and agreements with the waste reception facilities to be operated by the Adana Metropolitan Municipality as indicated in Section 8.3.1.

Impacts during the operation phase of the Project are divided into three classes. One of them is supply of raw materials, the second is waste generation and management which encompasses all the wastes generated during operation activities and their handling, haulage and disposal and the third is wastewater generation and management.

The Project is not expected to create waste treatment overload on the existing facilities. The hazardous waste disposal will be managed according to Turkish Environmental Legislation at the licensed facilities. Therefore, the hazardous wastes can be disposed of properly without any adverse impact. There will be negligible risk in disposing of the hazardous wastes generated during the operational phase of the Project. There will be a dedicated waste storage area in the Project site. There are adequate disposal facilities in the province that are licensed and operational.

As detailed Section 8.5 of this Chapter, the waste disposal infrastructure for domestic, hazardous, non-hazardous, and medical wastes are available and operational in Adana province. The cumulative load created by the Project on the waste disposal infrastructure in the region can be considered as negligible for disposal and treatment aspects. However, the management of these wastes needs to be performed adequately to ensure that the stages of temporary storage and management within the facilities do not cause adverse impacts which may range between minor to major impacts.

Table 8-17 shows the summary of the above-mentioned assessment results and the respective impact significances. Impact significances are determined based on the methodology given in Chapter 4 of this ESIA Report.

Table 8-17. Operation Phase Impact Magnitudes

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Supply of Materials	Negative Direct	Definition	The impacts regarding the material supply will be on a regional scale.	Without a sound EMS and WMP in use impacts are considered to continue during the operation phase of the Project (i.e., around 50 years).	During the operation phase, the raw material supply, use of energy, and other resources will be mostly from international and national sources or from supplies with high capacity (e.g., Aslantaş Dam) on which no significant impacts are expected due to the demand by the Project. Hence, potential impacts are estimated to be detected or perceived but the effects are unlikely to cause tangible changes.		Improper management of material supply may have some minor impacts on the local resources and suppliers.	It is expected to take up to a year for the initial condition of the material supply and resources are restored after cessation of the impact with restoration activities.
		Score	Regional	Very Long	Low	-	Likely	Short/Mid-term
		Value	3	5	2	-	3	2
	Impact Magnitude (G+D+I+F (or L)) x R		**26**					

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Waste Generation and Management	Negative Direct	Definition	Regarding the location of the licensed waste management facilities (e.g., impact on capacity of the facilities) and considering potential contaminant dispersion in the case of improper discarges to the marine environment, impacts are evaluated to be regional.	Without a sound EMS and WMP in use impacts are considered to last during the operation phase of the Project (i.e., around 50 years). Even after the cessation of the operation some impacts may still continue and require rehabilitation and treatment, particularly concerning hazardous wastes.	Without mitigation measures, and environmentally adequate practices, requirements by national regulations and international guidelines will be violated. Furthermore, impacts such as increase in public health risks, environmental contamination, and similar might create stresses on local environment and community.	-	Unless proper waste management practices are followed impacts such as increase in public health risks, environmental contamination, and similar are expected to be likely.	Unless adequate waste management practices are followed, impacts on environment are expected to be reversible only after proper restoration within one to five years after the cessation of the impact source.
		Score	Regional	Very Long	High	NA	Likely	Mid-term
		Value	3	5	4	-	3	3
	Impact Magnitude (G+D+I+F (or L)) x R		**45**					

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Wastewater Generation and Management	Negative Direct	Definition	Regarding the location of the licensed WWTP (e.g., impact on capacity of the facilities) and considering potential contaminant dispersion in the case that improper discarges to the marine environment impact are is evaluated to be regional.	Without a sound EMS and WMP in use impacts are considered to last during the operation phase of the Project (i.e., around 50 years). Even after the cessation of the operation some impacts may still continue and require rehabilitation and treatment, particularly concerning discharges of oily wastewater.	Without mitigation measures, and environmentally adequate practices, requirements by national regulations and international guidelines will be violated. Furthermore, impacts such as increase in public health risks, environmental contamination, and similar might create stresses on local environment and community.	-	Unless proper wastewater management practices are followed impacts such as increase in public health risks, environmental contamination, and similar are expected to be likely.	Unless adequate waste management practices are followed, impacts on environment are expected to be reversible only after proper restoration within one to five years after the cessation of the impact source.
		Score	Regional	Very Long	High	NA	Likely	Mid-term
		Value	3	5	4	-	3	3
	Impact Magnitude (G+D+I+F (or L)) x R		**45**					

Table 8-18. Operation Phase Impact Significances

Potentail Impact	Impact Magnitude	Sensitivity	Impact Significance		
			Value	Score	Description
Supply of Materials	26	3	**78**	**Medium**	The potential impact is expected to be detectable, particularly by local resources and suppliers and potentially also by the users of these resources and supplies. However, through good material management practices and mitigation measures including Project design with the selection of alternatives in line with the best management practices such impacts are estimated to be reduced to a level that is as low as reasonably practicable.
Waste Generation and Management	45	5	**225**	**High**	In the case of poor practices and improper management of wastes and wastewater from the site, both environmental and socio-economic elements are expected to be severely impacted. Furthermore, these may create a breach of regulations, and exceedance of limits identified by national regulations and international guidelines. However, such impacts can be prevented by following best management practices in line with BAT documents and ensuring compliance with the requirements of the legislative framework and international guidelines and standards.
Wastewater Generation and Management	45	5	**225**	**High**	In the case of poor practices and improper management of wastes and wastewater from the site, both environmental and socio-economic elements are expected to be severely impacted. Furthermore, these may create a breach of regulations, and exceedance of limits identified by national regulations and international guidelines. However, such impacts can be prevented by following best management practices in line with BAT documents and ensuring compliance with the requirements of the legislative framework and international guidelines and standards.

8.9 Mitigation Measures

The following mitigation measures will be implemented for material resources and waste management during both the construction and operation phases of the Project.

Material management:

- During the detailed design and procurement related to the construction works, under the authorisation by the Project Company, the contractor will be responsible for identifying sources for all materials, and equipment and will be required to consider environmental and social impacts in selecting materials to be used for the Project. This will include the use of less harmful materials where possible, considering the carbon footprint of alternative materials and considering the impacts of extraction, processing and transport. In particular, the contractor will be required to
    - select materials sources that are closest as feasible to the Project site so as to minimise the impact of transportation route and distance,
    - use recycled materials, and materials certified as being from "green" or lower carbon sources where practicable,
    - select quarries, crushing plants and asphalt plants as the source of relevant construction material operating with valid environmental and other permits and licenses. The third-party raw material source sites are required to be managed in full compliance with all applicable environmental, health and safety and social standards and specifications.
- In order to manage material resources and chemicals, during the detailed design of the PDH-PP Facility and the relevant procurement stage for installation and operation of the Facility, Ceyhan PP A.Ş. will be responsible for identifying sources for all materials and equipment and will evaluate environmental and social impacts in selecting materials to be used, including their storage conditions in line with the relevant regulations for the Project site;
- Appropriate storage conditions of these materials/chemicals will be established in line with the relevant chemical and health and safety regulations and international guidelines;
- The design and construction of the Associated Terminal Facility will be undertaken within the scope of the CPIR Port Project and under the responsibility of the relevant operating company. Hence, appropriate measures are expected to be taken by the relevant responsible party for the adequate management of the materials and resources.

Waste management:

- Before the construction activities, Ceyhan PP A.Ş. will prepare a site-specific WMP for the construction phase in line with the provisions by the Turkish Legislation, IFC General EHS Guidelines, IFC EHS Guideline for Petroleum-based Polymers Manufacturing (2007), and EBRD Sub-sector E&S Guidelines for Manufacture of Plastics and Synthetics (2014). Later on, this plan should be adapted for the operation phase of the Project. All wastes during the construction and operation phases will be managed in line with this Waste Management Plan (WMP) and the Turkish regulatory framework;
- All waste generated on-site will be collected, separated, labelled and temporarily stored on-site according to the requirements by relevant Turkish regulations which address waste minimisation, separation, labelling, storage, transportation and recycling/disposal;
- Whenever possible, priority shall be given to minimise the waste generation and raw material usage by the application of recovery and re-use as much as possible;
- Record keeping on waste generation, storage, and transportation to third-party waste management facilities will be maintained;
- Periodic inspections will be conducted in the waste recycling/disposal facilities to ensure proper disposal practices are implemented;
- In order to minimise the risks of infections and the spread of diseases medical wastes will not be mixed with other types of wastes and will be collected separately, transported via licensed haulers and disposed of at licensed facilities according to the provisions of the Medical Waste Control Regulation.
- Clean-up materials such as spill kits shall be managed as hazardous waste and disposed of appropriately. In the meantime, appropriate storage conditions for these materials/chemicals will be established in line with the relevant chemical and health and safety regulations.

Wastewater and site drainage management:

- A site drainage system to collect and manage runoff from the Project site will be maintained. Additionally, at the stockpile sites management strategies will be applied to minimize sediment transport and fugitive dust formation.
- The domestic wastewater to be generated currently during the construction phase of the Project will be collected in underground impermeable septic tanks and necessary agreements will be made with the Municipality for periodic collection via vacuum trucks for disposal to the municipality sewer system. An MBR WWTP will be established at the project site for the domestic wastewater to be generated during the

construction phase of the Project and effluent will be discharged to see after regulation limits are met.

- Domestic and industrial wastewater to be generated during the operation phase of the Project will be collected separately depending on the characteristics of wastewater types in accordance with the provisions of the “Drainage and Wastewater Gathering Philosophy” and “Specification for Drainage” and will be treated in the WWTP to be established in the Project site.

In accordance with the Drainage and Wastewater Gathering Philosophy (published on 12 June 2020) and Specification for Drainage (published on 23 April 2020), the Project Company will apply the following mitigation measures developed specifically for the operation of the Project process units:

- All wastewater drainage systems shall be routed to appropriate effluent treatment facilities, except NOS;
- Streams having the following characteristics shall not be released to any environment or wastewater drainage and collection systems;
    - Streams with temperature above 42°C,
    - Streams having pH outside the range of 6-9,
    - Volatile streams (any stream containing C4 and lighter compounds),
    - Pure hydrocarbon streams.
- Streams to be sent to OWS shall not contain dissolved hydrocarbon gases;
- The seal water from flare stack shall be sent to OWS;
- Blowdowns from steam drum/boilers containing phosphate and nitrogen compounds shall be diverted to OWS system and shall be flashed to recover steam and cooled down to 42°C;
- Possibly oily condensate to be collected within the process units shall be sent to condensate polisher. Depending on the total organic compound or oil concentration (above 10 ppm), contaminated stream condensate shall be diverted to OWS;
- Cooling water blowdown will be routed to outfall while backwash water for CW side-stream filter to WWT;
- Caustic and spent caustic (non-oily) streams resulting from the process units shall be collected via caustic sewer system. Non-neutralized streams (i.e., spent caustic) shall be treated separately within the unit;
- Considering the miscellaneous drainage inside the Project site including chemical drains, and drains from laboratories, and mechanical rooms, etc. such fluids shall not be permitted in NOS, POCS, OWS or SS drains and shall be handled separately;

- Rainwater to be collected in tank bund areas shall be connected to a valve pit outside the bund to prevent spill or leaks from entering the drains prior to water quality check. In the absence of oil, the tank bund content shall be diverted to the non-oily sewer (NOS) otherwise to the Possibly Oily Contaminated Sewer (POCS). If there is a small quantity of spill/leakage to be occurred, the tank bund shall be diluted with flushing water and shall be diverted to POCS;
- The products purged from the lines and the pieces of the equipment within the process will be collected in CDS and the products will be stored in dedicated process drums, to be reprocessed in the plant.
- In the scope of the Project, dumping of any liquid and solid material to the sea will not be allowed in the construction and operation phases. Measures will be taken in order to prevent any construction waste falling into sea and any spills or leaking of oil and petroleum products.
- A separate drainage system will be provided within the Facility for spent caustic. There will also be closed drain systems (CDS) on-site, where wastewater from process lines is collected in dedicated process drums to be re-processed in the Plant. All wastewater to be collected from the drainage systems except the non-oily sewer system (uncontaminated stormwater) will be sent to the treatment units/plants in the Facility.

Considering the activities in the laboratories, a series of mitigation measures and preventative actions are defined in the *Drainage and Wastewater Gathering Philosophy* document. Accordingly:

- Chemical wastes (high concentrated streams, reagents, heavy metals, solid chemical wastes, etc.) generated in the laboratory shall be held in containers for safe disposal off-site;
- Hydrocarbon samples and oil-dominant wastes shall be held in separate containers for safe disposal off-site;
- Oily water, laboratory sink wash, and emergency shower wash water shall be discharged to WWTP via the OWS system;
- Acid/alkaline waste shall be neutralized by operator in the Laboratory and discharged to WWTP via the OWS system.

Recommended pollution prevention measures for hazardous materials to be used and waste and wastewater to be generated on site in line with the provisions of IFC EHS Guideline for Petroleum-based Polymers Manufacturing (2007) and EBRD Sub-sector E&S Guidelines for Manufacture of Plastics and Synthetics (2014) are as follows:

- A Hazardous Material Management Program including spill prevention and control plans shall be prepared and implemented;
- Considering the solid polymer wastes (powders, granules etc.) i) recycling and reuse of the solid polymers, where possible, ii) treatment to remove and separately recover Volatile Organic Carbons (VOCs) (e.g., by steam stripping), iii) separation and storage in a safe manner due to the unstable nature of the materials are recommended;
- Recondition and reuse solvents and catalysts shall be ensured, where possible;
- Where possible, it shall be ensured to recover heat and energy from processes to reuse in the Project site. Thermal efficiency shall be improved to minimize heat loss;
- Ensure that untreated wastewater does not discharge to receiving environment;
- Separate wastewater (neutralize caustic effluents, collect oily effluents etc.), effluent streams and rainwater to reduce the need for wastewater treatment;
- Minimise the consumption of water used in production process and equipment cleaning and recycle wastewater where possible;
- Depending on technical and economic feasibility, install roofs if there is a risk that rainwater may fall on contaminated areas. If the installation of a roof is not possible or not feasible, potential contaminated rainwater from concerned area should be captured and treated before discharged to a receiving environment;
- Remove VOCs from wastewater through flash distillation or any other equivalent systems prior to treatment in the WWTP;
- Organics shall be separated and recycled to the process where possible;
- Emulsion and suspension polymerization aids should be selected with consideration of their biodegradability, as they may enter the wastewater stream during polymer recovery;
- Super reactant solutions shall be sent to specialized treatment for disposal;
- Acidic and caustic effluents from demineralized water preparation shall be neutralized prior to wastewater treatment;
- Oily effluents shall be collected in closed drainage channel/pipes and discharged to the WWTP in the facility; and
- Sufficient process fluid let-down capacity shall be provided to avoid process liquid discharge into the oily water drainage system.

8.10 Residual Impacts

For the construction and operation phases of the project, the residual impacts as a result of waste generation are estimated to be minor with the full implementation of the Project-specific WMP and the mitigation measures that are described above. Table 8-19 and Table 8-20 show the residual impact magnitudes for the construction and operation phases, respectively. Table 8-21 and Table 8-22 show the residual impact significances for the construction and operation phases, respectively.

Table 8-19. Construction Phase Residual Impact Magnitudes

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Supply of Materials	Negative Direct	Definition	The impacts regarding the material supply will be on a regional scale.	With the application of a sound EMS and efficient material and energy use practices potential impacts are expected to be only intermittent during the construction phase.	Impacts are expected to create no significant changes in the environment and social elements.		Through good management and application of the best management practices with environmentally concerned, proper material selection, impacts on resources and material supplies are considered to be unlikely.	Impacts are expected to be reversible in a short period of time.
		Score	Regional	Very short	Negligible	-	Unlikely	Short-term
		Value	3	1	1	-	1	1
	Impact Magnitude (G+D+I+F (or L)) x R		**6**					

<table>
<tr><th rowspan="2">Potential Impact</th><th rowspan="2">Impact Type</th><th colspan="7">Nature of Impacts (Magnitude designations)</th></tr>
<tr><th></th><th>Geographical Extent (G)</th><th>Duration (D)</th><th>Intensity (I)</th><th>Frequency (F)</th><th>Likelihood (L)</th><th>Reversibility (R)</th></tr>
<tr><td rowspan="4">Waste Generation and Management</td><td rowspan="3">Negative
Direct</td><td>Definition</td><td>Regarding the location of the licensed waste management facilities (e.g., impact on capacity of the facilities) impact is evaluated to be regional.
By the application of an efficient EMS and WMP other impacts due to waste generation are expected to be limited to the Project site.</td><td>With a sound EMS and WMP in use, impacts are considered to be only intermittent. Furthermore, considering the low risk regarding the capacity of the disposal/recycling/treatment facilities in the region, potential impacts on those are expected to be only for very short durations.</td><td>With mitigation measures and environmentally adequate practices impacts are expected to be negligible since there will be no direct disposal to the environment which will prevent impacts on environmental receptors.

Furthermore, considering the low risk regarding the capacity of the disposal/recycling/treatment facilities in the region, potential impacts on those are expected to be negligible.</td><td>-</td><td>With proper waste management practices impacts are expected to be unlikely.</td><td>By the use of adequate waste management practices potential impacts are expected to be reversible in short-term.</td></tr>
<tr><td>Score</td><td>Regional</td><td>Very short</td><td>Negligible</td><td>NA</td><td>Unlikely</td><td>Short-term</td></tr>
<tr><td>Value</td><td>3</td><td>1</td><td>1</td><td>-</td><td>1</td><td>1</td></tr>
<tr><td colspan="2">Impact Magnitude (G+D+I+F (or L)) x R</td><td colspan="6">6</td></tr>
</table>

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Wastewater Generation and Management	Negative Direct	Definition	Environmentally sound practices are expected to minimise such impacts. Hence, potential impacts are expected to be limited to the impact on the use of regional WWTP where the sewage collected on-site in a septic tank will be transferred for treatment via tanker trucks. Effects may occur from the discharge to the sea of the WWTP to be established.Hence, although on a small scale, impact is still classified as regional.	With an efficient site drainage, management and prevention of direct and without treatment discharges to the environment during the construction phase, potential impacts are considered to be of very short and intermittent character.	Wastewater effluents and drainages from the Project site will be managed in line with the national and international requirements and standards. There will be no environmental discharges during the construction phase hence impacts are expected to be negligible. Furthermore, considering the capacity of the regional WWTP relevant impact of the transfer of the domestic wastewater from the Project site is expected to be negligible.		With adequate wastewater management practices impacts are unlikely.	With adequate waste management practices potential impacts are reversible within a short period of time.
		Score	Regional	Very short	Negligible	NA	Unlikely	Short-term
		Value	3	1	1	-	1	1
	Impact Magnitude (G+D+I+F (or L)) x R		**6**					

Table 8-20. Operation Phase Residual Impact Magnitudes

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Supply of Materials	Negative Direct	Definition	The impacts regarding the material supply will be on a regional scale.	With a sound EMS, and material and good energy use practices in use potential impacts are expected to be only intermittent and for very short time.	Impacts are expected to create no significant changes in the environment and social elements.		Through a good management and application of the best management practices with environmentally concerned, proper material selection, impacts on resources and suppliers are considered to be unlikely.	Impacts are expected to be reversible in a short period of time.
		Score	Regional	Very short	Negligible	-	Unlikely	Short-term
		Value	3	1	1	-	1	1
	Impact Magnitude (G+D+I+F (or L)) x R		**9**					

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Waste Generation and Management	Negative Direct	Definition	Regarding the location of the licensed waste management facilities (e.g., impact on capacity of the facilities) potential impacts are evaluated to be regional.	With a sound EMS in use impacts are considered to be only intermittent. Furthermore, considering the low risk regarding the capacity of the disposal/recycling/treatment facilities in the region potential impacts on those are expected to be only for short durations.	With mitigation measures and environmentally adequate practices impacts are expected to be negligible since there will be no direct disposal to the environment which will prevent impacts on environmental receptors. Furthermore, considering the low risk regarding the capacity of the disposal/recycling/treatment facilities in the region potential impacts on those are expected to be negligible.	-	With proper waste management practices impacts are expected to be unlikely.	By the use of adequate waste management practices potential impacts are expected to be reversible in short-term.
		Score	Regional	Short	Negligible	NA	Unlikely	Short-term
		Value	3	2	1	-	1	1
	Impact Magnitude (G+D+I+F (or L)) x R		**6**					

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Wastewater Generation and Management	Negative Direct	Definition	By the use of the site drainage system and treatment of efflluents in the on-site WWTP before discharge, impacts are expected to be limited to local area.	With an efficient site drainage and wastewater management system and treatment of the effluents on-site, in line with the national and international standards impacts are considered to be of insignificant but detectable during the dischage of the effluent (i.e., during the operation phase).	Wastewater effluents and drainages from the Project site will be managed in line with the national and international requirements and standards. Treated effluent from the onsite WWTP will be discharged to the sea in accordance with the relevant discharge limits. Hence, potential impacts are expected to be detectable but lower than the standard limit values.	-	Although minor, impacts due to treated effluent discharge might be still detectable.	With good environmental practices and by following the necessary legislative requirements expected minor impacts are estimated to be reversible in a short term under the effect of natural recovery processes.
		Score	Local	Long	Low	NA	Likely	Short-term
		Value	2	1	2	-	3	1
	Impact Magnitude (G+D+I+F (or L)) x R		**10**					

Table 8-21 Construction Phase Residual Impact Significance

Potentail Impact	Impact Magnitude	Sensitivity	Impact Significance		
			Value	Score	Description
Supply of Materials	6	3	**18**	**Negligible**	The residual impacts are expected to be negligible during the construction phase by the application of suitable material supply and management practices.
Waste Generation and Management	6	3* (Medium)	**18**	**Negligible**	With an efficient EMS and adequate waste management strategies including minimisation of the waste generation and enhancing recycling and reuse impacts to the environmental resources will be negligible. *Since there will be no disposal to the potential impact will be limited to the impact on the capacity use of the receiving licenced disposal/recycling facilities. Hence, with the application of the WMP and EMS the receptor sensitivity changes from high to medium and the residual impact significance is expected to be negligible.
Wastewater Generation and Management	6	3* (Medium)	**18**	**Negligible**	By proper management of wastes and wastewater from the site, there will be no direct discharges to the environment. There is noeffluent discharges to environment currently either, because wastewater from the site will be collected in impermeable septic tanks and transferred to the regional WWTP. If the legal limits are complied with after the establishment of WWTP, environmental impact will be negligible. *Since construction phase will be conducted as a zero-discharge activity considering the environment the potential impact will be limited to the impact on the capacity use of the receiving licenced WWTP. Hence, the receptor sensitivity changes from high to medium and the residual impact significance is expected to be negligible.

Table 8-22. Operation Phase Residual Impact Significance

Potentail Impact	Impact Magnitude	Sensitivity	Impact Significance		
			Value	Score	Description
Supply of Materials	6	3	**18**	**Negligible**	The residual impacts are expected to be negligible during the operation phase by the application of suitable material supply and management practices.
Waste Generation and Management	7	3* (Medium)	**21**	**Negligible**	With an efficient EMS and adequate waste management strategies including minimisation of the waste generation and enhancing recycling and reuse impacts to the environmental resources will be negligible. Since there will be no disposal to the potential impact will be limited to the impact on the capacity use of the receiving licenced disposal/recycling facilities. Hence, with the application of the WMP and EMS the receptor sensitivity changes from high to medium and the residual impact significance is expected to be negligible.
Wastewater Generation and Management	8	5	**40**	**Low**	By proper management of wastes and wastewater from the site, there will be no direct discharges to the environment. There will be only treated effluent discharged to the sea from the on-site WWTP. Before the discharge the Project Company will ensure that effluent is treated in compliance with the national and international required discharge limits. Hence, potential impact will be minor due to discharge of the treated effluent to the sea.

CEYHAN PROPANE DEHYDROGENATION - POLYPROPYLENE PRODUCTION PROJECT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT

(CHAPTER-9)

FEBRUARY 2023

ANKARA

CEYHAN PROPANE DEHYDROGENATION - POLYPROPYLENE PRODUCTION PROJECT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT

Version	Revision	Date	Prepared By	Quality Management By	Checked By		Approved By
Draft	A.0	March 2021	Açelya Duman (2U1K)	Esra Okumuşoğlu (2U1K)	D. Emre Kaya (2U1K)	Simon Taylor (RINA)	Elif Doğru (RINA)
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	A.6	Octobe r 2022	Buket Mesta (2U1K)	Esra Okumuşoğlu (2U1K)	D. Emre Kaya (2U1K)	Simon Taylor (RINA)	Simon Taylor (RINA)
Final Draft	B.0	February 2023	Leyla Demircin (2U1K)	Esra Okumuşoğlu (2U1K)	D. Emre Kaya (2U1K)	Simon Taylor (RINA)	Ilya Gulakov (RINA)

REVISION CODES: A: DRAFT, B: FINAL DRAFT, C: FINAL

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ABBREVIATIONS

APCV	Air pollution contribution value
BOTAŞ	Turkish Petroleum Pipeline Company
BTC	Baku-Tbilisi-Ceyhan Crude Oil Pipeline
Ceyhan PDH-PP Project / Project	Ceyhan Propane Dehydrogenation - Poly-propylene Production Facility Project
CDE	Carbon dioxide equivalent
CPIR Port	Raw Material Supply, Storage and Port Facility Project
EBRD	European Bank for Reconstruction and Development
Ennotes	Ennotes Environmental Engineering Consultancy Ltd.
EU	European Union
GHG	Greenhouse gas
IAPCR	Industrial Air Pollution Control Regulation
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change
LTV	Long term value
LNG	Liquefied natural gas
LPG	Liquefied Petroleum Gas
MoEUCC	Ministry of Environment,Urbanization and Climate Change
NNE	North-northeast
RAMAQ	Regulation on Assessment and Management of Air Quality
RMGG	Regulation on the Monitoring of Greenhouse Gases
S	South
STV	Short term value
SW	Southwest
Terminal Facility	Jetty and Propoane Storage Tank
TPV	Total pollution value
VOC	Volatile organic compounds
WHO	World Health Organization

9 AIR QUALITY

Emissions during the construction and operation phases of the Ceyhan Propane Dehydrogenation - Polypropylene Production Facility Project (Ceyhan PDH-PP Project or Project) and Associated Terminal Facility Project will contribute to regional air pollutant levels and thereby may impact the health of nearby communities, workers and other sensitive receptors. This chapter presents the assessment of the impacts of emissions related to the Project and Associated Terminal Facility on air quality and sets out the mitigation measures to avoid or minimize the risks together with the residual impacts that are foreseen to remain.

The most significant direct or indirect sources of air pollutants from the petrochemical facility operations will include air emissions resulting from production processes, storage of products and chemicals as well as emissions from increased road traffic.

In addition to impacts on air quality during the operation of the Project, the assessment also considers short-term effects from construction activities. Adverse effects can be caused by emissions from construction machinery and vehicles and also from activities generating particulate matter (such as earthworks and storage of dusty materials). In addition to affecting health, dust can lead to unsightly and potentially harmful deposits on property and vegetation if not managed properly.

The following sources of information have been used during the assessment:

- Baseline air quality measurement report, July 2020;
- Air Quality Modelling Report by Ennotes Environmental Engineering Consulting Ltd. (April 2021)
- Data provided by the General Directorate of Meteorology
- General Directorate of Meteorology website (http://www.mgm.gov.tr);
- Air Quality Monitoring Stations website, (http://www.havaizleme.gov.tr);
- Adana Environmental Status Report (2018).

The significance criteria that were used related to impacts on air quality were established by identifying the impact magnitudes and receptor sensitivity. The magnitude and sensitivity criteria for impact assessment methodology are detailed in *Chapter 4: Scope and Methodology*. For determining the magnitudes of the impacts, impact intensity should also be assessed according to changes in baseline air quality. The details on the methodology for the determination of impact intensity, Project specific receptor sensitivity, and criteria to identify impact significance are given in Section 9.4 of this chapter.

9.1 Legal Context

9.1.1 National and International Ambient Air Quality Standards

This section provides an overview of Turkish and international ambient air quality standards. In Turkey, ambient air quality is regulated under the Regulation on Assessment and Management of Air Quality - RAMAQ (Official Gazette Date/Number: 06.06.2008/26898) and Industrial Air Pollution Control Regulation – IAPCR (Official Gazette Date/Number: 03.07.2009/27277), which set up a tiered system to reduce air quality limits (general air quality limits and limits applicable to industries) over time and identify ambient air quality limits for pollutants.

Annexes of these regulations specify air quality targets as summarised in Table 9-1 below. As Turkey is a candidate for accession to the European Union (EU), standards set out in the EU Council Directive 2008/50/EC, and World Health Organisation (WHO) Air Quality Guidelines for particulate matter, nitrogen dioxide, and sulphur dioxide, which are generally equivalent to IFC targets, are also considered to be relevant and included in Table 9-1.

Annex-2 Table 2.2 of IAPCR specifies ambient air quality limit values which decrease gradually each year until 2024. IAPCR limit values are shown in Table 9-1. Annex-2 Table 2.3 identifies air quality limit values inside facility boundaries for specific facilities including petrochemical facilities. However, the modelling study conducted within the scope of this Study did not cover an evaluation of these limit values because air quality values within the facility depend significantly on the exact locations of the sources as well as all the barriers within the facility such as building walls, stacks, etc. Therefore, these parameters shall be monitored once the Facility is operational.

Table 9-1. EU Council Directive 2008/50/EC, Turkish ambient air quality standards (as per RAMAQ Annex 1 and IAPCR Annex 2) and IFC standards

Parameter	Concentration in µg/m³								
	Hourly average			Short-term value, STV (Daily average)			Long-term value, LTV (Annual average)		
	EU	Turkish standards	IFC	EU	Turkish standards	IFC	EU	Turkish standards	IFC
Nitrogen dioxide (NO_2)	200	2019-2023 =250 2024[a]=200	200	-	-	-	40	2019-2023[a] = 40 2024 = 40	40
Nitrogen oxides (NOx)	-	-	-	-	-	-	30	-	-
Sulfur dioxide (SO_2)	350	2019-2023 =350 2024= 350	-	125	2019-2023 =125 2024=125	20	-	2019-2023 and 2024=60	-
Carbon monoxide (CO)	-	-	-	10,000 (8-hr)	2019-2023 (8-hr) =10,000 2024= 10,000	-	-	-	-
Total organic compounds (carbon equivalent)	-	2019-2023=280 2024=280	-	-	2019-2023=70 2024=70	-	-	-	-

Parameter	Concentration in μg/m³								
	Hourly average			Short-term value, STV (Daily average)			Long-term value, LTV (Annual average)		
	EU	Turkish standards	IFC	EU	Turkish standards	IFC	EU	Turkish standards	IFC
Particulate matter with diameter of 10 μm or less (PM_{10})	-	-	-	50	2019-2023 = 50 2024=50	50	40	2019-2023 = 40 2024=40	20
Fine particles <2.5μm ($PM_{2.5}$)	-	-	-	25	-	25	25 (2015) 20 (2020)	-	10
PM Deposition	-	-	-	-	2019-2023 and 2024=390	-	-	2019-2023 and 2024=210	-

[a] as provided in IAPCR Table 2.2, limit to be decreased equally each year until 2024.

9.1.2 Air Quality Index

The air quality index is a scale defined by the Ministry of Environment Urbanization and Climate Change (MoEUCC) to identify air quality. The index classifies ambient air quality into 6 categories from 1 (very good) to 6 (hazardous) and every category is visualised by colors. The index is based on the concentrations of five pollutants. These pollutants and their air quality index levels are shown in Table 9-2.

Table 9-2. Air quality index of main pollutants

Air Quality Index	Air Quality Index	SO_2 Hourly Average [μg/m³]	NO_2 Daily Average [μg/m³]	CO Daily Average [μg /m³]	O_3 Hourly Average [μg/m³]	PM_{10} Daily Average [μg/m³]
1-(Very Good)	0 – 50	0-100	0-100	0-5500	0-120	0-50
2-(Moderate)	51 – 100	101-250	101-200	5501-10000	121-160	51-100
3-(Sensitive)	101 – 150	251-500	201-500	10001-16000[L]	161-180	101-260
4-(Unhealthy)	151 – 200	501-850	501-1000	16001-24000	181-240	261-400
5-(Very Unhealthy)	201 – 300	851-1100	1001-2000	24001-32000	241-700	401-520
6-(Hazardous)	301 – 500	>1101	>2001	>32001	>701	>521

9.2 Climate and Meteorological Conditions

Adana is influenced by two types of climate. The Mediterranean climate is observed on shorelines and plains (winters are mild and wet, summers are hot and dry) and continental climate is observed in uplands (winters are cold and snowy, summers are hot and dry). Ceyhan district has the characteristics of the Mediterranean climate as it is located on the shore. As the high mountains in the north of the province provide a barrier against the northern winds, summers are extremely hot in Adana. Often, precipitation does not occur for 2-3 months in the summer season and snowfall very rarely occurs in the city during the year.

Meteorological data on temperature, precipitation, relative humidity, pressure and wind obtained from the General Directorate of Meteorology are described in the following sections.

9.2.1 Temperature and Sunshine

Monthly average values of surface air temperature based on data collected for a period of 90 years (1929-2019) are provided in Table 9-3.

Table 9-3. Monthly climatological means for temperature and sunshine in Adana (based on 90 years of monitoring data between 1929-2019)

Temperature parameters	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Mean temp. (°C)	9.4	10.5	13.4	17.5	21.7	25.6	28.2	28.6	26.0	21.6	15.8	11.1
Mean high temp. (°C)	14.7	16.1	19.4	23.7	28.2	31.7	33.8	34.6	33.1	29.0	22.5	16.7
Mean low temp. (°C)	5.1	5.9	8.2	11.8	15.7	19.7	22.9	23.3	20.0	15.6	10.6	6.8
Max. recorded temp.(°C)	26.5	28.5	32.0	37.5	41.3	42.8	44.4	45.6	43.2	41.5	34.3	30.8
Min. recorded temp. (°C)	-8.1	-6.6	-4.9	-1.3	5.6	9.2	13.2	14.8	9.3	3.5	-4.3	-4.4
Mean daily sunshine (hrs)	4.5	5.2	5.9	7.1	9.0	10.5	10.6	10.3	9.0	7.3	5.8	4.2

The climatological annual mean temperature, annual mean maximum temperature and annual mean minimum temperature observed in Adana are 19.1ºC, 25.3ºC and 13.8ºC, respectively. The minimum and maximum temperatures measured in the city during the last 90 years are -8.1ºC in January 1964 and 45.6ºC in August 1958, respectively.

9.2.2 Precipitation

Based on the meteorological data obtained from the Adana regional meteorological station between 1950 and 2015, the highest climatological mean of monthly total precipitation is 127.3 mm for December, while the lowest climatological mean of monthly total precipitation is 9.8 mm for August. The climatological mean of total annual precipitation and the total number of rainy days per year are 671.3 mm and 75, respectively, as calculated for 65-year period (see. Table 9-4).

Table 9-4. Precipitation climatology in Adana (based on 65 years of monitoring data between 1950 and 2015)

Precipitation parameters	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Mean number of days with precipitation	10.6	10.1	9.6	8.6	6.3	3.0	0.9	0.7	2.6	5.4	6.9	10.3
Mean of total monthly precipitation (mm)	111.6	89.7	65.4	51.9	48.8	22.0	10.2	9.8	19.6	43.6	71.4	127.3

9.2.3 Humidity and Air Pressure

Based on the meteorological data obtained from the Adana Ceyhan regional meteorological station for a period of 58 years (1961-2019), the climatological monthly mean of humidity in the region ranges from 60.4% in October to 69.9% in December (see. Table 9-5).

Table 9-5. Climatology for relative humidity and air pressure in Adana Ceyhan (based on 58 years of monitoring data between 1961-2019)

Humidity and pressure parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ave. humidity (%)	68.4	66.9	67.1	67.5	65.8	64.6	66.7	67.5	63.3	60.4	62.8	69.9
Min. humidity (%)	20.2	18.9	16.9	15.0	13.8	13.2	15.9	16.0	11.1	11.3	15.4	21.6
Mean pressure (hPa)	1015.2	1013.5	1011.3	1009.4	1007.8	1005.2	1002.2	1003.1	1007.0	1011.1	1014.2	1015.7
Max. pressure (hPa)	1032.0	1030.4	1029.2	1023.7	1019.2	1014.6	1011.7	1009.5	1018.5	1023.6	1027.2	1028.8
Min. pressure (hPa)	989.4	989.3	990.9	994.2	993.9	996.0	993.0	995.6	999.5	994.5	997.2	989.1

9.2.4 Wind Characteristics

The prevailing wind direction in Adana is from north-northeast (NNE) in winter, south (S) in March and September, and southwest (SW) in summer (June, July and August). The average wind speed is 2.2 m/s. The maximum wind speed is recorded as 126.4 km/h.

The prevailing wind direction shifts to the opposite direction in cold months (November, December and February). The reason for the shift is that during the cold months the thermal low pressure on land changes into dynamic high pressure and thermal high pressure offshore turns into thermal low pressure.

9.3 Air Quality Baseline Conditions

9.3.1 Background

The land use around the Project site is described in *Chapter 5: Land Use and Zoning*. There are a number of industrial developments within proximity of the Project site. The region is characterised by major industrial development with major air emission sources. The Project site neighbours the Turkish Petroleum Pipeline Company (BOTAŞ) Ceyhan Marine Oil Terminal which is the terminus for the Baku-Tbilisi-Ceyhan Crude Oil Pipeline (BTC) Project approximately 1.5 km to the southwest and the Toros Agri-Industry approximately 2 km to the east of Project site boundaries. To the west of the BOTAŞ Ceyhan Marine Oil Terminal, a coal-fired thermal power plant (İsken Sugözü Thermal Power Plant) is located, which is approximately 9 km southwest of the Project site. Yumurtalık Free Trade Zone, including a cement factory, is located to the east of the Toros Agri-Industry located at approximately 3.5

km from the Project site. Additionally, the Project site is located to the south of the Ceyhan Dörtyol Road, a potential fuel emission source, at a distance of approximately 500 m.

The secondary sources of air pollution in Adana province are emissions from domestic heating, traffic, and industry. There are several MoEUCC air quality monitoring stations in the region of the Project site. The nearest stations are Osmaniye and Hatay-İskenderun stations within 30 km and Adana (Doğankent) station within 55 km from the Project site. The locations of the stations are shown in Figure 9-1.

Figure 9-1. Air quality monitoring stations around the Project site

The air quality parameters monitored at these stations are PM10, SO_2, NO, NO_2, NOx, CO on both long-term average and maximum daily bases. Year-long average concentrations of these parameters measured at the stations for the peirod between 13th November 2019 and 13th November 2020 are given in Table 9-6 below.

Table 9-6. Yearly average data from the air quality monitoring stations around the Project site for the period between 13th November 2019 and 13th November 2020 (https://www.havaizleme.gov.tr/)[1]

Station	Average and Max Values	Distance to Project site (km)	PM_{10}	SO_2	NO_2	NO_x	CO
			(µg/m³)				
Adana (Doğankent)	Max. Daily	~ 55	**650.25***	86.86	74.55	79.96	-
	Average (yearly)		11.33	10.31	9.33	12.76	-

[1] Ministry of Environment and Urban Planning, Air Quality Monitoring Stations Website: http://www.havaizleme.gov.tr/

Station	Average and Max Values	Distance to Project site (km)	PM_{10}	SO_2	NO_2	NO_X	CO
			(µg/m³)				
Osmaniye	Max. Daily	~ 30	**497.78***		-	-	-
	Average (yearly)		**51.78***		-	-	-
Hatay-İskenderun	Max. Daily	~ 30	**86.29***	116.59	121.96	178.67	5433.79
	Average (yearly)		13.38	19.91	20.53	29.45	829.15
Limit Values	IAPCR[2] (annual)	-	40	20	40	-	-
	IAPCR[3] (daily)		50	125	250	-	10,000 (8-hr)
	EU[4]- 1 hour	-	-	350	200	-	-
	EU- Daily	-	50	125	-	-	10,000 (8-hr)
	EU- annual	-	40	-	-	30	-
	IFC-annual	-	20	-	40	-	-

*The maximum daily PM_{10} in Doğankent station, maximum daily and average yearly PM_{10} in Osmaniye station and maximum daily PM_{10} in Iskenderun station are above the limits given in IAPCR.

Based on the measurements of the monitored air quality parameters (data retrieved on 13.11.2020), the air quality index is defined as "Good" (i.e., Low risks related to air quality and low or no risks due to air pollution (MoEUCC, 2019)) for Adana (Doğankent) and Hatay (Iskenderun) stations. At the time of the data retrieval, the air quality index information for Osmaniye station was not available except for PM_{10}. Additionally, all values obtained from these monitoring stations except the PM_{10} measurement at Osmaniye Station are below the defined annual limits in IAPCR, EU-Directive and IFC Standards. On the other hand, maximum daily concentrations measured in the monitoring period is seen to exceed the maximum daily limits defined by EU and IAPCR at all stations.

9.3.2 Baseline In-situ Monitoring

The air quality monitoring at the stations around Adana does not fully represent the site conditions due to the distance between the Project site and the stations. Therefore, baseline in-situ air quality measurements were conducted within the scope of the EIA study. The sampling locations for air quality baseline monitoring are shown in Figure 9-2. The air quality baseline data collection program covers the following measurements:

- Passive sampling:
  - NOx at 11 locations for 2 months;
  - SO_2 at 11 locations for 2 months;
  - Volatile organic compounds (VOC) at 11 locations for 2 months;
- Settled dust at 2 locations for 2 months;
- PM_{10} at 2 locations for 1 month;
- $PM_{2.5}$ at 2 locations for 1 month.

[2] Industrial Air Pollution Control Regulation: Table 2.2 of Annex 2
[3] Industrial Air Pollution Control Regulation: Table 2.2 of Annex 2
[4] EU Council Directive 2008/50/EC

During the air quality monitoring, MCZ Micro PNS LVS1 measurement devices were used for PM_{10} measurement, dust sampling tubes were used for PM deposition and Passive Samplers were used for NO_2, SO_2, and VOC measurement using the methods given in Table 9-7.

Table 9-7. Air pollutant measurement methods

Emissions	Method	Method No
PM deposition	Gravimetric	TS 2341
PM_{10}	Gravimetric	TS EN 12341
NO_2, SO_2 and VOC	Passive Sampling	EN 13528-1

As per the aforementioned regulation, the following parameters were calculated for each air pollutant based on the in-situ monitoring results:

- Long-Term Value (LTV): Arithmetical mean of the sampling results;
- Short-Term Value (STV): Maximum daily average value or the value remaining below 95% of all measurements after ranking from low to high;
- Total Pollution Value (TPV): Sum of Air Pollution Contribution Values (APCV) and LTV, which is considered for proposed projects/new facilities.

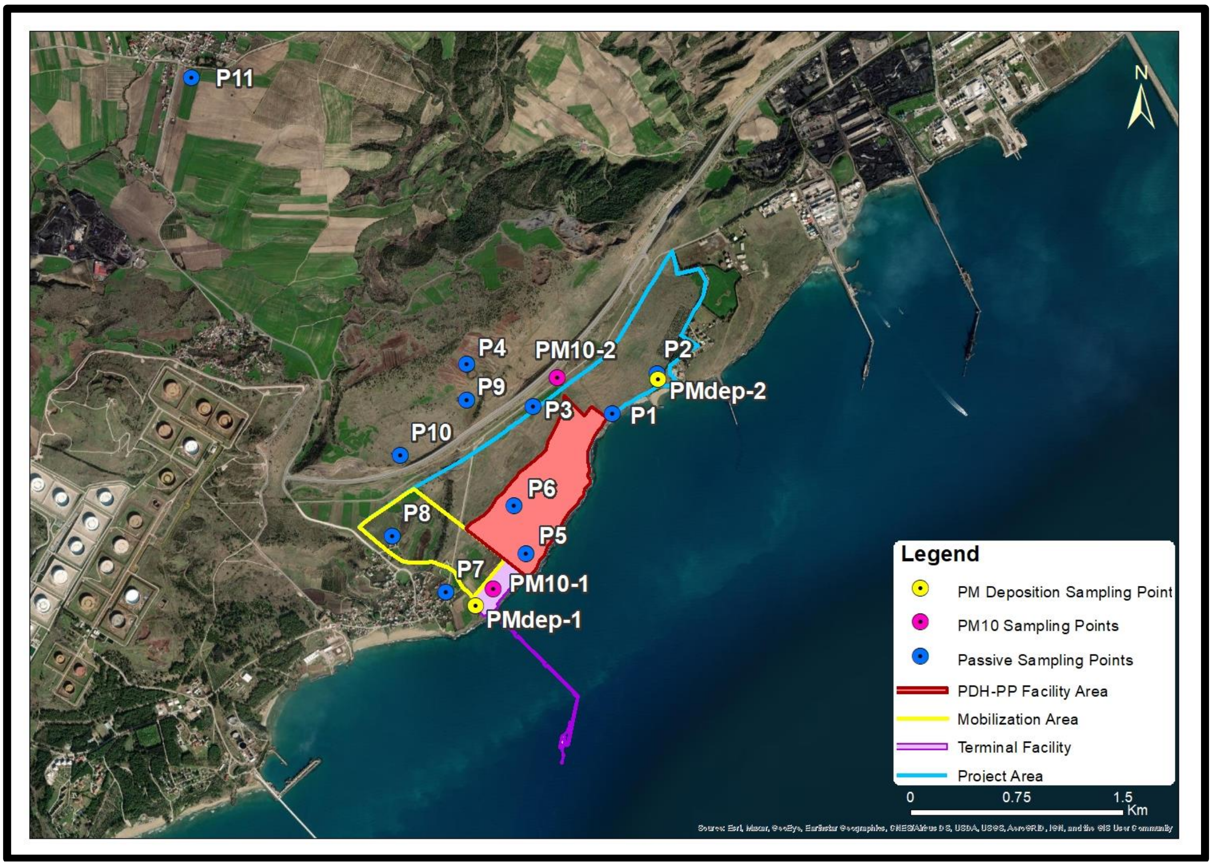

Figure 9-2. In-situ air quality monitoring stations (for all parameters) ($PM_{2.5}$ and PM deposition sampling locations are the same with PM_{10}; i.e.,PM10-1 and PM10-2

9.3.3 Results of PM Deposition Sampling

The results of PM deposition sampling and comparison of the calculated LTV and STV values with Turkish regulatory limits (as per IAPCR Annex 2, Table 2.2) and with international standards are presented in Table 9-8. Accordingly, baseline air quality values for in-situ monitoring were identified to be well below the national limit values.

Table 9-8. PM deposition sampling results

İn-situ Monitoring Station	Result (mg/m²-day)		Short Term Value (mg/m²-day)	Long Term Value (mg/m²-day)
	Sampling-1	Sampling-2		
PM10-1	88.5	80.2	88.5	84.4
PM10-2	107.3	110.1	110.1	108.7
National short term limit value for 2020 (mg/m²-day)			**390**	**-**
National long term limit value for 2020 (mg/m²-day)			**-**	**210**
International limit value			**-**	**-**

9.3.4 Results of PM_{10} Sampling

Results of PM_{10} sampling and comparison of the calculated STV values with Turkish (as per IAPCR Annex 2, Table 2.2) and international (i.e., IFC and EU) regulatory limits are presented in Table 9-9. Accordingly, baseline air quality values for in-situ monitoring were identified to be well below the national and international limit values.

Table 9-9. PM_{10} sampling results

In-situ Monitoring Station	Result (ug/m³)	National Short Term Value-2020 (ug/m³)	International Short Term Value-2020 (ug/m³)	
			EU	IFC
PM10-1	30.16	50	50	50
PM10-2	32.67	50	50	50

9.3.5 Results of $PM_{2.5}$ Sampling

Results of $PM_{2.5}$ sampling and comparison of the calculated STV values with international (i.e., IFC and EU) limits are presented in Table 9-10. Accordingly, baseline air quality values for in-situ monitoring were identified to be well below the international limit values.

Table 9-10. $PM_{2.5}$ sampling results

In-situ Monitoring Station	Result (mg/Nm³)	National Short Term Value-2020 (ug/m³)	International Short Term Value-2020 (ug/m³)	
			EU	IFC
PM10-1	1.24	-	25	25
PM10-2	1.28	-	25	25

9.3.6 Results of NO_2 Sampling

Results of NO_2 sampling and comparison of the calculated LTV values with Turkish regulatory limits (as per IAPCR Annex 2, Table 2.2) and international standards (i.e., EU and IFC) are presented in Table 9-11. Accordingly, baseline air quality values for in-situ monitoring were identified to be well below the national and international limit values.

Table 9-11. NO_2 sampling results

In-situ Monitoring Station	Result (ug/m^3)			National 1 Year Value (ug/m^3)	International 1 Year Value (ug/m^3)	
	Sampling-1	Sampling-2	Average		EU	IFC
P-1	3.26	2.37	2.82	40	40	40
P-2	<0.01	2.97	1.49	40	40	40
P-3	5.21	3.01	4.11	40	40	40
P-4	2.97	2.08	2.53	40	40	40
P-5	1.78	<0.01	0.90	40	40	40
P-6	1.44	2.04	1.74	40	40	40
P-7	1.77	1.48	1.63	40	40	40
P-8	4.29	2.70	3.50	40	40	40
P-9	<0.01	<0.01	0.01	40	40	40
P-10	2.75	0.52	1.64	40	40	40
P-11	3.93	1.48	2.71	40	40	40

9.3.7 Results of SO_2 Sampling

Results of SO_2 sampling and comparison of the calculated LTV values with Turkish regulatory limits (as per IAPCR Annex 2, Table 2.2) are presented in Table 9-12. Accordingly, baseline air quality values for in-situ monitoring were identified to be well below the national limit values.

Table 9-12. SO_2 sampling results

In-situ Monitoring Station	Result (ug/m^3)			National Long Term Value (ug/m^3)	International Long Term Value (ug/m^3)	
	Sampling-1	Sampling-2	Average		EU	IFC
P-1	5.66	<2.92	4.29	60	-	-
P-2	7.28	<2.92	5.10	60	-	-
P-3	<2.92	<2.92	2.92	60	-	-
P-4	<2.92	<2.92	2.92	60	-	-
P-5	<2.92	3.48	3.20	60	-	-
P-6	<2.92	3.79	3.36	60	-	-
P-7	<2.92	<2.92	2.92	60	-	-
P-8	<2.92	<2.92	2.92	60	-	-
P-9	6.28	<2.92	4.60	60	-	-
P-10	5.51	<2.92	4.22	60	-	-
P-11	3.52	<2.92	3.22	60	-	-

9.3.8 Results of VOC Sampling

Results of VOC sampling and comparison of the calculated STV values with Turkish regulatory limits (as per IAPCR Annex 2, Table 2.2) are presented in Table 9-13. Accordingly, baseline air quality values for in-situ monitoring were identified to be below the national limit values except for the first sampling result at P-10 monitoring station located nearby the Ceyhan Dörtyol Road, which is a potential fuel emission source.

Table 9-13. VOC sampling results

In-situ Monitoring Station	Result (ug/m^3)			National Short Term Value (ug/m^3)	International Short Term Value (ug/m^3)	
	Sampling-1	Sampling-2	Average		EU	IFC
P-1	49.27	12.11	30.69	70	-	-
P-2	-	-	-	70	-	-
P-3	48.49	3.72	26.11	70	-	-
P-4	58.46	17.51	37.99	70	-	-
P-5	-	-	-	70	-	-
P-6	-	36.38	18.19	70	-	-
P-7	-	-	-	70	-	-
P-8	-	-	-	70	-	-
P-9	-	-	-	70	-	-
P-10	**90.51**	5.02	47.77	70	-	-
P-11	-	1.36	0.68	70	-	-

9.3.9 Summary of Baseline Air Pollutant Levels

It is observed that the detected baseline values for PM deposition and PM_{10} remain below the Turkish ambient air quality limits for industrial facilities. The average LTV SO_2 and NO_2 remain below the Turkish ambient air quality limits for the year 2024 given in Table 9-1 at all locations. When the VOC baseline concentrations were assessed, the first sampling value of one of the measurement locations (P-10) was found to be above STV limit values; on the other hand, when the average of two samplings are evaluated, values at all measurement locations were found to be below the limit values. Although the PM parameters are below the national and international limits, the relatively high concentrations can be attributed to the dominant industrial land use in the region.

9.4 Air Quality Modelling

Air quality modelling study was conducted by Ennotes Environmental Engineering Consultancy Ltd. (Ennotes). The study results are provided in the Air Quality Assessment and Modelling Report by Ennotes (April 2021).

9.4.1 Methodology

Air Quality Modelling

Air quality modelling study was conducted using “Lakes Environmental AERMOD View” dispersion model software (under License No: AER0005591). This model is one of the most state-of-the-art computer models which can estimate hourly, daily, and annual ground level concentration values, based on real-time data varying over time. The model comprises the calculations of different dispersion models for different sources (point, volume, line) ranging from isolated stacks to fugitive pollutants and also takes into consideration aerodynamic waves and turbulence. Hourly, daily, and annual average ground level concentration values of the pollutants in the ambient air can be estimated by the model.

Emission dispersions are calculated using hourly meteorological data which cover all hours of one year. Thus, all meteorological conditions are considered in the modelling study for the Project site. Long-term meteorological data needed for modelling studies are obtained from the regional meteorological stations. In this study, Ceyhan Meteorological Station is considered representative of the site and the meteorological data recorded at this station was used in the modelling study. Since upper atmospheric observation (radiosonde observations) values of the region are not conducted by this station, these records were obtained from Adana Meteorological Station which is the nearest radiosonde station.

Impact Assessment Criteria

The significance criteria for the related impacts on air quality were established by identifying the impact intensity and receptor sensitivity. The impact intensity and receptor sensitivity criteria are summarised in Table 9-14 and Table 9-15. The impact assessment criteria specific to the air quality are used together with the impact assessment methodology described in *Chapter 4: Scope And Methodology* for the assessment of the air quality impacts of the Project.

Table 9-14. Intensity of Impact

Impact Significance	Description
Negligible	- No perceptible change in baseline conditions.
Low	- Temporary dust and gas emissions within the Project site during construction and operation activities; - Temporary emissions due to construction equipment and vehicle movements resulting in a change in baseline air quality by 20%; - Emissions during operation resulting in change in baseline air quality by 20%.
Moderate	- Temporary dust and gas emissions extending the Project site during construction and operation activities; - Temporary emissions due to construction equipment and vehicle movements resulting in a change in baseline air quality by 40% but still below regulatory and International Finance Corporation (IFC) air emission limits; - Emissions during operation resulting in change in baseline air quality by 40% but still below regulatory and IFC air emission limits.
High	- Temporary emissions due to construction equipment and vehicle movements, and during operation resulting in a change in baseline air quality by 70% or above regulatory and IFC air emission limits;

Impact Significance	Description
	- Emissions during operation resulting in change in baseline air quality by 70% or above regulatory and IFC air emission limits.
Very High	- Continuous emissions due to construction equipment and vehicle movements, and during operation resulting in a change in baseline air quality over 70% or and highly above regulatory and IFC air emission limits; - Emissions during operation resulting in change in baseline air quality over 70% or highly above regulatory and IFC air emission limits. - The impact is likely to cause very serious to catastrophic damage to environmental or social components

Table 9-15. Receptor sensitivity

Sensitivity	Definition
Low	Forest areas in close vicinity of the Project site.
Medium	Industrial facilities in close vicinity of the Project site.
High	Schools and Residential areas in close vicinity of the Project site.

9.4.2 Emissions

Air quality impacts of the Project were assessed for both construction and operation phases of the Project and Associated Terminal Facility. Relevant assessment is detailed in the following subsections.

Construction phase

The site preparation activities at the early stage of the construction phase will mainly cover earthworks. Significant air pollutants of this step will be dust generated from blasting, excavation, construction vehicle movements, and the release of engine emissions from construction equipment and vehicles at the construction site.

In order to calculate dust emissions, emission factors were used. Particulate matter emission factors are taken from the IAPCR Annex-12 “Table 12: Emission factors for the used to calculation of dust emissions”. Dust emissions from excavation, loading, and vehicle movements are calculated using IAPCR Annex-12 emission factors which are shown in Table 9-16.

Table 9-16. Emission Factors for Earthwork Activities

Sources	Emission Factors		Unit
	Uncontrolled	Controlled	
Blasting	-	0.52 x 0.00022 x (A)1,5	
Extraction	0.025	0.0125	kg/ton
Loading	0.010	0.005	
Unloading	0.010	0.005	
Primary Crusher	0.243	0.0243	
Secondary Crusher	0.585	0.0585	

Sources	Emission Factors		Unit
	Uncontrolled	Controlled	
Tertiary Crusher	0.585	0.0585	
Transport (total round trip)	0.7	0.35	kg/km-vehicle
Storage	5.8	2.9	kg dust/hectare day

Earthwork activities including excavation, loading, unloading, and transportation activities for the construction of the The Project and Assciated Facility (approximately 4,557,000 m^3 soil) will be completed in 16 months as part of overall construction phase. It is assumed that the activities will be conducted for 25 days a month, and for 24 hours a day. In total, 100,000m^3 of the excavated material will be used for filling at the Ceyhan PDH-PP Project site, whereas the remaining 4,357,000 m^3 of it will be transferred to the neighbouring CPIR Port to be used as filling material in the marine section of the CPIR Port Project. The filling of the marine section of the CPIR Port is expected to continue for 18 months. The total filling amount will be 24,000,000 tons for the entire Raw Material Supply, Storage, and Port Facility Project (CPIR Port) Project. Since the impact areas for both projects (i.e., The Project and Associated Terminal Facility and CPIR Port Project) are similar, the impacts of dust generation from CPIR Port filling activities are also taken into consideration and discussed in *Chapter 18: Cumulative Impact Assessment*. The dust emission calculations for the construction activities are given in Table 9-17. The total emission calculated for controlled conditions for the Project site earthwork activities is 52.07 kg/h.

Table 9-17. Dust emission calculations for all construction activities

Activity	Controlled (Amount x Emission factor)
Blasting	0.00022 x (120 m^2)$^{1.5}$ = **1.5 kg/blasting**
Earthwork Activity	
Excavation	1,982.6 t/h x 0.0125 kg/ton = **24.78 kg/h**
Loading	1,982.6 t/h x 0.005 kg/ton = **9.91 kg/h**
Transportation (It is assumed that one track carries 40 tons of soil)	(0.35 kg / km x 1 km (round trip) x 1,982.6 (t/h)/40 ton/vehicle) = **17.35 kg/h**
Unloading	6.02 ton/h x 0.005 kg/ton = 0.03 **kg/h**
Subtotal (Project site Earthworks)	52.07 kg/h
Transportation for Backfilling	(0.35 kg / km x 2 km (round trip) x 2,222.2 (ton/h)/40 ton/vehicle) = **38.89 kg/h**
Unloading for Backfilling	2,222.2 ton/h x 0,005 kg/ton **= 11.111 kg/h**
Total (excluding blasting)	**102.071 kg/h**

It is noted that volumes of excavated materials described above are greater than those assumed in the national EIA due to more precise information on excavations being available at the beginning of the detailed design stage.

Operation phase

In the operational stage, the main emission sources in the Project operation phase will be stacks. During the operation phase mainly NO_2 emission is expected from the stacks due to the use of propane in the processes during the operation phase and the use of natural gas at the start-up of the process.

Additionally, VOC emissions are expected from the hydrocarbon storage tanks. These include the the propane tank in the Associated Terminal Facility and storage tanks in the Project site. VOC emissions are generally from two sources at the chemical storage plants. These are:

1. Connection equipment;
2. Breathing losses of storage tanks.

Regarding the potential VOC emissions, in order to include the accumulated impact on air quality during the operation phase, stotage tanks both in the Associated Terminal Facility and in the Project site are taken into consideration.

Connection Equipment (Associated Terminal Facility and Project site)

Emission factors and emission calculations based on emission factors for connection equipment (such as valves, pumps, and flanges) given in Protocol for Equipment Leak Emission Estimates Report (1995) prepared by U.S. Environment Protection Agency, are shown in Table 9-18.

Table 9-18. Connection Equipment Used for Emission Calculations

Equipment	Emission Factor (kg/h/source)	Source (number)	Mass Flow (kg/h)
Valve	7.8E-6	1870	0.0146
Pumps	2.4 E-5	50	0.0012
Other	4.0 E-6	94	0.0004
P-Connectors	7.5 E-6	0	0.0000
Flanges	3.1 E-7	5651	0.0018
Open-ended lines	2.0 E-6	0	0.0000
Total			**0.0179**

Storage tanks (Project site and Associated Terminal Facility)

According to IAPCR Annex-12, 3.1 "Mass flow rates should be calculated using the EPA TANKS software in the crude oil and fuel filling and storage facilities, without directly measuring the organic emission concentration from storage tanks”. In accordance with this provision, emissions from vents of storage tanks were calculated using EPA TANKS software.

The meteorological data required for the EPA TANKS software were obtained from the Adana Meteorology Station 1960-2019 meteorology bulletin. These values are as presented in
Table 9-19.

Table 9-19. Meteorological Data Used in EPA TANKS Software

METEOROLOGICAL DATA				
Daily Average Temperature (ºF)			66.2	
Atmospheric Pressure (Psia)			14.653	
Month	**Daily Maximum Temperature (ºF)**	**Daily Minimum Temperature (ºF)**	**Daily Average Intensity of Solar Radiation(btu/ft²day)**	**Average Wind Speed (mph)**
January	57.2	37.4	638	3.355
February	59	39.2	877	3.355
March	66.2	42.8	1180	3.579
April	73.4	50.0	1486	3.579
May	82.4	57.2	1756	3.802
June	87.8	64.4	1907	4.026
July	93.2	69.8	1883	4.250
August	93.2	71.6	1703	3.802
September	89.6	64.4	1449	3.355
October	82.4	55.4	1074	2.684
November	69.8	46.4	757	2.684
December	59.0	39.2	569	3.131
Yearly	77.0	53.6	1273	3.759

In the Associated Terminal Facility and Project site tank farms organic chemicals will be stored in 3 of the total 5 tanks. Two of these tanks (41-TK-002 and 41-TK-003) will be designed as pressurized tanks which do not have an open vent nozzle. Hence, no VOC emission to air is expected from these tanks. Therefore, modelling studies were carried out for only 1 group of tanks (i.e., 41-TK-001) that will be used for the storage of solvent. Characteristics of the tanks in the Associated Terminal Facility and in the Project site are presented in Table 9-20.

Table 9-20. Physical Properties of Chemical Tanks in the Associated Terminal Facility and in the Project site

Tank No	Content	Number of Tank	Tank Type	Volume (m^3)	Diameter (mm)	Height or Weight (mm)	Max. Liquid Height (mm)
Project Site							
41-TK-001 Solvent Tank	C9-C10 aromatic hydrocarbon	1	Internal Floating Roof Tank	55	4100	4200	2700
41-TK-003 – Propylene tank	99.8 % Propylene	4	Not included in the modelling study (pressurized tank) (the tank has no vents or nozzle				

Tank No	Content	Number of Tank	Tank Type	Volume (m^3)	Diameter (mm)	Height or Weight (mm)	Max. Liquid Height (mm)
Project Site							
			connection equipments and valves are included in the figre given in Table 9-18)				
01-TK-102 Caustic Tank	%10 Caustic %90 Water	1	Not included in the modelling study				
01-TK-101 Neutralization tank	%2 Soda Ash %0.5 Sodium Nitrate %97.5 Water	1	Not included in the modelling study				
35-TK-001 Spent Caustic Tank	%7.4 Na_2S %2.7 NaHS H_2O Balance	1	Not included in the modelling study				
Associated Terminal Facility							
41-TK-002 Propane Tank	Propane 95%	1	Not included in the modelling study (pressurized tank) (it has no vents or nozzle connection equipments and valves are included in the figure given in Table 9-18)				

The Project site 41-TK-001 tank, physical properties of which are given above has a fuel circulation (turnover) of 24 times a year. These tanks and ceilings are painted white and will be in good condition and ceiling types will be conical. The emission values calculated as a result of tank modelling are presented in Table 9-21.

Table 9-21. VOC Emission Values from 41-TK-001 Tank

Tank ID	Number of Tanks	EPA TANKS Model Result (lbs/year)	EPA TANKS Model Result (kg/hour)
41-TK-001	1	10.52	0.05

Regarding the ambient air quality during the construction and operation phases of the Ceyhan The Project and Assciated Facility, certain facilities planned for the future will also have an impact on the air quality of the region in addition to the facilities that are currently in operation in the region. In order to determine the contribution of the facilities currently in operation, background air quality measurement results, which are shown in Section 9.3, were used.

Furthermore, within the scope of the planned CPIR Port project, a tank farm is planned to be established to include storage tanks for Liquefied petroleum gas (LPG), Ethylene, Ethane, and Naphta, which are expected to have some cumulative impacts on the regional air quality. The details of the tanks planned for the CPIR Port Project and potential emissions are discussed in *Chapter 18: Cumulative Impact Assessment*.

In below, information related to the stacks including their dimensions (height, diameter) and temperature as well as emission values, as provided by the Project Company, are given in below Table 9-22. Emission standards that is considered in the modelling study are provided in Table 9-23 given below.

Table 9-22. Stack Information and Emission Values* Used in Modelling Study

No	Stack Name	Flue Gas Outlet Velocity (m/s)	Stack Height from the Ground (m)	Stack Diameter (m)	Temperature (°C)	Dust (kg/h)	NO_2 (kg/h)	SO_2 (kg/h)	CO (kg/h)
1	01-H-101 Charge Heater	5.83	82.16	2.00	164.0	0.34	3.42	1.20	3.42
2	01-H-102 No1 Interheater	5.94	71.30	1.90	168.0	0.31	3.11	1.09	3.11
3	01-H-103 No2 Interheater	5.90	76.10	1.80	163.0	0.28	2.81	0.98	2.81
4	01-H-104 No3 Interheater	5.76	74.80	1.65	163.0	0.23	2.31	0.81	2.31
5	Utility Boiler-25-PK-001A	15.00	60	2.21	190.0	0.98	9.77	3.42	9.77
6	Utility Boiler-25-PK-001B	15.00	60	2.21	190.0	0.98	9.77	3.42	9.77

* After completion of the detailed design, final stack height may vary from those in Table 9-22. In case a cange in design, the models will need to be updated, and consequent assessments may need to be revised in accordance to the new design values. The Table 9-23 showas that all design emissions are in line with the relevant standards.

Table 9-23. Design Emission Levels of Process Units and Relevant Emission Standards

Stack No	Stack Name	Dust				NO_x				SO_2				CO			
		Design Concentration (mg/Nm^3)	National Limit Value (mg/Nm^3)	IFC EHS Guidelines for LVPOCM	EU BAT/BREF[1, 2]	Design Concentration (mg/Nm^3)	National Limit Value (mg/Nm^3)	IFC EHS Guidelines for LVPOCM	EU BAT/BREF [1, 2]	Design Concentration (mg/Nm^3)	Limit Value (mg/Nm^3)	IFC EHS Guidelines for LVPOCM	EU BAT/BREF [1, 2]	Design Concentration (mg/Nm^3)	National Limit Value (mg/Nm^3)	IFC EHS Guidelines for LVPOCM	EU BAT/BREF [1, 2]
1	01-H-101	10	10[3]	20	N/A	100	800[3]	300	N/A	35	100[3]	100	N/A	100	100[3]	Not defined	N/A
2	01-H-102	10	10[3]	20	N/A	100	800[3]	300	N/A	35	100[3]	100	N/A	100	100[3]	Not defined	N/A
3	01-H-103	10	10[3]	20	N/A	100	800[3]	300	N/A	35	100[3]	100	N/A	100	100[3]	Not defined	N/A
4	01-H-104	10	10[3]	20	N/A	100	800[3]	300	N/A	35	100[3]	100	N/A	100	100[3]	Not defined	N/A
5	Utility Boiler-A	5	5[4]	20	N/A	100	300[4]	300	N/A	35	35[4]	100	N/A	100	100[4]	Not defined	N/A
6	Utility Boiler-B	5	5[4]	20	N/A	100	300[4]	300	N/A	35	35[4]	100	N/A	100	100[4]	Not defined	N/A
7	Regenerative Thermal Oxidizer (RTO)	10	140[5]	20	N/A	100	NA[6]	300	N/A	100	NA[6]	100	N/A	100	Not defined	Not defined	N/A

[1] BAT are applicable for the production of lower olefins in the thermal cracking process. The planned development project concerns propylene production in the catalytic propane dehydrogenation process.
The Oleflex™ Process is a moving bed catalytic process designed to selectively dehydrogenate a paraffin feed to the corresponding mono-olefin. Feed to the Oleflex unit must be free of impurities that could harm the platinum containing catalyst or cause reactor fouling. The catalyst employed is highly selective for the desired reaction; successive and competing reactions such as skeletal isomerization, diolefin production, and cracking are minimized by proper catalyst formulation and choice of operating conditions.

[2] Ceyhan Plant includes in PDH unit 4 Process Heaters each one with its own stack heating capacity of 28.14 MW, 25.46 MW, 20.88 MW, 30.94 MW. Therefore BAT for Large Combustion Plants (LCP) is not applicable. On the other hand, design emission standards for the units are in compliance with EU BAT for Production of Large Volume Organic (PoLVOC) Chemicals, which are 60- 100 mg/Nm^3 for NOx and 10 – 50 mg/Nm^3 for CO. It should be noted that there is no defined dust and SO_2 emission imits in EU BAT for PoLVOC (in Section 13 Production of lower Olefins).

[3] Industrial Air Pollution Control Regulation (IAPCR) Annex 2 Section 2.5 Table 5.2

[4] IAPCR Annex 2 Section 1.4.3

[5] IAPCR Annex 1 Section b.1. Diagram 1

[6] IAPCR Annex 1 Section 4.3. Table1.2.1

9.4.3 Dispersion Modelling Results

A dispersion model was developed for the construction and operation phases. For the construction phase, a modelling study was conducted for the activities in the Project site and associated facilities as described in Section 9.4.2. For the generation of dust, two different scenarios were evaluated:

(i) Dust generation due to earthwork activities at the Project site;
(ii) Dust generation due to earthwork activities and filling activities both in the Project site and in the CPIR Port (i.e., dust generation from CPIR Port filling activities that is expected to continue parallel to the Project construction activities).

The second scenario is discussed in *Chapter 18: Cumulative Impact Assessment.*

For the operational phase, a modelling study was conducted for dust parameters (PM_{10} and PM deposition) as well as for NO_2, SO_2, and CO emissions from the stacks. Furthermore, two different scenarios have been studied for the VOC emissions from the storage tanks. These scenarios can be summarized as follows:

- **Scenario 1**: Examination of VOC emissions distribution from tanks in the Ceyhan The Project and Assciated Facility and in the Associated Terminal Facility (i.e., propane tank) under controlled operating conditions;
- **Scenario 2**: Examination of VOC emissions distribution from the tanks in the Ceyhan The Project and Assciated Facility and in the Associated Terminal Facility under controlled operating conditions added with the potential background emissions from the hydrocarbon storage tanks in the CPIR Port Project (in Section 9.4.2). This scenario aims to assess the cumulative emission distribution due to VOC emissions.

The results of the second scenario are discussed in *Chapter 18: Cumulative Impact Assessment.*

9.4.3.1 Construction phase

Modelling studies were carried out to simulate air quality regarding the dust parameters (PM_{10} and PM deposition) during construction activities. APCV of pollutants obtained from the modelling studies are shown in Table 9-24. Based on the modelling results, average maximum APCV dispersion of PM_{10} for controlled conditions are shown in Figure 9-3.

Table 9-24. Construction phase maximum APCV determined from the modelling studies for controlled conditions

Stage	Parameter	Period	Maximum APCV (µg/m³ for PM_{10}) (mg/m².day for PM Deposition) and relevant Coordinates	National Limit Value (2020) (µg/m³)	EU Limit Values (µg/m³)	IFC Limit Values (µg/m³)
Construction	PM_{10} (µg/m³)	Daily	**6,466** (763468,4087801)	50	50	50
		Exceedance	**365**	35 times in a year		
		Yearly	**2,717.99** (763468,4087801)	40	40	20
	PM Deposition (mg/m²day)	STV*	**1,116.58** (763147,4087418)	390	-	-
		LTV**	**524.43** (763468,4087801)	210	-	-

*STV represents monthly mean values, ** LTV represents yearly mean values

As shown in Table 9-24, daily and yearly APCV of PM10 from construction activities under uncontrolled working conditions are 6,466 µg/m³ and 2,717.99 µg/m³, respectively. IAPCR and EU criteria specify the maximum number of exceedances for daily PM_{10} limit values allowed yearly as 35 times. However, modelling results indicate daily APCVs for PM_{10} exceed the limit values 365 times in one year. Additionally, for yearly PM_{10}, maximum APCVs are above the national, EU, and IFC limit values for all phases. Therefore, the daily and yearly APCV of PM_{10} during the construction phase do not comply with the national and international limit values. Therefore, it is important to take necessary mitigation measures as explained in Section 9.7 and stay in close communication with affected stakeholders (e.g., Incirli residents, personnel of the surrounding facilities, etc.) in order to effectively respond to potential grievances.

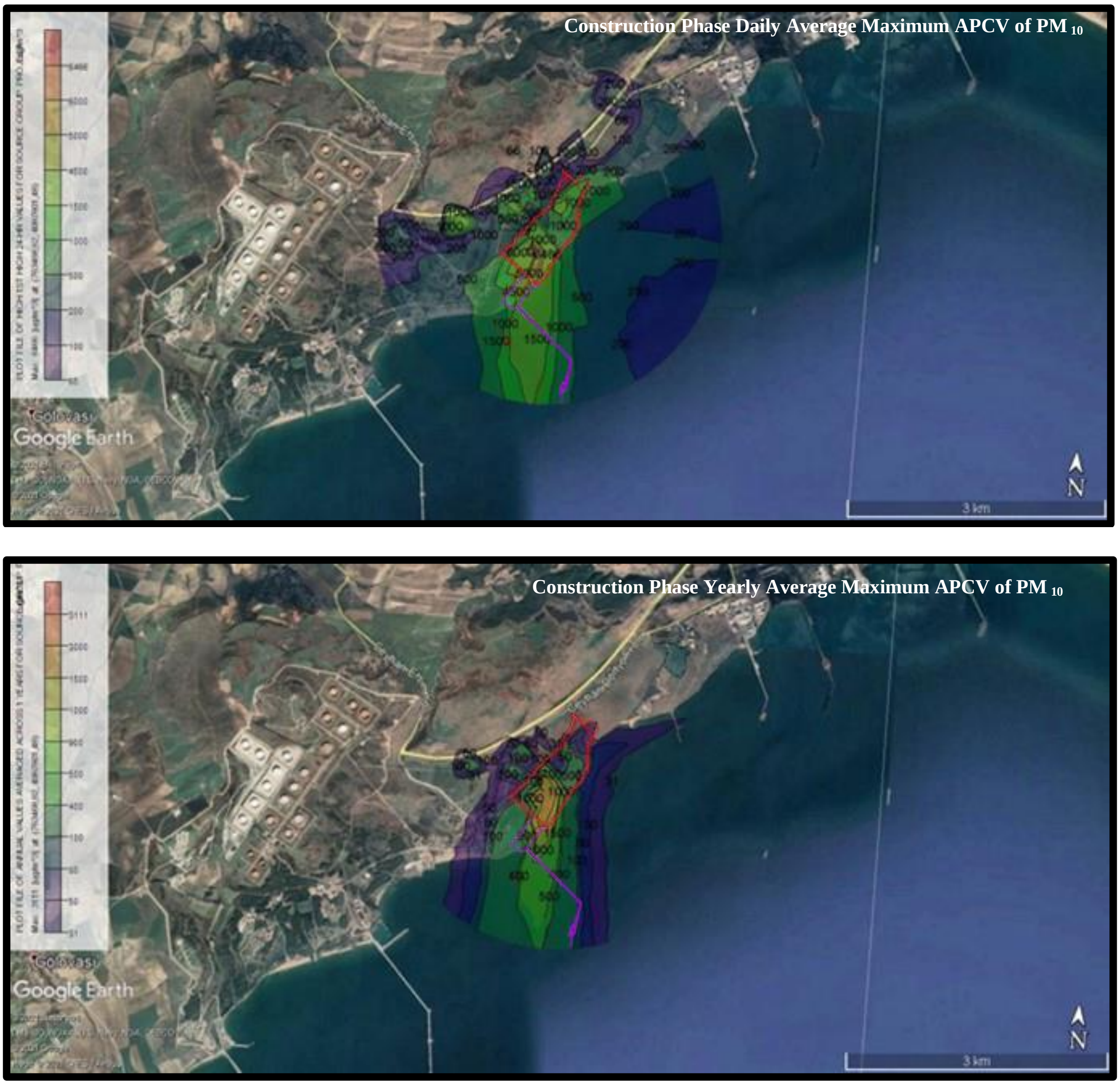

Figure 9-3. Daily average (upper panel) and yearly average (lower panel) maximum APCV dispersion of PM_{10} during the construction phase

APCVs of PM_{10} from the construction phase under controlled conditions calculated for the baseline monitoring locations are presented in Table 9-25 for controlled conditions. TPV represents the sum of the long-term measurement results (background concentrations) and APCV. Table 9-25 shows that daily and yearly TPV of PM_{10} are higher than national and EU/IFC limit values at Monitoring Station 1 and 2 (PM10-1 and PM10-2). The yearly exceedance frequency modelled for Station 1 (59 times a year) is above the national and EU/IFC admissible limit of exceedance frequency, whereas it is below the limit values for Station 2. APCV values presented here are based on the cumulative emissions of the Project activities and the CPIR Port activities as they indicate pollutant concentrations at the nearby receptors.

Table 9-25. PM_{10} APCVs and TPVs due to construction activities at baseline measurement locations under controlled conditions*

Parameter	Measurement Point	Period	Air Pollution Contribution Value (Model Result)	Background (LTV)	Total Pollution Value (TPV)	National Limit Value - 2020	EU Limit Values	IFC Limit Values
PM_{10} (µg/m^3)	1 İncirli	Daily	357.90	30.16	**388.06**	50	50	50
		Exceedance	59		**62**	Max. 35 times in a year		
		Yearly	27.30		**57.46**	40	40	20
	2 Toros Dormitories	Daily	306.21	32.67	**338.88**	50	50	50
		Exceedance	15		18	Max. 35 times in a year		
		Yearly	7.38		**40.05**	40	40	20

**APCVs and TPVs represent the modelled concentrations at monitoring locations*

After the evaluation of the change in the ambient air quality with respect to PM10 concentrations at the baseline monitoring points, the following can be said *for PM10 baseline monitoring points (Monitoring Station 1 (PM10-1) is located to the southwestern boundary of the Project site near Incirli village and Monitoring Station 2 (PM10-2) is located to the northern boundary of the Project site near the motorway):*

- Daily TPV value of PM_{10} is predicted to increase by more than 70% creating a high impact magnitude at both locations. The sensitivity of the immediate surrounding is considered to be high (residential area) at Monitoring Station 1 and low (forest areas) at Monitoring Station 2 .
- Yearly TPV value of PM_{10} is predicted to increase by more than 70% creating a high impact magnitude at Monitoring Station 1 (with high sensitivity) and by approximately 23% at Monitoring Station 2, creating a moderate impact magnitude at Monitoring Station 2 (with low sensitivity).

Impact significances for the construction phase are evaluated in Section 9.6.1.

9.4.3.2 Operation phase

Modelling studies were carried out for NO_2, PM_{10}, PM deposition, SO_2, CO, and VOC emissions during operation activities. APCVs of pollutants obtained from the modelling studies are shown in Table 9-26. Based on the modelling results, average maximum APCV dispersion of NO_2, PM_{10}, PM deposition, SO_2, VOC, CO, PM_{10}, for controlled conditions are shown in Figure 9-4 through Figure 9-8.

Table 9-26. Operation phase maximum APCV determined from the modelling studies for controlled conditions

Stage	Parameter	Period	Maximum APCV ($\mu g/m^3$ for PM_{10}) (mg/m2.day for PM Deposition) and relevant Coordinates	National Limit Value (2020) ($\mu g/m^3$)	EU Limit Values ($\mu g/m^3$)	IFC Limit Values ($\mu g/m^3$)
Operation	**PM_{10} ($\mu g/m^3$)**	Daily	11.61 (763085,4088924)	50	50	50
		Exceedance	0	Max. 35 times in a year		
		Yearly	1.23 (763157,4089232)	40	40	20
	NO_2 ($\mu g/m^3$)	Hourly	51.25 (763585, 4089057)	200	200	200
		Exceedance	-	Max. 18 times in a year		
		Yearly	4.28 (763085, 4088849)	40	40	40
	SO_2 ($\mu g/m^3$)	Hourly	339.08 (763368,4089289)	350	350	-
		Exceedance	1	Max. 24 times in a year	-	-
		Daily	**31.69** (763085,4088924)	125	125	125
		Yearly	3.31 (763085,4088924)	60	-	-
	CO ($\mu g/m^3$)	8-hour average per day	135.38 (763085, 4088924)	10,000	10,000	-
	VOC ($\mu g/m^3$)	Hourly (Scenario-1)	218.58 (763621, 4087980)	280	-	-
		STV (Scenario-1)	34.73 (763878, 4086806)	70	-	-

The results shown in Table 9-26 can be interpreted as follows:

- Daily and yearly APCV of PM_{10} due to operational activities under controlled working conditions are 11.61 $\mu g/m^3$ and 1.23 $\mu g/m^3$, respectively. Hence, modelled concentrations are below the national and international limit values;
- Operation phase NO_2 emissions comply with emission standards;
- Hourly, daily and yearly emissions comply with emission standards,
- Operation phase CO emission values are in compliance with national and international emission standards.
- VOC emission values comply with both hourly and short-term national limit values.
- Ground level maximum APCV's indicate that contribution of the Project will be less than 25% of the who guideline values which is the prime target of the IFC Guidelines. With this intention, the modelling study indicates that; interms of APCV, there is a room for potential other industries which might have similar emissions. At this stage, there is no detailed information about potential future projects in the CPIR zone. Therefore, in terms of the Project contricbution, 25% of the natiolan limit

and international standard is used as threshold value in terms of cumulative impacts.

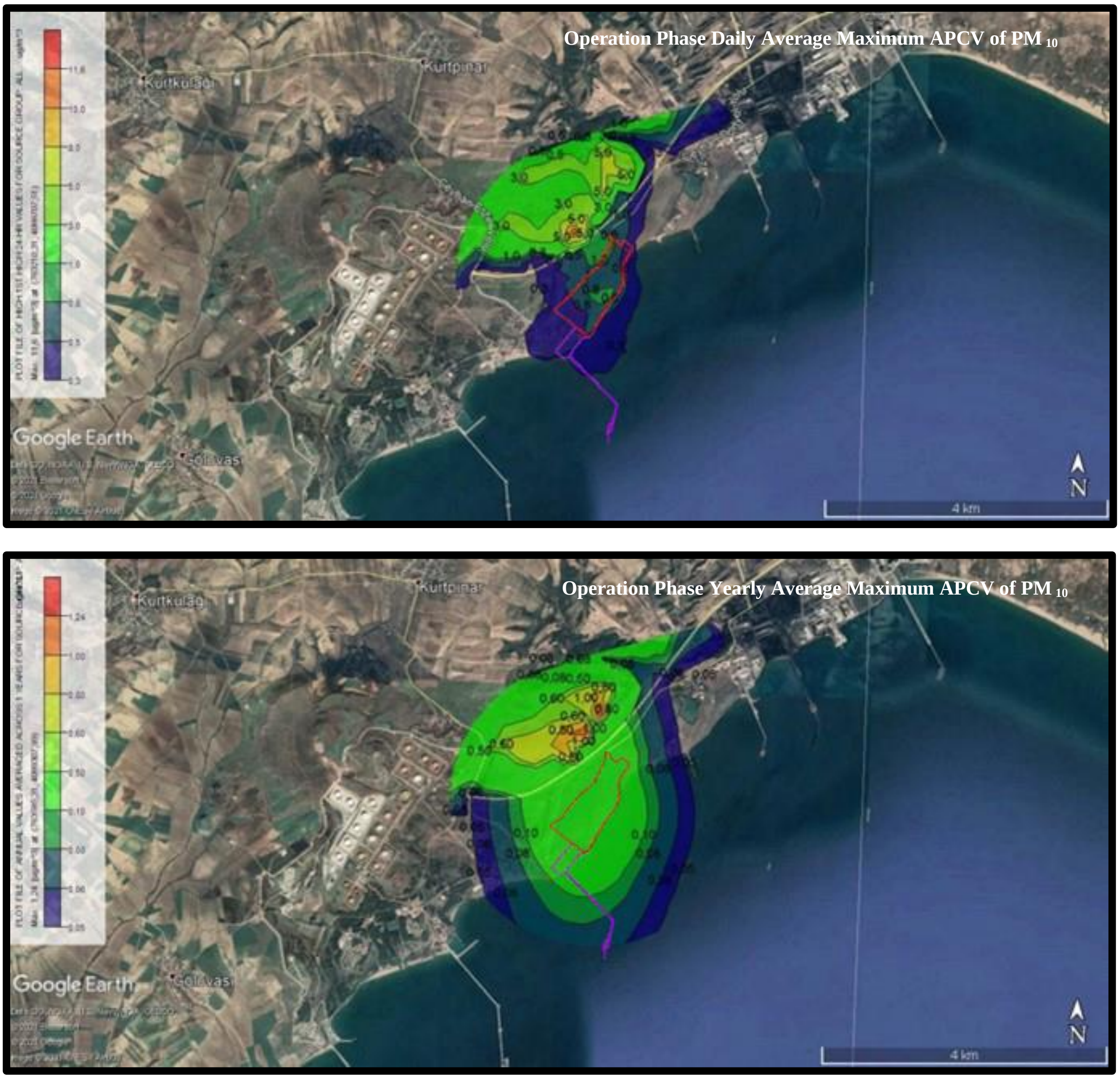

Figure 9-4. Daily average (upper panel) and yearly average (lower panel) maximum APCV dispersion of PM_{10} during the operation phase

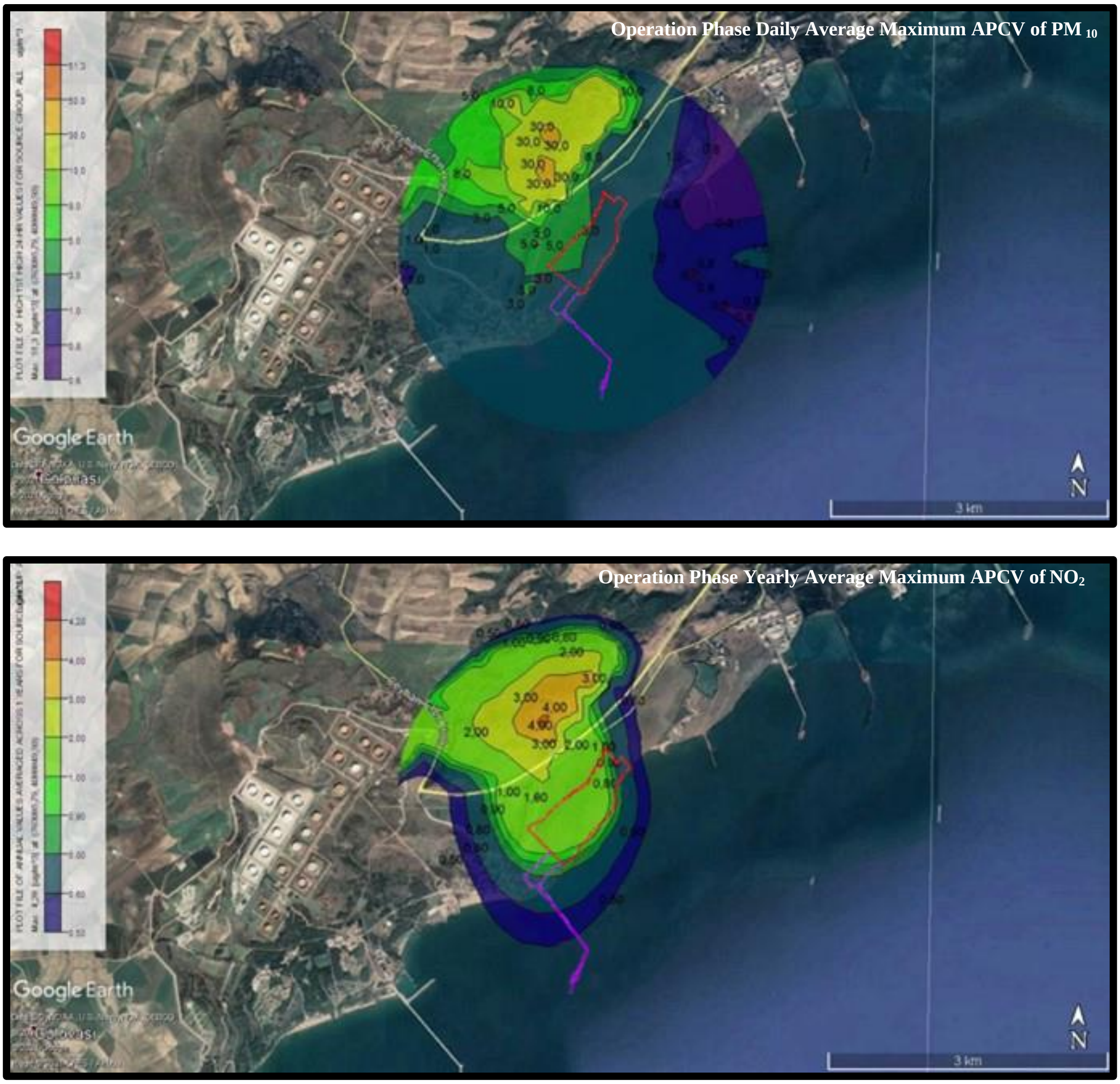

Figure 9-5. Daily average (upper panel) and yearly average (lower panel) maximum APCV dispersion of NO_2 during the operation phase

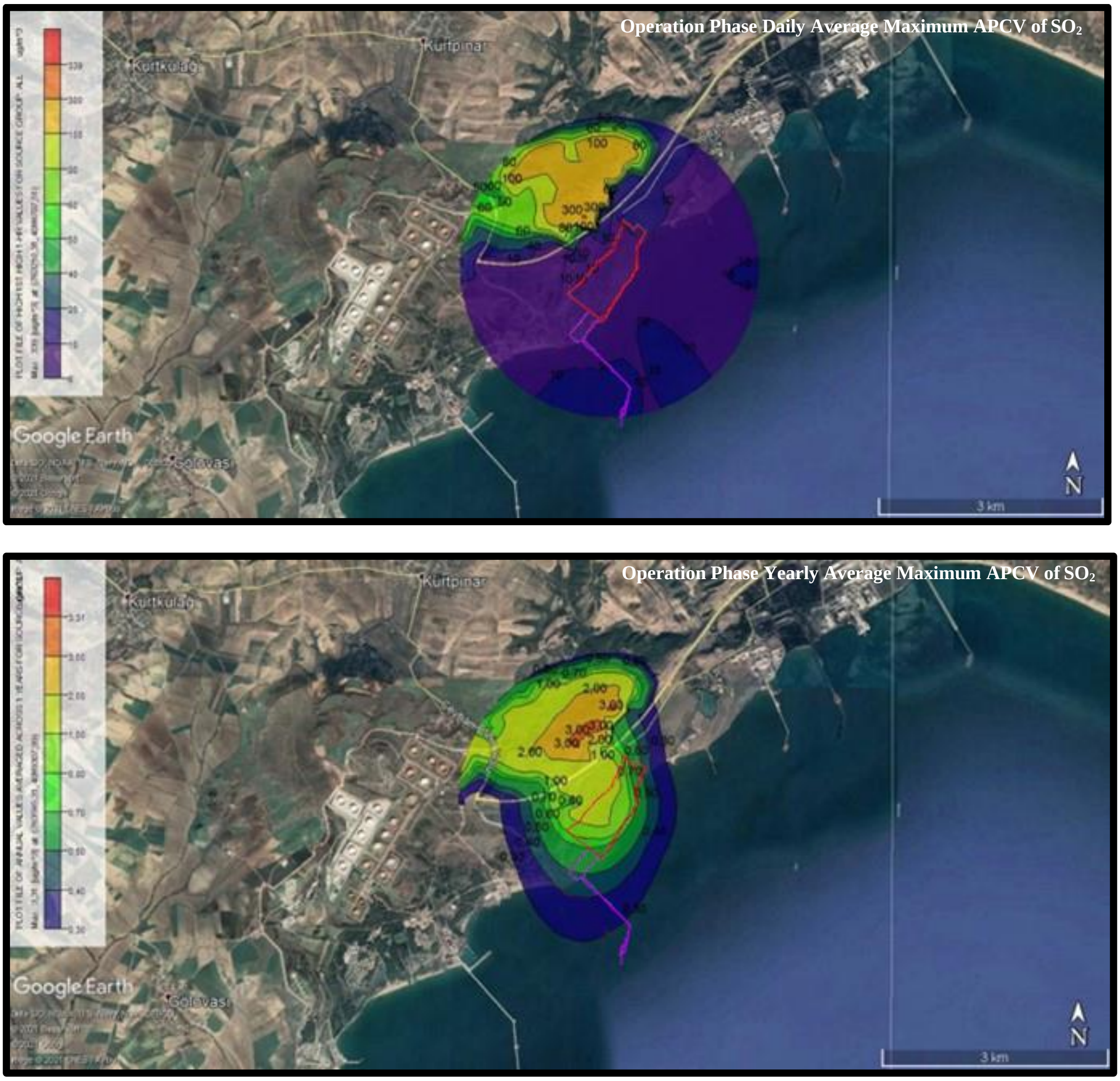

Figure 9-6. Daily average (upper panel) and yearly average (lower panel) maximum APCV dispersion of SO_2 during the operation phase

Figure 9-7. 8-hourly average maximum APCV dispersion of CO during the operation phase

Figure 9-8. Yearly average maximum APCV dispersion of VOC for Scenario-1 (i.e., tanks in the Ceyhan The Project and Assciated Facility under controlled operating conditions) during operation

APCV's and TPV of air pollutants due to operation activities under controlled conditions calculated for the baseline monitoring locations are presented in Table 9-27.

Table 9-27. PM_{10}, NO_2, SO_2 and VOC APCV and TPV of **operation activities** at baseline measurement locations for controlled conditions

Parameter	Measurement Point	Period	Air Pollution Contribution Value (Model Result)	Background (LTV)	Total Pollution Value (TPV)	National Limit Value - 2020	EU Limit Values	IFC Limit Values
PM_{10} (µg/m³)	PM10-1 İncirli	Daily	0.25	30.16	30.41	50	50	50
		Exceedance	0		0	Max. 35 times in a year		
		Yearly	0.05		**30.21**	40	40	20
	PM10-2 Toros Dormitories	Daily	0.09	32.67	32.76	50	50	50
		Exceedance	0		0	Max. 35 times in a year		
		Yearly	0.02		**32.69**	40	40	20
NO_2 (µg/m³)	P-1	Hourly	1.27	2.82	4.09	200	200	200
		Exceedance	0		0	Max. 18 times in a year		
		Yearly	0.54		3.36	40	40	40
	P-2 Toros Dormitories	Hourly	1.03	1.49	2.52	200	200	200
		Exceedance	0		0	Max. 18 times in a year		
		Yearly	0.37		1.86	40	40	40
	P-3	Hourly	13.58	4.11	17.69	200	200	200
		Exceedance	0		0	Max. 18 times in a year		
		Yearly	2.64		6.75	40	40	40
	P-4	Hourly	51.26	2.53	53.79	200	200	200
		Exceedance	0		0	Max. 18 times in a year		
		Yearly	4.28		6.81	40	40	40
	P-5	Hourly	1.84	0.90	2.74	200	200	200
		Exceedance	0		0	Max. 18 times in a year		
		Yearly	0.93		1.83	40	40	40
	P-6	Hourly	3.30	1.74	5.04	200	200	200
		Exceedance	0		0	Max. 18 times in a year		
		Yearly	1.46		3.20	40	40	40
	P-7 İncirli	Hourly	2.66	1.63	4.29	200	200	200
		Exceedance	0		0	Max. 18 times in a year		

Parameter	Measurement Point	Period	Air Pollution Contribution Value (Model Result)	Background (LTV)	Total Pollution Value (TPV)	National Limit Value - 2020	EU Limit Values	IFC Limit Values
		Yearly	0.80		2.43	40	40	40
	P-8 İncirl.	Hourly	2.29	3.50	5.79	200	200	200
		Exceedance	0		0	Max. 18 times in a year		
		Yearly	0.75		4.25	40	40	40
	P-9	Hourly	11.83	0.01	11.84	200	200	200
		Exceedance	0		0	Max. 18 times in a year		
		Yearly	2.85		2.86	40	40	40
	P-10	Hourly	2.22	1.64	3.86	200	200	200
		Exceedance	0		0	Max. 18 times in a year		
		Yearly	1.02		2.66	40	40	40
	P-11 Kurtpınari Primary School	Hourly	0.90	2.71	3.61	200	200	200
		Exceedance	0		0	Max. 18 times in a year		
		Yearly	0.19		2.90	40	40	40
SO_2 (µg/m^3)	P-1	Hourly	10.43	4.29	14.72	350	350	-
		Exceedance	0		0	Max. 24 times in a year	-	-
		Yearly	0.40		4.69	60	-	-
	P-2 Toros Dormitories	Hourly	9.55	5.10	14.65	350	350	-
		Exceedance	0		0	Max. 24 times in a year	-	-
		Yearly	0.25		5.35	60	-	-
	P-3	Hourly	74.39	2.92	77.31	350	350	-
		Exceedance	0		0	Max. 24 times in a year	-	-
		Yearly	1.82		4.74	60	-	-
	P-4	Hourly	118.95	2.92	121.87	350	350	-
		Exceedance	0		0	Max. 24 times in a year	-	-
		Yearly	3.26		6.18	60	-	-
	P-5	Hourly	7.20	3.20	10.40	350	350	-
		Exceedance	0		0	Max. 24 times in a year	-	-

Parameter	Measurement Point	Period	Air Pollution Contribution Value (Model Result)	Background (LTV)	Total Pollution Value (TPV)	National Limit Value - 2020	EU Limit Values	IFC Limit Values
		Yearly	0.69		3.89	60	-	-
	P-6	Hourly	7.33	3.36	10.69	350	350	-
		Exceedance	0		0	Max. 24 times in a year	-	-
		Yearly	1.12		4.48	60	-	-
	P-7 İncirli	Hourly	8.08	2.92	11.00	350	350	-
		Exceedance	0		0	Max. 24 times in a year	-	-
		Yearly	0.51		3.43	60	-	-
	P-8 İncirli	Hourly	6.93	2.92	9.85	350	350	-
		Exceedance	0		0	Max. 24 times in a year	-	-
		Yearly	0.46		3.38	60	-	-
	P-9	Hourly	155.82	4.60	160.42	350	350	-
		Exceedance	0		0	Max. 24 times in a year	-	-
		Yearly	2.04		6.64	60	-	-
	P-10	Hourly	7.68	4.22	11.90	350	350	-
		Exceedance	0		0	Max. 24 times in a year	-	-
		Yearly	0.61		4.83	60	-	-
	P-11 Kurtpinari Primary School	Hourly	11.91	3.22	15.13	350	350	-
		Exceedance	0		0	Max. 24 times in a year	-	-
		Yearly	0.11		3.33	60	-	-
VOC ($\mu g/m^3$)	P-1	Hourly	40.90	30.69	71.59	280	-	-
		STV	2.24		32.93	70	-	-
	P-2	Hourly	23.01	-	23.01	280	-	-
		STV	1.28		1.28	70	-	-
	P-3	Hourly	2.32	-	2.32	280	-	-
		STV	0.29		0.29	70	-	-
	P-4	Hourly	2.34	52.21	54.55	280	-	-
		STV	0.13		52.34	70	-	-

Parameter	Measurement Point	Period	Air Pollution Contribution Value (Model Result)	Background (LTV)	Total Pollution Value (TPV)	National Limit Value - 2020	EU Limit Values	IFC Limit Values
	P-5	Hourly	146.07	-	146.07	280	-	-
		STV	8.27		8.27	70	-	-
	P-6	Hourly	46.61	18.19	64.80	280	-	-
		STV	5.04		23.23	70	-	-
	P-7	Hourly	11.62	-	11.62	280	-	-
		STV	0.65		0.65	70	-	-
	P-8	Hourly	1.71	-	1.71	280	-	-
		STV	0.09		0.09	70	-	-
	P-9	Hourly	1.23	-	1.23	280	-	-
		STV	0.06		0.06	70	-	-
	P-10	Hourly	2.12	47.77	49.89	280	-	-
		STV	0.14		47.91	70	-	-
	P-11	Hourly	0.89	0.68	1.57	280	-	-
		STV	0.05		0.73	70	-	-

The results in Table 9-28 indicate the following:

- Daily TPV values for PM_{10} are in compliance with limit values. However. due to the high background concentrations. while yearly TPV values are in compliance with national and EU limits. they are above the limit values set by IFC for both measurement points;
- Operation Phase NO_2 values are seen to comply with the emission standards;
- Operation Phase SO_2 emissions comply with the emission standards;
- Operation Phase VOC emissions comply with the emission standards.

After the evaluation of the change in baseline ambient air quality at the baseline monitoring points the following interpretations can be made for the operation phase of the Project:

- Change in daily PM_{10} is negligible (i.e.. <1%) at both measurement locations. Similarly. the change in yearly PM_{10} is negligible (i.e.. <1%) at both monitoring locations; however. the final TPV value is above the IFC limit values due to high baseline concentrations. The magnitude of the impact is determined as negligible. The receptor sensitivity at PM10 Monitoring Station 1 (PM10-1) is high and the sensitivity of Monitoring Station 2 (PM10-2) is low;
- The hourly and yearly TPV values for NO_2 are below the national and international limit values. However. the estimated increase in NO_2 concentrations relative to the baseline conditions is greater than 70% for hourly concentrations at monitoring stations P-3. 4. 5. 6. 7. 9 and 10 creating high impact magnitude. At monitoring stations P-1. 2 and 8. the increase in hourly concentrations is above 40% which also creates high impact magnitude. The increase in yearly concentration is modelled to be below 70% at monitoring stations P- 3. 7. 10 where the receptor sensitivities vary from low to high. which creates high impact magnitude. For monitoring stations P- 1 and 11. since the increase in the concentration is modelled to be below 20%. the impact magnitude is classified as low. For monitoring stations P-2 and 8. the increase in the concentration is estimated below 40% and the receptors' sensitivity is classified as high; therefore. the impact magnitude is classified as moderate. For monitoring stations P- 4. 5. 6 and 9 where the receptor sensitivity is low. the yearly increase is estimated as above 70% which creates high impact magnitude.
- The hourly and yearly TPV values for SO_2 are below the national and international limit values. The increase in SO_2 concentrations compared to the baseline conditions is greater than 70% at all locations. creating high impact magnitude. The increase in yearly concentrations is above 40% at the monitoring stations P-3 and 9 where the receptor sensitivity varies from low to high. The impact magnitude for those points is classified as high. For Monitoring Station P-4. where the receptor sensitivity is low. the yearly increase is estimated above 70% which creates high impact magnitude. For monitoring stations P-1. 2. 7. 8. 10. and 11. the increase in

concentrations is below 20%. Thus. the impact magnitude is classified as low for these points. Lastly. for the monitoring stations P-5 and 6 with low sensitivity. the increase in concentrations is estimated below 40% creating moderate impact magnitude.

- The hourly and short-term TPV values for VOC are below the national and international limit values. Baseline VOC could only be detected at five of the monitoring stations (P-1. 4. 6. 10 and 11). For the monitoring stations where VOC is detected during baseline monitoring. based on TPVs the increase in VOC concentration is estimated above 70% at three points (P-1. 6 and 11). The magnitude of the impacts is therefore classified as high. For other monitoring stations (4 and 10) the impact magnitude is low. Lastly. for the short-term TPV values. the increase in VOC concentrations at two monitoring stations (4 and 10) are below 3% creating negligible impact magnitude. For monitoring stations P-1 and 11. the increase in VOC concentrations (6-7%) is low creating low impact magnitude. For Monitoring Station P-6. the increase in VOC concentrations is estimated above 20%. creating moderate impact magnitude.

Impact significances for the operation phase are evaluated in Section 9.6.2.

9.5 Greenhouse Gases

Background

Greenhouse gases can be described as gases that trap heat in the atmosphere. These gases allow sunlight to reach the Earth's surface unimpeded. The visible part of sunlight. which is short-wave energy. heats the surface and invisible long-wave energy radiates back into the atmosphere. Greenhouse gases (GHGs) absorb long-wave energy. thereby allowing less heat to escape back to space. trapping it in the lower atmosphere. Greenhouse gases are responsible for the greenhouse effect. which ultimately leads to climate change. The main anthropogenic source of greenhouse gases is the burning of fossil fuels.

In line with the Equator Principles IV (July 2020) and the Recommendations of the Task Force on Climate-related Financial Disclosures. Climate Change Risk Assessment (CCRA) needs to be prepared. Climate Change Risk Assessment Report which is given in Annex-L is prepared by RINA.

The assessment is based on the review of the available data on the existing operations and the proposed Project has been undertaken. Information on the Construction Phase of the Project is based on the detailed engineering design of the Project. Data for the Operational Phase has been taken from the most up-to-date information available at the time of writing and supplemented with assumptions where necessary.

The Intergovernmental Panel on Climate Change (IPCC) published literature values for CO in AR5 (Fifth Assessment Report) WG1 (Working Group 1) – Chapter 8. and this will help calculate the total emissions from the Project. Table 9-28 gives the Global Warming Potential for CO. CH_4. and N_2O.[5]

Table 9-28. Global Warming Potentials (GWPs) of GHGs as reported by IPCC AR5 (IPCC. 2014)

Greenhouse Gases	Formula	GWP	Greenhouse Gases
Carbon dioxide	CO_2	1	Carbon dioxide
Methane	CH_4	28	Methane
Nitrous oxide	N_2O	265	Nitrous oxide
Carbon monoxide	CO	2 – 3.3	Carbon monoxide

Methodology

In order to calculate emissions from the project. the IPCC Guidelines for National Greenhouse Gas Inventories published in 2006. The European Bank for Reconstruction and Development (EBRD). The European Investment Bank (EIB). and UK GHG emission conversion factor by Department for Business. Energy & Industrial Strategy were used (IPCC. 2006; EBRD. 2017; BEIS. 2020; EIB. 2020).

Project Boundaries

The project boundary separates the elements whose emissions are included in the assessment from those that are not. Construction phase emissions are normally not included in the assessment as they are typically not considered to be significant compared to operational emissions. However. construction-related emissions were included in the assessment as they are greater than 5% of the total emissions. For the calculation of total GHG emissions from the Project. construction. Scope 1. Scope 2. and Scope 3 emissions are assessed.

Construction Phase GHG Emissions

There are two main phases in the contractions works. Phase-1 Early Site Work (basic and process design and limited topsoil removal and excavation work not exceeding 1.000.000 m^3 material excavation). and the Phase-2 main construction (including engineering. procurement and commissioning activities). It is planned that construction Phase-2 will take 38 months after finalising Financial Closure. According to information supplied by the project owners. various types of machinery will be used during construction activities (see. Table 9-29). In calculating Construction phase GHG emissions. UK Government GHG Conversion Factors

[5] As there is not much detail about global warming potential (GWP) values relative to CO_2 for NMVOCs, NO_x, and SO_2, only the greenhouse gases given in Table 9-28 were calculated.

for Company Reporting 2020 Version 1.0 were used. It is estimated that the load factor is 0.5.

Table 9-29. Machinery List for the Construction Phase

Machinery	Capacity	Description	QTY
Tower Crane	1000 - 1500 ton	Equipment Erec.	1
Crawler	600 - 800 ton	Equipment Erec.	1
Crawler	300 - 400 ton	Equipment Erec.	2
Crawler	160 - 250 ton	Equipment Erec.	2
Mobile Telescopic	150 - 200 ton	Pipe Fab. & Erection	5
Mobile Telescopic	60 - 100 ton	Pipe Fab. & Erection	12
Mobile Telescopic	25 - 50 ton	Pipe Fab. & Erection	10
Tower Crane	10 ton	Furnaces& Boiler	4
Trailer	10 - 60 ton	Transport	15
Boom Truck	10 ton	Transport	8
Forklift	5 ton	Pipe prafab.Civil & Steel Str.	5
Manlift	40mt	Piping&steel str.	15

Total fuel consumption from machinery is 53.532.2 tonnes and 1.036.800 kW. Total emissions from construction phase are calculated as 81.200 TCO_2e (tonnes CO_2 equivalent).

Under the construction phase of the Project. Scope 3 emissions from category 3 (Fuel- and Energy-Related Activities. Not Included in Scope 1 or Scope 2) and category 7 (Employee Commuting) defined in EPA (2021) were calculated as 8.863 (tonnes) TCO_2e annually (GHG Protocol. 2021).

Total GHG emissions (Scope 1 and Scope 3) from the construction of Ceyhan PDH-PP Plant were calculated as 90.062 tCO_2e. In addition. as the construction phase activities will not be more than 38 months duration. and there will be limited emission sources. total emissions from the construction phase were calculated on a yearly basis for the 49-year operation period as 1.838 TCO_2e annually.

Operation Phase GHG Emissions

Scope 1 Direct GHG Emissions

Scope 1 emissions are direct greenhouse (GHG) emissions that occur from sources that are controlled or owned by an organization (e.g.. emissions associated with fuel combustion in boilers. furnaces. vehicles).

Within the scope of the project. there are two utility boilers. one 34 MW charge heater and three interheaters with a thermal power of 31. 28 and 28 MW. respectively. The utility boilers are in operation at 50% load each (34 MW). The PDH Off gas available is assumed to be used as fuel gas to both Heaters and Boilers. Since the combustion would be complete combustion. no CH4 are foreseen in the flue gas streams. The PDH might be responsible for a small share of NOx (Nitrous Oxide). that the Company can include in the future GHG assessment. To the purpose of GHG estimation. the NOx emissions are not estimated since they represent a very small share compared to the CO2 emissions.

In order to calculate GHG emissions. “2006 IPCC Guidelines for National Greenhouse Gas Inventories the Default Emission Factors for Stationary Combustion in The Energy Industries” document was used. The projects emission sources and their yearly emission were given in Table 9-30.

Table 9-30. Calculation of Boilers and Heaters GHG Emissions (Global warmings for – CO)

Service	Thermal Power (MW)	Pollutant	Pollutant Flowrate (kg/h)	Working Hour/day	Working Day/year	Total CO_2 (tonnes/year)
Charge Heater (01-H-101)	34	CO_2	4.177	24	333	33.382
No 1 Interheater	31	CO_2	3.807	24	333	30.427
No 2 Interheater	28	CO_2	3.435	24	333	27.453
No 3 Interheater	23	CO_2	2.819	24	333	22.526
NVIRO		CO_2	3308	24	333	26.437
Utility Boiler 1 (Assuming 34 MW Thermal Input)	34	CO_2	4.116	24	333	32.891
Utility Boiler 2 (Assuming 34 MW Thermal Input)	34	CO_2	4.116	24	333	32.891
					Total Emissions (tCO_2)	**206.013**

Moreover. the total Scope 1 emissions in the operation phase amount to 206.013 tCO2/year (for boilers and heaters).

Scope 2 Indirect GHG Emissions

Scope 2 emissions are indirect GHG emissions associated with the purchase of electricity. steam. heat. or cooling generated from a fossil fuel source. It is planned that net electricity consumption in the project will be 667 GWh yearly. However. since the Project company has planned to cover electricity needs with energy from renewable sources. it is considered that there will be no Scope 2 emissions.

Scope 3 Other Indirect GHG Emissions

Scope 3 emissions are the result of activities from assets not owned or controlled by the reporting organization. but that the organization indirectly impacts in its value chain. It has to be remarked that. the Scope 3 emissions estimation is not compulsory in the context of the CCRA. however the TCFD recommendations encourages the more virtuous companies to assess them appropriately.

The feedstock will be supplied by one of the project's partner. Sonatrach. and Propane (556.000 tonnes/year) will be transported from Algeria twice a month by sea tankers. The distance from Algeria to the project location is about 3.400 km per transfer. It is projected that transfer will be bimonthly. and emissions calculated for one way. Annual GHG emissions were given in Table 9-31.

Table 9-31. Calculation of Transportation GHG Emissions

Feedstock	Product (tonnes/year)	Number of shipments from Algeria per year	Distance One Way (km)	Emission Factor (kg CO2e/km)	CO_2e (t/year)
Propane	556.000	24	81.600	0.00943	770
				tCO_2e (tonnes/year)	**770**

UK Government GHG Conversion Factors for Company Reporting 2020 Version 1.0 (BEIS. 2020)

While calculating Scope 3 emissions (see. Table 9-32). The Scope 3 Evaluator Tool are used (GHG Protocol. 2021). Emissions from Category 3 and Category 7 defined in EPA (2021) calculated as 673 tCO2e (tonnes/year).

Table 9-32. Scope 3 GHG emissions

Scope 3 Categories	CO2e (kg/year)	CO2e (tonnes/year)
Category 3 Fuel- and Energy-Related Activities. Not Included in Scope 1 or Scope 2	460.517	460
Category 7 Employee commuting	212.500	213
TCO_2e (tonnes/year)		**673**

Under the operation phase of the project. total Scope 3 emissions (energy use) are calculated as 1.443 TCO_2e (tonnes/year).

Total GHG emissions (Scope 1. Scope 2. and Scope 3) from the operation of the Ceyhan Polypropylene Production Plant are calculated as 207.456TCO_2e (tonnes/year).

Annual Total Emissions (Construction and Operation)

The total GHG emissions from the construction phase of the Project are calculated as 90.063 tCO_2e. However. as the construction phase activities will last more than 38 months. and there will be limited emission sources. total emissions from the construction phase were calculated on yearly basis for the 49-year operation as 1.838 tCO2e (tonnes/year). With emissions from Scope 1. 2. and 3. the total GHG emissions from the operational phase of the Project are. therefore. calculated as 207.456 tCO2e/y (see. Table 9-33).

Table 9-33. Major annual GHG emissions

Emissions		Activity	CO_2e
Construction Phase	Scope 1	Construction activities (trucks. forklifts. tower cranes. etc.)	81.200
	Scope 3	Category 3 - Fuel- and Energy-Related Activities. Not Included in Scope 1 or Scope 2 Category 7 – Employee commuting	8.863
		Construction TCO_2e	**90.063**
Operation Phase	Scope 1	Operational process (Boilers. Heaters. Flue Gas. and Vent Gas Treating System)	206.013
			-
	Scope 3	Transportation and Distribution Category 3 - Fuel- and Energy-Related Activities. Not Included in Scope 1 or Scope 2 Category 7 – Employee commuting	1.443
		Operation TCO_2e	**207.456**

GHGs emissions from the Project were calculated under Scope 1. and 3 for both construction and operation phases. GHG emissions during the operation phase were quantified as 207.456 tCO2e/y. which is higher than the threshold of and 100.000 tCO2e/y specified in the Equator Principles IV (July 2020). The Equator Principles Financial Institutions requires the client to report publicly on an annual basis on GHG emission levels (combined Scope 1 and Scope 2 Emissions) and GHG efficiency ratio. as appropriate. The Project Company therefore will report GHGs emissions annually.

The Project is classified as Category B[6] under the Communiqué on Monitoring and Reporting of Greenhouse Gas Emissions and The Facility is required to submit an improvement report containing the information within the scope of the second or third paragraphs of the Communiqué to the Ministry every two years on 30 June.

9.6 Impacts on Air Quality

9.6.1 Impacts during Construction

During the construction of the Project. dust emissions will arise from blasting activities. earth movements. loading. unloading and transport of excavation materials both inside and outside the Project site. Air dispersion modelling study was undertaken for PM_{10} dispersion to estimate the air quality impacts associated with the construction activities. Within the scope of the modelling study. excavation activities were considered to be completed in 8 months as part of the total construction phase and it is assumed that the activities will last for 25 days a month for 24 hours a day.

According to the results of the modelling studies. daily and yearly APCVs of PM_{10} to be originated from construction activities in controlled working conditions are 6.466 µg/m^3 and

[6] "Category B: Plants with an annual emission of more than 50,000 tons of CO_2 (eq) and equal or less than 500,000 tons of CO2 (eq), calculated according to their installed capacity, including transferred CO_2, excluding CO_2 from biomass"

2.717.99 µg/m^3. respectively. IAPCR and EU criteria specify the allowed yearly maximum number of exceedances of daily PM_{10} limit values as 35 times. However. modelling results indicate that maximum daily APCVs for PM_{10} will likely exceed the limit values 365 times in a year. Additionally. yearly PM_{10} maximum APCVs are above the national. EU and IFC limit values for the construction phase. Therefore. it is important to take necessary mitigation measures as explained in Section 9.7 and stay in close connection with affected stakeholders in the vicinity (e.g.. Incirli residents. personnel of the surrounding facilities etc.) in order to effectively respond to their potential grievances.

Additionally. evaluation of the estimated change in baseline ambient air quality at the baseline measurement locations indicates the following results:

For PM_{10} baseline monitoring stations (Monitoring Station 1 is located to the southwestern boundary of the Project site near Incirli village and Monitoring Staiton 2 is located to the northern boundary of the Project site near the motorway)

- Daily TPV value of PM_{10} is increased by more than 70% creating a very high impact intensity at both measurement locations. The sensitivity of the immediate surrounding is considered to be high (i.e.. presence of residential area) at *Monitoring Station* 1 and low (i.e.. presence of forest areas) at *Monitoring Station* 2;
- Yearly TPV value of PM_{10} is increased by more than 70% resulting in a very high impact instensity at *Monitoring Station* 1 with high sensitivity and increased approximately by 23% creating a medium impact intensity at *Monitoring Station* 2 with low sensitivity.

Table 9-34 shows the summary of the conclusions mentioned above and the impact significances for the monitoring points. Impact significances are determined based on the methodology given in Chapter 4 and in sub-section 9.4.1 of this ESIA Report.

Table 9-34. Summary of Impact Significances of the Receptors during the Construction Phase

Potential Impact	Impact Type		Nature of Impacts (Magnitude designations)							Receptor Sensitivity	Impact Significance (Magnitude x Significance)
				Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)		
PM_{10} (µg/m³) at PM10-1	Negative Direct	Daily	Score	Local	Medium (16 months for earthworks)	Very High	-	Probable	Short-term after the cessation of the emission source.	PM10-1 High	**Medium**
			Value	2	3	5	-	5	1		**75**
		Yearly	Score	Local	Medium	Very High	-	Probable	Short-term		Medium
			Value	2	3	5	-	5	1		**75**
	Impact Magnitude (G+D+I+F (or L)) x R			**Daily: 15 Yearly: 15**						5	**Medium**
PM_{10} (µg/m³) at PM10-2	Negative Direct	Daily	Score	Local	Medium	Very High	-	Probable	Short-term	PM10-2 Low	Negligible
			Value	2	3	5	-	5	1		**15**
		Yearly	Score	Local	Medium	Medium	-	Probable	Short-term		Negligible
			Value	2	3	3	-	5	1		**13**
	Impact Magnitude (G+D+I+F (or L)) x R			**Daily: 15 Yearly: 13**						**1**	**Negligible**

It should be noted that the significances of impacts described above are for the baseline monitoring points that are mostly located at the boundaries of the Project site. The emissions are expected to decrease with increased distance from the emission source and receptors that are away from the source of emissions have the potential to experience impacts less than described above and impact significance is expected not to be as significant considering annual TPV values and to vary between minor to moderate at worst considering daily TPV values.

Transport of construction materials will also cause emissions related to construction traffic which may potentially impact the ambient air quality. This type of transportation will be temporary. and the significance of impacts might range from minor to major. depending on the amount of transportation and the location of receptors. It is expected that these impacts will be reduced to impacts of less significance with the implementation of measures mentioned in Section 9.7 below.

9.6.2 Impacts during Operation

There will be impacts on the air quality from the Project activities during the operational phase which will be mainly related to air emissions from the production. and storage of products and chemicals as well as emissions from increased road traffic. It is expected that necessary exhaust/treatment systems will be included in the design of the Project facilities to eliminate emissions and prevent significant impacts.

An air dispersion modelling study was undertaken for the NO_2. PM_{10}. SO_2. CO. and VOC parameters which are considered significant regarding air quality impacts of the Project operation. Accordingly:

- Daily and yearly APCVs of PM_{10} due to operational activities in controlled working conditions are 11.61 μg/m^3 and 1.23 μg/m^3. respectively. Hence. modelled concentrations are below the national and international limit values;
- Operation phase NO_2 emissions comply with emission standards;
- Operation phase SO_2 maximum APCV exceeds hourly emission limits 1 time in a year. which is within the acceptable maximum exceedance frequency defined by the standards (i.e.. max 24 times yearly). Hourly. daily and yearly emissions comply with emission standards;
- Both CO and VOC emission values are in compliance with national and international emission standards.

Upon evaluating the impact on baseline air quality conditions at the baseline monitoring locations. the following interpretations can be made for the operation phase of the Project:

- Change in daily PM_{10} is negligible (i.e.. <1%) at both measurement locations. Similarly. the change in yearly PM_{10} is negligible (i.e.. <1%) at both monitoring locations. However. the final TPV is above the IFC limit values due to high baseline concentrations. The intensity of the impact is determined as low accordingly. The receptor sensitivity of the Monitoring Station 1 is high and the sensitivity of the Monitoring Station 2 is low.

- The hourly and yearly TPVs for NO_2 are below the national and international limit values. On the other hand. when the increase in NO_2 concentrations relative to the baseline conditions is considered. it is seen that the increase in hourly concentrations is greater than 70% at monitoring stations P-3. 4. 5. 6. 7. 9 and 10 resulting in very high impact intensity. At monitoring stations P-1. 2 and 8. the increase in hourly concentrations is above 40% which results in high impact intensity. Nevertheless. the increase in yearly concentration is below 70% at measurement points 3. 7. 10 where the receptor sensitivities vary low to high. which results in high impact intensity. For the monitoring stations P-1 and 11. since the increase in the concentration is below 20%. the impact intensity is classified as low. For monitoring stations P-2 and 8. since the increase in the concentration is below 40% where the receptors' sensitivity is classified as high. the impact intensity is classified as medium. For monitoring stations P-4. 5. 6. and 9 where the receptor sensitivity is low. the yearly increase is above 70% which results in very high impact intensity.
- The hourly and yearly TPV values for SO_2 are below the national and international limit values. When the increase in SO_2 concentrations is considered as compared to the baseline conditions. it is seen that the increase in hourly concentrations is greater than 70% at all locations. resulting in high impact intensity. The increase in yearly concentrations is above 40% at the monitoring stations P-3 and 9 where the receptor sensitivity varies between low and high. The impact intensity for those points is classified as high. For the monitoring station P-4. where the receptor sensitivity is low. the yearly increase is above 70% which results in very high impact intensity. For monitoring stations P-1. 2. 7. 8. 10. and 11. the increase in concentrations is below 20%. Thus. the impact intensity is classified as low for these points. Lastly. for the monitoring stations P-5 and 6 with low sensitivity. the increase in concentrations is below 40% resulting in medium impact intensity.
- The hourly and short-term TPV values for VOC are below the national and international limit values. Baseline VOC could only be detected at five of the monitoring stations (P-1. 4. 6. 10 and 11). For the monitoring stations where VOC is detected during baseline monitoring. based on TPVs the increase in VOC concentration is estimated above 70% at three points (P-1. 6. and 11) regarding the hourly concentrations. The magnitude of the impacts is therefore classified as very high. For other monitoring stations (4 and 10) the impact magnitude is low. Lastly. for the short-term (STV) TPVs. the increase in VOC concentrations at two monitoring stations (4 and 10) are below 3% creating negligible impact intensity. For monitoring stations P-1 and 11. the increase in VOC concentrations (6-7%) is low creating low

impact intensity. For Monitoring Station P-6. the increase in VOC concentrations is estimated above 20%. creating medium impact intensity.

Table 9-35 shows the summary of the conclusions mentioned above and the impact significances for the measurement points. Impact significances are determined based on the methodology given in Chapter 4 and in sub-section 9.4.1 of this Chapter.

Table 9-35. Summary of Impact Significances of the Receptors during the Operation Phase

Parameter	Measurement Point	Period	Nature of Impact					Impact Magnitude	Receptor Sensitivity	Impact Significance
			Geographical Extent(G)	Duration (D)	Intensity (I)	Likelihood (L)	Reversibility (R)			
PM_{10} (µg/m³)	PM10-1	Daily	Local	Long	Low	Probable	Short-term	13	High	Low
			2	4	2	5	1			65
		Yearly	Local	Long	Low	Probable	Short-term	13		Low
			2	4	2	5	1		5	65
	PM10-2	Daily	Local	Long	Low	Probable	Short-term	13	Low	Negligible
			2	4	2	5	1			13
		Yearly	Local	Long	Low	Probable	Short-term	13		Negligible
			2	4	2	5	1		1	13
NO_2 (µg/m³)	P-1	Hourly	Local	Long	High	Probable	Short-term (detention time is less than a week in the atmosphere)	15	High	Medium
			2	4	4	5	1			75
		Yearly	Local	Long	Low	Probable	Short-term	13		Low
			2	4	2	5	1		5	65
	P-2	Hourly	Local	Long	High	Probable	Short-term	15	High	Medium
			2	4	4	5	1			75
		Yearly	Local	Long	Medium	Probable	Short-term	14		Low
			2	4	3	5	1		5	70
	P-3	Hourly	Local	Long	Very High	Probable	Short-term	16	High	Medium
			2	4	5	5	1			80
		Yearly	Local	Long	High	Probable	Short-term	15		Medium
			2	4	4	5	1		5	75
	P-4	Hourly	Local	Long	Very High	Probable	Short-term	16	Low	Negligible
			2	4	5	5	1			16
		Yearly	Local	Long	Very High	Probable	Short-term	16		Negligible

Parameter	Measurement Point	Period	Nature of Impact					Impact Magnitude	Receptor Sensitivity	Impact Significance
			Geographical Extent(G)	Duration (D)	Intensity (I)	Likelihood (L)	Reversibility (R)			
			2	4	5	5	1		1	16
	P-5	Hourly	Local	Long	Very High	Probable	Short-term	16	Low	Negligible
			2	4	5	5	1			16
		Yearly	Local	Long	Very High	Probable	Short-term	16		Negligible
			2	4	5	5	1		1	16
	P-6	Hourly	Local	Long	Very High	Probable	Short-term	16	Low	Negligible
			2	4	5	5	1			16
		Yearly	Local	Long	Very High	Probable	Short-term	17		Negligible
			2	4	6	5	1		1	17
	P-7	Hourly	Local	Long	Very High	Probable	Short-term	16	High	Medium
			2	4	5	5	1			80
		Yearly	Local	Long	High	Probable	Short-term	15		Medium
			2	4	4	5	1		5	75
	P-8	Hourly	Local	Long	High	Probable	Short-term	15	High	Medium
			2	4	4	5	1			75
		Yearly	Local	Long	Medium	Probable	Short-term	14		Low
			2	4	3	5	1		5	70
	P-9	Hourly	Local	Long	Very High	Probable	Short-term	16	Low	Negligible
			2	4	5	5	1			16
		Yearly	Local	Long	Very High	Probable	Short-term	16		Negligible
			2	4	5	5	1		1	16
	P-10	Hourly	Local	Long	Very High	Probable	Short-term	16	Low	Negligible
			2	4	5	5	1			16
		Yearly	Local	Long	High	Probable	Short-term	15		Negligible
			2	4	4	5	1		1	16
	P-11	Hourly	Local	Long	Medium	Probable	Short-term	14	High	Low
			2	4	3	5	1			70

<table>
<tr><th rowspan="2">Parameter</th><th rowspan="2">Measurement Point</th><th rowspan="2">Period</th><th colspan="5">Nature of Impact</th><th rowspan="2">Impact Magnitude</th><th rowspan="2">Receptor Sensitivity</th><th rowspan="2">Impact Significance</th></tr>
<tr><th>Geographical Extent(G)</th><th>Duration (D)</th><th>Intensity (I)</th><th>Likelihood (L)</th><th>Reversibility (R)</th></tr>
<tr><td rowspan="2"></td><td rowspan="2"></td><td>Yearly</td><td>Local</td><td>Long</td><td>Low</td><td>Probable</td><td>Short-term</td><td rowspan="2">13</td><td></td><td>Low</td></tr>
<tr><td></td><td>2</td><td>4</td><td>2</td><td>5</td><td>1</td><td>5</td><td>65</td></tr>
<tr><td rowspan="25">SO_2 ($\mu g/m^3$)</td><td rowspan="4">P-1</td><td>Hourly</td><td>Local</td><td>Long</td><td>Very High</td><td>Probable</td><td>Short-term</td><td rowspan="2">16</td><td rowspan="3">High</td><td>Medium</td></tr>
<tr><td></td><td>2</td><td>4</td><td>5</td><td>5</td><td>1</td><td>80</td></tr>
<tr><td>Yearly</td><td>Local</td><td>Long</td><td>Low</td><td>Probable</td><td>Short-term</td><td rowspan="2">13</td><td>Low</td></tr>
<tr><td></td><td>2</td><td>4</td><td>2</td><td>5</td><td>1</td><td>5</td><td>65</td></tr>
<tr><td rowspan="3">P-2</td><td>Hourly</td><td>Local</td><td>Long</td><td>Very High</td><td>Probable</td><td>Short-term</td><td rowspan="2">16</td><td rowspan="3">High</td><td>Medium</td></tr>
<tr><td></td><td>2</td><td>4</td><td>5</td><td>5</td><td>1</td><td>80</td></tr>
<tr><td>Yearly</td><td>Local</td><td>Long</td><td>Low</td><td>Probable</td><td>Short-term</td><td rowspan="2">13</td><td>Low</td></tr>
<tr><td></td><td></td><td>2</td><td>4</td><td>2</td><td>5</td><td>1</td><td>5</td><td>65</td></tr>
<tr><td rowspan="4">P-3</td><td>Hourly</td><td>Local</td><td>Long</td><td>Very High</td><td>Probable</td><td>Short-term</td><td rowspan="2">16</td><td rowspan="3">High</td><td>Medium</td></tr>
<tr><td></td><td>2</td><td>4</td><td>5</td><td>5</td><td>1</td><td>80</td></tr>
<tr><td>Yearly</td><td>Local</td><td>Long</td><td>High</td><td>Probable</td><td>Short-term</td><td rowspan="2">15</td><td>Medium</td></tr>
<tr><td></td><td>2</td><td>4</td><td>4</td><td>5</td><td>1</td><td>5</td><td>75</td></tr>
<tr><td rowspan="4">P-4</td><td>Hourly</td><td>Local</td><td>Long</td><td>Very High</td><td>Probable</td><td>Short-term</td><td rowspan="2">16</td><td rowspan="3">Low</td><td>Negligible</td></tr>
<tr><td></td><td>2</td><td>4</td><td>5</td><td>5</td><td>1</td><td>16</td></tr>
<tr><td>Yearly</td><td>Local</td><td>Long</td><td>Very High</td><td>Probable</td><td>Short-term</td><td rowspan="2">16</td><td>Negligible</td></tr>
<tr><td></td><td>2</td><td>4</td><td>5</td><td>5</td><td>1</td><td>1</td><td>16</td></tr>
<tr><td rowspan="4">P-5</td><td>Hourly</td><td>Local</td><td>Long</td><td>Very High</td><td>Probable</td><td>Short-term</td><td rowspan="2">16</td><td rowspan="3">Low</td><td>Negligible</td></tr>
<tr><td></td><td>2</td><td>4</td><td>5</td><td>5</td><td>1</td><td>16</td></tr>
<tr><td>Yearly</td><td>Local</td><td>Long</td><td>Medium</td><td>Probable</td><td>Short-term</td><td rowspan="2">14</td><td>Negligible</td></tr>
<tr><td></td><td>2</td><td>4</td><td>3</td><td>5</td><td>1</td><td>1</td><td>14</td></tr>
<tr><td rowspan="4">P-6</td><td>Hourly</td><td>Local</td><td>Long</td><td>Very High</td><td>Probable</td><td>Short-term</td><td rowspan="2">16</td><td rowspan="3">Low</td><td>Negligible</td></tr>
<tr><td></td><td>2</td><td>4</td><td>5</td><td>5</td><td>1</td><td>16</td></tr>
<tr><td>Yearly</td><td>Local</td><td>Long</td><td>Medium</td><td>Probable</td><td>Short-term</td><td rowspan="2">14</td><td>Negligible</td></tr>
<tr><td></td><td>2</td><td>4</td><td>3</td><td>5</td><td>1</td><td>1</td><td>14</td></tr>
<tr><td>P-7</td><td>Hourly</td><td>Local</td><td>Long</td><td>Very High</td><td>Probable</td><td>Short-term</td><td>16</td><td>High</td><td>Medium</td></tr>
</table>

Parameter	Measurement Point	Period	Nature of Impact					Impact Magnitude	Receptor Sensitivity	Impact Significance
			Geographical Extent(G)	Duration (D)	Intensity (I)	Likelihood (L)	Reversibility (R)			
			2	4	5	5	1			80
		Yearly	Local	Long	Low	Probable	Short-term	13		Low
			2	4	2	5	1		5	65
	P-8	Hourly	Local	Long	Very High	Probable	Short-term	16	High	Medium
			2	4	5	5	1			80
		Yearly	Local	Long	Low	Probable	Short-term	13		Low
			2	4	2	5	1		5	65
	P-9	Hourly	Local	Long	Very High	Probable	Short-term	16	Low	Negligible
			2	4	5	5	1			16
		Yearly	Local	Long	High	Probable	Short-term	15		Negligible
			2	4	4	5	1		1	15
	P-10	Hourly	Local	Long	Very High	Probable	Short-term	16	Low	Negligible
			2	4	5	5	1			16
		Yearly	Local	Long	Low	Probable	Short-term	13		Negligible
			2	4	2	5	1		1	13
	P-11	Hourly	Local	Long	Very High	Probable	Short-term	16	High	Medium
			2	4	5	5	1			80
		Yearly	Local	Long	Low	Probable	Short-term	13		Low
			2	4	2	5	1		5	65
VOC (µg/m³)	P-1	Hourly	Local	Long	Very High	Probable	Short-term	16	High	Medium
			2	4	5	5	1			80
		STV	Local	Long	Low	Probable	Short-term	13		Low
			2	4	2	5	1		65	65
	P-4	Hourly	Local	Long	Negligible	Probable	Short-term	12	Low	Negligible
			2	4	1	5	1			12
		STV	Local	Long	Low	Probable	Short-term	13		Negligible
			2	4	2	5	1		1	13

Parameter	Measurement Point	Period	Nature of Impact					Impact Magnitude	Receptor Sensitivity	Impact Significance
			Geographical Extent(G)	Duration (D)	Intensity (I)	Likelihood (L)	Reversibility (R)			
	P-6	Hourly	Local	Long	Very High	Probable	Short-term	16	Low	Negligible
			2	4	5	5	1			16
		STV	Local	Long	Medium	Probable	Short-term	14		Negligible
			2	4	3	5	1		1	14
	P-10	Hourly	Local	Long	Low	Probable	Short-term	13	Low	Negligible
			2	4	2	5	1			13
		STV	Local	Long	Negligible	Probable	Short-term	12		Negligible
			2	4	1	5	1		1	12
	P-11	Hourly	Local	Long	Very High	Probable	Short-term	16	High	Medium
			2	4	5	5	1			80
		STV	Local	Long	Low	Probable	Short-term	13		Medium
			2	4	2	5	1		5	75

As in the construction phase. impact of the emissions are expected to decrease with increased distance from the source of emissions. Therefore. receptors that are futher from the source of emissions are likely to to experience impacts less than described above.

9.7 Mitigation Measures

9.7.1 Mitigation of Air Quality Impacts during Construction

An Air Quality Control and Monitoring Plan will be prepared. which will include mitigation measures that will be implemented to reduce dust emissions. Additionally. air pollutants will be monitored at nearby sensitive locations to ensure minimal impacts in accordance with the Air Quality Control and Monitoring Plan. During the first three months of the construction during earthworks. monthly PM_{10} measurements shall be done. If the monitoring results are observed to be below limit values. measurements will continue to be conducted quarterly. if limit values are exceeded. the measurements will continue to be conducted monthly.

The following mitigation measures will be implemented to address dust emissions during construction:

- Good management and housekeeping practices and dust suppression methods will be applied. Water spraying will be performed at dust generating areas inside the Project site. especially during dry weather conditions;
- Turkish Regulation on the Control of Excavated Soils. Construction and Demolition Wastes (Official Gazette Date/No: 18.03.2004/25406) will be followed which requires taking necessary measures to minimize dust emissions during excavation;
- Excavated soils will be stockpiled (as necessary) at designated areas and will be placed as far as possible from the settlements to the west. Dusty and loose materials will be properly covered. and top layers will be kept moist;
- Where high dust emission can not be prevented particularly due to wind effect and at locations close to the residential areas in addition to the water spreying polymer emulsions (approved chemical dust suppressants) will be used for dust suppression. particularly at the temporary Excavated Material Storage Areas. on stockpiles. slopes. on the temporary unpaved. or earth roads within the Project site;
- Where necessary in order to minimise the fugitive dust transport to the residential areas wind breaks or barriers will be installed around the storage piles. particularly in the temporary Excavated Material Storage Areas;
- Screens will be placed as necessary at the construction site to reduce dust emissions.

The following mitigation measures will be implemented to minimize dust emissions related to the transport of materials during construction:

- Vehicle speed limits will be applied inside and outside the Project site for paved and unpaved roads (e.g.. unpaved orads around 10km/h. paved roads around 20 km/h within the site). Truck operators will be trained to comply with speed limits and good construction site practices;
- Necessary applications will be made to the relevant authority to upgrade the offsite road conditions. On-site roads will be well-maintained against dust emissions;
- Transfer roads will be sprayed with water as necessary (for example using mobile watering bowsers) to prevent significant dust emissions. especially in dry weather conditions;
- Trucks carrying excavated soils will be covered before leaving the construction area;
- The material drop distance will be limited between the offloading point and stockpile to no more than 1 m and the flow of material will be restricted using dead boxes. socks. drop down spouts/sleeves;
- Frequently used and long-term haulage roads will be paved (e.g.. asphalt. concrete. etc.);
- Daily visual inspections will be done at the stockpiles. haulage roads and during the heavy vehicle movements in order to detect dust emission sources.

Exhaust Emissions

- Construction equipment and trucks will be maintained regularly to keep them in good working condition to minimize exhaust emissions caused by poor performance;
- Low sulphur contained fuel will be used;
- Engines of the equipment/trucks will be prevented from idling;
- Unnecessary Project traffic will be avoided inside and outside of the Project side by adequate planning of material transport;
- A Construction Traffic Management Plan will be prepared and implemented which will decrease the impacts of traffic resulting from the construction activities.

9.7.2 Mitigation of Air Quality Impacts during Operation

The Air Quality Control and Monitoring Plan to be developed will include mitigation measures that will be implemented to minimise emissions during operation. In addition. the Air Quality Control and Monitoring Plan will specify measurements of air pollutants at nearby sensitive locations as necessary. The Air Quality Control and Monitoring Plan will include details of sampling locations. monitoring frequency. methods of sampling for each parameter. applicable regulatory limits and will require analysis of samples by accredited laboratories. The Air Quality Monitoring Plan (AQMP) will set forth the details of the monitoring regarding the potential emission sources on site and potential receptors off-site. separately. The monitoring will include weekly inspection of the potential sources (connection equipment such as valves. pumps. connectors. etc.. and storage tanks) of leaks and emissions of VOC by the use of portable monitoring devices and periodic monitoring of stack emissions for NO2 during operation. The AQMP will also identify the relevant responsibilities within the scope of the inspection. monitoring. record keeping and reporting procedures as well as the details of record keeping and reporting for the monitoring results and exceptional and accidental releases. Hence. continuous record keeping and periodic evaluation of the monitoring results will ensure the detection of any changes in emissions or ambient air quality values that may be affected by the Project operation or by cumulative impacts from outside sources and enables preemptive measures to be taken preventing any potential impacts.

In addition. direct and indirect greenhouse gas emissions will be quantified annually during operation.

A Traffic Management Plan will be prepared and implemented which will decrease the impacts of traffic resulting from the operation activities.

The emission factors provided by the Project Company for the operational phase have taken into account certain control measures for the reduction of air emissions below a certain limit. In that respect. the Project Company will ensure selection of adequate emission reduction technologies during the design phase of the Project.

Mitigation measures given below are applied to all types of polymer production as a Good International Industry Practise[*]. In this respect. Project Company will evaluate these measures during detailed design and implement them based on technical and economic feasibility. After the completion of the detailed design. a report will be submitted to the lender before the start of the construction on how and in which parts the measures mentioned below are applied.

- Advanced equipment design to reduce fugitive emissions:
    - use of valves with bellow or double packing seals;
    - magnetically driven or canned pumps. or pumps with double seals and a liquid barrier;
    - magnetically driven or canned compressors. or compressors using double seals and a liquid barrier;
    - magnetically driven or canned agitators. or agitators with double seals and a liquid barrier;

[*] European Commission Reference Document on Best Available Techniques in the Production of Polymers (August 2007)

  - minimisation of the number of flanges (connectors);
  - effective gaskets;
  - closed sampling systems;
  - drainage of contaminated effluents in closed systems;
  - collection of vents.

- Fugitive loss assessment and measurement study to identify process elements with the highest potential for fugitive loss;

- Equipment monitoring and maintenance (M&M) and leak detection and repair (LDAR) (e.g.. a portable monitoring device) programme will be applied based on a component and service database in combination with the fugitive loss assessment and measurement;

- Dust emission reduction techniques:
  - dense phase conveying is more efficient to prevent dust emissions than dilute phase conveying;
  - reduction of velocities in dilute phase conveying systems to values as low as possible;
  - reduction of dust generation in conveying lines through surface treatment and proper alignment of pipes;
  - use of cyclones and/or filters in the air exhausts of dedusting units. The use of fabric filter systems is more effective. especially for fine dust;
  - use of wet scrubbers.

- Minimization of plant start-ups and stops to avoid peak emissions and reduce overall consumption (e.g.. energy. monomers per tonne of product);

- Securing the reactor contents in case of emergency stops (e.g.. by using containment systems) and recycling the contained material or to use it as fuel;

- to treat the air purge flows coming from degassing silos and reactor vents with one or more of the following techniques:
  - recycling;
  - thermal oxidation;
  - catalytic oxidation;
  - adsorption;
  - flaring (Flaring systems are to treat discontinuous emissions from the reactor system. Flaring of discontinuous emissions from reactors is only BAT if these emissions cannot be recycled back into the process or used as fuel.).

9.8 Residual Impacts

For the construction phase. impacts from air emissions can be effectively mitigated through good management practices and the implementation of mitigation measures such as dust suppression. mentioned above. Hence. mitigation measures are expected to minimise such impacts to short and intermittent events that will be reversible in a short-term by the effect of the natural processes. The Residual Impact Significances for the construction phase are given in Table 9-36.

For the operation phase. based on the results of the dispersion modelling studies. the residual impacts from emissions generated by the operation of the proposed Project are predicted to vary between negligible to low (excluding VOCs) provided that necessary mitigation measures (i.e.. the establishment of emission reduction system with the minimum required efficiency) are undertaken and periodic inspections and monitoring are performed to prevent any continuos releases or emissions of the air pollutants.

Regarding the VOCs. due to potential long-residence times of certain VOC types. the residual impacts are still evaluated to be medium to low for the sensitive receptors. However. the selection of the advanced equipment design to reduce fugitive emissions. continuous inspection and monitoring at the potential sources of emissions and at the sensitive receptor points will ensure such impacts are prevented. The Residual Impact Significances for the operation phase are given in Table 9-37.

Table 9-36. Construction Phase Residual Impact Significances

Potential Impact	Impact Type		Nature of Impacts (Magnitude designations)								
				Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)	Receptor Sensitivity	Impact Significance (Magnitude x Significance)
PM_{10} (μg/m^3) at PM10-1	Negative Direct	Daily	Score	Local	Short (short-term intermittent impacts)	Very High	-	Unlikely	Short-term after the cessation of the emission source.	PM10-1 High	**Low**
			Value	2	1	5	-	1	1		**45**
		Yearly	Score	Local	Short	Very High	-	Unlikely	Short-term		Low
			Value	2	1	5	-	1	1		**45**
	Impact Magnitude (G+D+I+F (or L)) x R			**Daily: 15 Yearly: 15**						**5**	**Low**
PM_{10} (μg/m^3) at PM10-2	Negative Direct	Daily	Score	Local	Short	Very High	-	Unlikely	Short-term	PM10-2 Low	Negligible
			Value	2	1	5	-	1	1		**9**
		Yearly	Score	Local	Short	Medium	-	Unlikely	Short-term		Negligible
			Value	2	1	3	-	1	1		**9**
	Impact Magnitude (G+D+I+F (or L)) x R			**Daily: 15 Yearly: 13**						**1**	**Negligible**

Table 9-37. Operation Phase Residual Impact Significances

Parameter	Measurement Point	Period	Nature of Impact					Impact Magnitude	Receptor Sensitivity	Impact Significance
			Geographical Extent(G)	Duration (D)	Intensity (I)	Likelihood (L)	Reversibility (R)			
PM_{10} (µg/m³)	PM10-1	Daily	Local	Very short	Low	Unlikely	Short-term	6	High	Low
			2	1	2	1	1			30
		Yearly	Local	Very short	Low	Unlikely	Short-term	6		Low
			2	1	2	1	1		5	30
	PM10-2	Daily	Local	Very short	Low	Unlikely	Short-term	6	Low	Negligible
			2	1	2	1	1			6
		Yearly	Local	Very short	Low	Unlikely	Short-term	6		Negligible
			2	1	2	1	1		1	6
NO_2 (µg/m³)	P-1	Hourly	Local	Very short	High	Unlikely	Short-term	8	High	Low
			2	1	4	1	1			40
		Yearly	Local	Very short	Low	Unlikely	Short-term	6		Low
			2	1	2	1	1		5	30
	P-2	Hourly	Local	Very short	High	Unlikely	Short-term	8	High	Low
			2	1	4	1	1			40
		Yearly	Local	Very short	Medium	Unlikely	Short-term	7		Low
			2	1	3	1	1		5	35
	P-3	Hourly	Local	Very short	Very High	Unlikely	Short-term	9	High	Low
			2	1	5	1	1			45
		Yearly	Local	Very short	High	Unlikely	Short-term	8		Low
			2	1	4	1	1		5	40
	P-4	Hourly	Local	Very short	Very High	Unlikely	Short-term	9	Low	Negligible
			2	1	5	1	1			9
		Yearly	Local	Very short	Very High	Unlikely	Short-term	9		Negligible
			2	1	5	1	1		1	9
	P-5	Hourly	Local	Very short	Very High	Unlikely	Short-term	9	Low	Negligible
			2	1	5	1	1			9

Parameter	Measurement Point	Period	Nature of Impact					Impact Magnitude	Receptor Sensitivity	Impact Significance
			Geographical Extent(G)	Duration (D)	Intensity (I)	Likelihood (L)	Reversibility (R)			
		Yearly	Local	Very short	Very High	Unlikely	Short-term	9		Negligible
			2	1	5	1	1		1	9
	P-6	Hourly	Local	Very short	Very High	Unlikely	Short-term	9	Low	Negligible
			2	1	5	1	1			9
		Yearly	Local	Very short	Very High	Unlikely	Short-term	9		Negligible
			2	1	5	1	1		1	9
	P-7	Hourly	Local	Very short	Very High	Unlikely	Short-term	9	High	Low
			2	1	5	1	1			45
		Yearly	Local	Very short	High	Unlikely	Short-term	8		Low
			2	1	4	1	1		5	40
	P-8	Hourly	Local	Very short	High	Unlikely	Short-term	8	High	Low
			2	1	4	1	1			40
		Yearly	Local	Very short	Medium	Unlikely	Short-term	7		Low
			2	1	3	1	1		5	35
	P-9	Hourly	Local	Very short	Very High	Unlikely	Short-term	9	Low	Negligible
			2	1	5	1	1			9
		Yearly	Local	Very short	Very High	Unlikely	Short-term	9		Negligible
			2	1	5	1	1		1	9
	P-10	Hourly	Local	Very short	Very High	Unlikely	Short-term	9	Low	Negligible
			2	1	5	1	1			9
		Yearly	Local	Very short	High	Unlikely	Short-term	8		Negligible
			2	1	4	1	1		1	8
	P-11	Hourly	Local	Very short	Medium	Unlikely	Short-term	7	High	Low
			2	1	3	1	1			35
		Yearly	Local	Very short	Low	Unlikely	Short-term	6		Low
			2	1	2	1	1		5	30
SO_2	P-1	Hourly	Local	Very short	Very High	Unlikely	Short-term	9	High	Low

Parameter	Measurement Point	Period	Nature of Impact					Impact Magnitude	Receptor Sensitivity	Impact Significance
			Geographical Extent(G)	Duration (D)	Intensity (I)	Likelihood (L)	Reversibility (R)			
($\mu g/m^3$)			2	1	5	1	1			45
		Yearly	Local	Very short	Low	Unlikely	Short-term	6		Low
			2	1	2	1	1		5	30
	P-2	Hourly	Local	Very short	Very High	Unlikely	Short-term	9	High	Low
			2	1	5	1	1			45
		Yearly	Local	Very short	Low	Unlikely	Short-term	6		Low
			2	1	2	1	1		5	30
	P-3	Hourly	Local	Very short	Very High	Unlikely	Short-term	9	High	Low
			2	1	5	1	1			45
		Yearly	Local	Very short	High	Unlikely	Short-term	8		Low
			2	1	4	1	1		5	40
	P-4	Hourly	Local	Very short	Very High	Unlikely	Short-term	9	Low	Negligible
			2	1	5	1	1			9
		Yearly	Local	Very short	Very High	Unlikely	Short-term	9		Negligible
			2	1	5	1	1		1	9
	P-5	Hourly	Local	Very short	Very High	Unlikely	Short-term	9	Low	Negligible
			2	1	5	1	1			9
		Yearly	Local	Very short	Medium	Unlikely	Short-term	7		Negligible
			2	1	3	1	1		1	7
	P-6	Hourly	Local	Very short	Very High	Unlikely	Short-term	9	Low	Negligible
			2	1	5	1	1			9
		Yearly	Local	Very short	Medium	Unlikely	Short-term	7		Negligible
			2	1	3	1	1		1	7
	P-7	Hourly	Local	Very short	Very High	Unlikely	Short-term	9	High	Low
			2	1	5	1	1			45
		Yearly	Local	Very short	Low	Unlikely	Short-term	6		Low
			2	1	2	1	1		5	30

Parameter	Measurement Point	Period	Nature of Impact					Impact Magnitude	Receptor Sensitivity	Impact Significance
			Geographical Extent(G)	Duration (D)	Intensity (I)	Likelihood (L)	Reversibility (R)			
	P-8	Hourly	Local	Very short	Very High	Unlikely	Short-term	9	High	Low
			2	1	5	1	1			45
		Yearly	Local	Very short	Low	Unlikely	Short-term	6		Low
			2	1	2	1	1		5	30
	P-9	Hourly	Local	Very short	Very High	Unlikely	Short-term	9	Low	Negligible
			2	1	5	1	1			9
		Yearly	Local	Very short	High	Unlikely	Short-term	8		Negligible
			2	1	4	1	1		1	8
	P-10	Hourly	Local	Very short	Very High	Unlikely	Short-term	9	Low	Negligible
			2	1	5	1	1			9
		Yearly	Local	Very short	Low	Unlikely	Short-term	6		Negligible
			2	1	2	1	1		1	6
	P-11	Hourly	Local	Very short	Very High	Unlikely	Short-term	9	High	Low
			2	1	5	1	1			45
		Yearly	Local	Very short	Low	Unlikely	Short-term	6		Low
			2	1	2	1	1		5	30
VOC (μg/m^3)	P-1	Hourly	Local	Very short	Very High	Unlikely	Short-term	9	High	Low
			2	1	5	1	1			45
		STV	Local	Very short	Low	Unlikely	Short -term	6		Low
			2	1	2	1	1		5	30
	P-4	Hourly	Local	Very short	Negligible	Unlikely	Short -term	5	Low	Negligible
			2	1	1	1	1			5
		STV	Local	Very short	Low	Unlikely	Short -term	6		Negligible
			2	1	2	1	1		1	6
	P-6	Hourly	Local	Very short	Very High	Unlikely	Short -term	9	Low	Negligible
			2	1	5	1	1			9
		STV	Local	Very short	Medium	Unlikely	Short -term	7		Negligible

Parameter	Measurement Point	Period	Nature of Impact					Impact Magnitude	Receptor Sensitivity	Impact Significance
			Geographical Extent(G)	Duration (D)	Intensity (I)	Likelihood (L)	Reversibility (R)			
			2	1	3	1	1		1	7
	P-10	Hourly	Local	Very short	Low	Unlikely	Short -term	6	Low	Negligible
			2	1	2	1	1			6
		STV	Local	Very short	Negligible	Unlikely	Short -term	5		Negligible
			2	1	1	1	1		1	5
	P-11	Hourly	Local	Very short	Very High	Unlikely	Short -term	9	High	Low
			2	1	5	1	1			45
		STV	Local	Very short	Low	Unlikely	Short -term	6		Low
			2	1	2	1	1		5	30

CEYHAN PROPANE DEHYDROGENATION - POLYPROPYLENE PRODUCTION PROJECT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT

(CHAPTER-10)

FEBRUARY 2023

ANKARA

CEYHAN PROPANE DEHYDROGENATION - POLYPROPYLENE PRODUCTION PROJECT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT

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10.1 Introduction

This chapter presents the assessment of the noise and vibration impacts that will be generated during the construction and operation phases of the Ceyhan Propane Dehydrogenation - Polypropylene Production Facility (Ceyhan PDH-PP Project or Project) and associated Terminal Facilites. In order to evaluate the impact of noise and vibration due to the Project activities, a noise modeling study and vibration calculations were undertaken covering the Project site and its surroundings, for earthworks, structural works and operation phase.

The first baseline insitu noise monitoring was carried out at the nearest receptors by ARTEK Environmental Laboratory, Adana Branch in order to determine background noise levels before the start of the construction phase of the Project in 2020. The updated baseline noise monitoring was carried out on March 11, 2021 by Frekans within the scope of the new modelling study. For the assessment of the cumulative noise level which is the sum of modeled noise level and background noise level the modeling results are compared with the Turkish and International Finance Corporation (IFC) standards. The noise modelling study report is presented in Annex-G.

10.2 Definitions and Methodology

10.2.1 Definitions

Definitions of basic acoustical terms and concepts related to the study are given below.

Sound: Sound is a vibrational disturbance, stimulating human aural sensory response, transmitted in a predictable manner determined by the medium through which it propagates. To be audible, the disturbance must fall within the frequency range 20 Hz to 20,000 Hz. Sound levels are expressed in decibels (dB) on a logarithmic scale, where 0 dB is nominally the "threshold of hearing" and 120 dB is nominally the "threshold of pain".

Noise: Noise is typically defined as "unwanted sound.

Background (Baseline) noise: Prevailing noise in a specified environment measured in the absence of the noise being studied.

Decibels (dB): It is the unit describing the amplitude of the sound. The human hear responds to sound logarithmically. The bel is the logarithm of the ratio of the two powers and decibel is 1/10 bel.

Frequency: The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or Hz.

Sound pressure level (L_p): It is a logarithmic measure of the effective sound pressure of a sound relative to a reference value. It is measured in decibels (dB) above a standard reference level. The commonly used "zero" reference sound pressure in air is 20 µPa RMS (root mean square), which is usually considered the threshold of human hearing (at 1 kHz).

Sound power level (L_w): Ten times the logarithm of the ratio of the sound power under consideration of the standard reference power of 1 pW (10^{-6} W). The quantity obtained is expressed in decibels.

Equivalent Sound Level (Leq): Quantifies the noise environment as a single value of sound level for any desired duration. Leq correlates well with the effects of noise on people. Leq is also sometimes known as Average Sound Level.

L10: Sound pressure level that is exceeded 10% of the time of measurement.

L90: Sound pressure level that is exceeded 90% of the time of measurement.

A-Weighting: A-weighting is the most commonly used method of characterizing sound as it is experienced through human hearing. It provides a measure of sound pressure level designed to reflect the response of the human ear, which does not respond equally to all frequencies, by giving greater weight to the frequencies of sound to which the human ear is most sensitive. The resultant sound level is said to be A-weighted, and the units are in decibels (dBA).

C-Weighting: A measure of sound pressure level designed to reflect the response of the human ear, for higher levels above 100 dB when the human ear's response is flatter.

LAeq: A-weighted equivalent sound pressure level.

LAmax: The maximum A weighted sound pressure level detected in the measurement time domain.

LCeq: C weighted equivalent sound pressure level.

Point Source: A source of sound which is concentrated to a point.

Area Source: A source of sound which is distributed over an area.

Line Source: A source of sound emanating from a linear geometry.

Noise Barrier: A physical obstruction that is constructed between the highway noise source and the noise sensitive receptor(s) that lowers the noise level, including standalone noise walls, noise berms (earth or other material), and combination berm/wall systems.

Noise Berms: Noise barriers constructed from natural earthen materials such as soil, stone, rock, rubble, etc. in a natural, unsupported condition are termed, noise berms.

Noise Walls: Noise barrier systems that are manufactured according to a technical design and assembled on-site to obstruct the noise propagating from the noise source to receptors.

The threshold of perception of the human ear is approximately 3 dB and a 5 dB change is considered to be clearly noticeable to the ear. This is primarily due to the logarithmic measuring metric typically associated with decibels. The perceived change with regard to decibel levels is shown below:

Table 10-1. The perceived change with regard to decibel levels

Change in sound level	Perceived Change to the Human Ear
± 1 dB	Not perceptible
± 3 dB	Threshold of perception
± 5 dB	Clearly noticeable
± 10 dB	Twice as loud
± 20 dB	Four-fold change

10.2.2 Methodology

The noise model was developed using the CadnaA acoustical software. The important parameters for the modeling and the methods used are described below.

The information on ground topography and buildings is included in the noise model as sound propagation is strongly affected by terrain elevation and by buildings between sources and receivers. To develop the noise model of the Project, the surface topography data was obtained from the Digital Elevation Model (DEM) Dataset from NASA, Reverb Earth Science Discovery tool as shown in Figure 10-1. Meteorological data (average relative humidity, average temperature, wind frequencies and directions as obtained from the General Directorate of Meteorology) was also input to noise mapping software.

The calculations were carried out in line with ISO 9613-2 which is recommended by the Turkish Regulation on the Assessment and Management of Environmental Noise (Official Gazette Date and Number: 04.06.2010/27601) and the European Union (EU) Noise Directive. The ISO 9613-2:1996 standard was used for calculating noise from construction vehicles, machinery and other equipment. The Lw of each source, denoting the the loudness of the equipment, was entered into the noise model. There are three different approaches for determining Lw as described below:

- Calculation of L_w from L_p measurements (Sound power levels of equipment which will be used in the construction and operation phases of the Project were calculated from measurements performed in the Project as detailed in relevant sections).
- Use of reference values. In order to determine the L_w of construction machinery and equipment, the Roadway Construction Noise Model User's Guide (RCM) of the U.S. Federal Highway Administration was used. This guide includes sound pressure levels

of various construction equipment. L_w was calculated based on the information given in this guide.

- Combinations of the options above are used to determine the L_w values of machinery and equipment. Machinery with similar power and capacity has similar acoustic properties regardless of their use. Measurements conducted and documented throughout time are used for the calculations of L_w values of several types of equipment.

In addition to L_w, the type of noise source is an important parameter for noise modelling. Different types of noise sources can be used in the model including point, line and area sources. Because of the mobility and dynamic behaviour of construction equipment, it was modeled as an area source. The calculations related to traffic noise, caused by construction trucks and equipment, were carried out with XPS31-133 French Standard which is recommended by the Turkish Noise Regulations and European Commission for the assessment of environmental noise caused by sources such as highways, bridges, and tunnels by using the emission values mentioned in the “Guide du bruit des transports terrestres, fasciculeprevision des niveaux sonores CETUR 1980” document.

Another important parameter for noise modelling is ground absorption (G). Ground absorption varies between 0 to 1 for hard-reflective surfaces and soft-absorptive surfaces, respectively. When calculating noise propagation, G for undeveloped land of greenfield character was assumed to be 0.9.

The noise prediction model used in this study is limited to the defined noise sources as described in the next sections of this chapter. There may be other noise sources that cannot be foreseen at this stage. Modelling results provide information on noise propagation based on the noise sources considered.

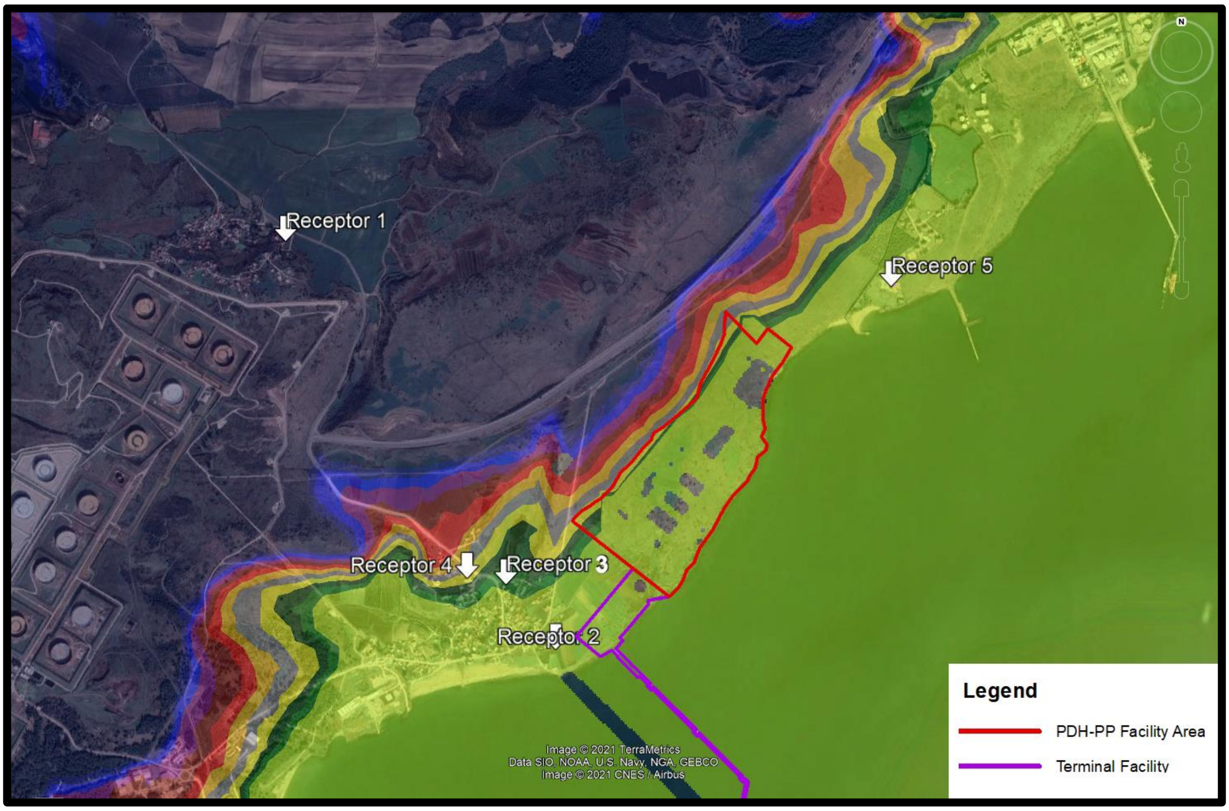

Figure 10-1. Project site DEM, NASA's USGS dataset

Project Phasing and Noise Modeling Conditions

Within the scope of the Project, noise modelling was undertaken considering two phases, construction (38 months including site preparation and main construction activities) and operation. Construction phase noise has been modelled by taking into consideration three different scenarios; namely (i) construction activities without piling; (ii) construction with piling at the closest location to the residential areas; and (iii) construction with piling near the middle section of the Associated Facility (Terminal Facility). Operational noise impact of the project has been evaluated with all machinery and equipment working at full power at the same time. Other relevant assumptions made during the noise modelling study are given in the related sections of this Chapter.

10.3 Environmental Noise Standards and Guidelines

10.3.1 Turkish Regulations

Noise

Environmental noise is regulated by the Turkish Regulation on the Assessment and Management of Environmental Noise - RAMEN (Official Gazette Date and Number: 04.06.2010/27601). The noise indicators for overall annoyance defined by RAMEN are L_{day}, $L_{evening}$ and L_{night}. The indicators are for A-weighted long-term average sound level determined over all the day periods of a year. The indicators are intented for certain periods of a day. L_{day} day-noise indicator is for between 19:00- 07:00 hrs, $L_{evening}$ evening-noise indicator is for between 19:00 – 23:00 hrs, and L_{night} night-time noise indicator is for between 23:00 – 07:00 hrs. The regulation sets noise limits for these indicators applicable to various areas (e.g. industrial areas, residential areas or combination of both). Noise limits for construction sites are given in Table 10-2.

Table 10-2. Environmental noise limits for construction sites

Type of activity (construction, demolition and renovation)	Leq-daytime (dBA) (07:00 - 19:00)
Building	70
Road	75
Other sources	70

In accordance with the regulation, construction activities in or close to residential areas are not permitted during evening (between 19:00 – 23:00 hrs) and night-time (between 23:00 – 07:00 hrs) periods unless a permit is obtained from the relevant authorities. Furthermore, the limits given in Table 10-2 will be decreased 5 dBA for evening time period and 10 dBA for night-time period for construction works. Construction working hours for the Project is considered to be 24 hours a day as worst case scenario. A night time work permit should therefore be obtained from Adana Provincial Directorate of Environment, Urbanization and Climate Change (PDoEUCC).

For the operational phase of the Project, limit values for noise emission sources of industrial facilities in the Turkish Regulation on the Assessment and Management of Environmental Noise are presented in Table 10-3 which gives maximum allowable environmental noise levels that shall be met at the nearest off-site receptor.

Table 10-3. Environmental noise limits for industrial facilities (Leq-dBA)

Areas	L_{day} (dBA) (07:00 - 19:00)	L_{eve} (dBA) (19:00 - 23:00)	L_{night} (dBA) (23:00 - 07:00)
Areas where sensitive receptors are located including education, culture, health, summer houses and camping areas	60	55	50
Commercial and residential areas where residential buildings dominate	65	60	55
Commercial and residential areas where workplaces dominate	68	63	58
Industrial areas	70	65	60

The Project site falls within the category of "Commercial and residential areas where residential buildings dominate" and the associated noise limits shown in Table 10-5 are applicable during the operation phase of the Project. In addition, the aforementioned regulation requires that the noise level at the nearest sensitive area (e.g. residential building) shall not exceed the baseline noise levels by more than 5 dBA.

Vibration

The Turkish Regulation on the Assessment and Management of Environmental Noise (Annex VII) also sets limits for ground vibrations to be perceived at very sensitive and sensitive receptors. The relevant limits for the Project are those limits that are set for piling activities during construction and construction machinery as given in Table 10-4. Additionally, maximum allowable ground vibration limits considering nearest sensitive and very sensitive receptors defined for blasting activities are given in Table 10-5.

Table 10-4. Maximum allowable ground vibration limits for pile driving and construction machinery

Area	Maximum Allowable Vibration Velocity (peak value in mm/s) (Frequency band between 1 Hz to 80 Hz)	
	Continuous vibration	Intermittent Vibration
Residential areas	5	10
Industrial and commercial areas	15	30

Table 10-5. Maximum allowable ground vibration limits from blasting (for nearest sensitive receptors)

Vibration Frequency (Hz)	Maximum Allowable Vibration Velocity (peak value in mm/s)
1	5
4-10	19
30-100	50

10.3.2 International Standards

Noise

IFC General Environmental, Health and Safety (EHS) Guidelines and World Health Organization (WHO) Noise Guidelines set limits for noise for two types of receptors and two time periods, as shown in Table 10-6.

Table 10-6. IFC and WHO noise level guidelines (one hour Leq-dBA)

Receptor	Daytime (07:00 - 22:00)	Nighttime 22:00 - 07:00
Residential areas	55	45
Commercial/industrial areas	70	70

WHO and IFC standards state that cumulative noise level limits depend on the background noise levels. As such, in determination of the limits, background noise levels are taken into consideration. In order to evaluate cumulative noise levels, energetic summation of background noise and project noise exposure are assessed. When the cumulative noise levels are less than the limit values of Lday = 55 dBA and Lnight = 45 dBA, the limits are set to these values. If the cumulative noise values are higher than these limit values, the cumulative noise levels should not exceed background noise by more than 3 dBA.

Vibration

The following international standards for vibration impacts were used in this assessment:

- Guidance on effects of vibration levels on humans provided by BS 5228-2:2009 (see. Table 10-7);
- Transient vibration guide values for cosmetic damage of buildings provided in BS 7385-2:1993 (see. Table 10-8).

Table 10-7. Guidance on Effects of Vibration Levels on Humans

Vibration level, mm/s	Effect
0.14	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3	Vibration might be just perceptible in residential environments.
1.0	It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents.
10	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

Source: BS 5228-2:2009. Code of practice for noise and vibration control on construction and open sites.

Table 10-8. Transient Vibration Guide Values for Cosmetic Damage of Buildings

Type of building	Peak component particle velocity (vibration) in frequency range of predominant pulse, mm/s	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures Industrial and heavy commercial buildings	50	50
Unreinforced or light framed structures Residential or light commercial buildings	15-20	20-50
Note: Values referred to are at the base of the building		

Source: BS 7385-2:1993. Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration

According to BS 7385-2:1993, minor damage to buildings is possible at vibration levels greater than twice those given in Table 10-8, and major damage to a building structure can occur at values greater than four times the tabulated values.

In addition, the values in Table 10-8 are related predominantly to transient vibration that does not generate resonant responses in structures and to low-rise buildings. Where the dynamic loading is caused by continuous vibration such as generate resonance, then the guide values in Table 10-8 might need to be reduced by up to 50%. Therefore, the lower limit for vibration level that may cause cosmetic damage to residential buildings is 5 mm/s, while the limit of human perception is much lower, comprising 0.14 to 0.30 mm/s.

10.4 Insitu Baseline Monitoring

The first insitu environmental noise monitoring were conducted between 21 August – 23 August 2020 at Monitoring Point 1, 15 August – 17 August 2020 at Monitoring Point 2 and 5, 27 July – 29 July 2020 at Monitoring Point 3 and 25 July – 27 July 2020 at Monitoring Point 4 by ARTEK Environmental Laboratory, Adana Branch.

The locations of receptors identified as the representative monitoring points were selected depending on the likelihood of noise impact from the facility. For the purpose of noise impact assessment (both for construction and operation phases of the Project) five locations were identified to represent the potential receptors in the Project impact area. The identified receptor points represent a cluster of receptors which have the same or similar background characteristics in terms of environmental noise levels. Moreover, receptors to be evaluated can be defined as representative points which have the highest possibility to be exposed to noise due to complex operations. Baseline noise measurements at each point were conducted for 48 hours. The monitoring points are shown in Figure 10-2.

The measurement locations in the study are described below:

- Monitoring Point 1 (LT1): at the vicinity of one of the nearest residential area (i.e. Toros Tarım housing facility) to the northeast of the Project site;
- Monitoring Point 2 (LT2): at Karatepe locality to the north of the Project site;
- Monitoring Point 3 (LT3): within the nearest residential area (i.e., Incirli locality) to the southwest of the Project site;
- Monitoring Point 4 (LT4): within the nearest residential area (i.e., Incirli locality) to the southwest of the Project site;
- Monitoring Point 5 (LT5): within the nearest residential area (i.e., Incirli locality) to the southwest of the Project site.

The distances of the monitoring points to the Project site boundary are presented in Table 10-9. The results of the first baseline noise monitoring are provided in Table 10-10. Noise level measurement at the monitoring points were conducted in line with the measurement duration required by the Turkish Regulation on the Assessment and Management of Environmental Noise (RAMEN) and by the IFC / WHO guidelines, separately. The results for both measurements are presented in Table 10-10 along with a comparison with the maximum acceptable limit values defined by the relevant legislation and guidelines.

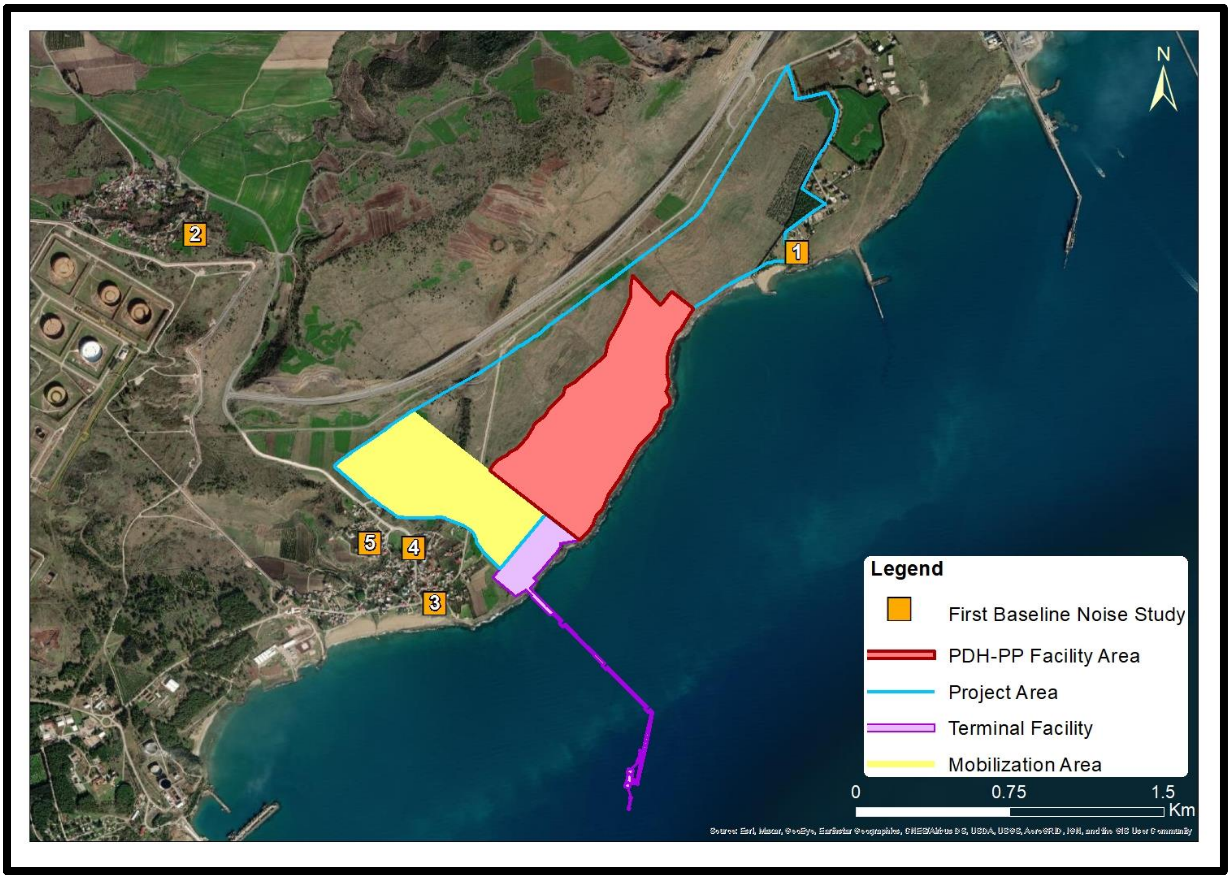

Figure 10-2. Monitoring Points for the First Baseline Noise Study (Reference EIA Report)

Table 10-9. Distance of measurement locations to the boundary of the Project Site

Monitoring Point	Distance to Project site boundary (m)
LT1	575
LT2	1800
LT3	680
LT4	530
LT5	700

Table 10-10. Results of baseline noise measurements

Monitoring Point	Noise – A weighted									
	Baseline Leq (dBA)			National Limit Values (RAMEN)			Baseline Leq (dBA)		International Limit Values (IFC / WHO) (dBA)	
	L_{day}	L_{eve}	L_{night}	L_{day}	L_{eve}	L_{night}	L_{day}	L_{night}	L_{day}	L_{night}
LT1	40.7	37.2	36.5	70.0	65.0	60.0	40.0	36.7	55.0	45.0
LT2	36.9	35.1	35.0	70.0	65.0	60.0	36.4	35.0	55.0	45.0
LT3	51.8	57.0	37.6	70.0	65.0	60.0	52.9	37.6	55.0	45.0
LT4	48.7	53.8	37.1	70.0	65.0	60.0	50.8	38.1	55.0	45.0
LT5	40.5	40.6	41.0	70.0	65.0	60.0	40.5	40.9	55.0	45.0

The first baseline monitoring revealed the following:

- Day/evening/night-time noise levels at monitoring points LT3 and LT4 located in Incirli localityare relatively higher than the levels measured at other monitoring points. This difference is attributed mostly to the daily traffic noise in addition to daily activities of the local residents.
- Day/evening/night-time noise levels at other monitoring points (i.e. LT1, LT2 and LT5) are measured to be similar. The noise at these points are generated mostly by the daily activities of the local residents.
- Except for LT5, night-time noise levels at all monitoring points, are lower than daytime and evening noise levels as expected.

A second baseline noise level monitoring was conducted in 2021 to evaluate the background noise climate of the current conditions in the impact area. Similar to the first monitoring study, noise level measurements were carried out at the closest settlements. The receptor points were identified based on the likelihood of noise impact from the facility. Insitu noise monitoring and subsequent impact assessment was done for identified five receptor pointsthat is found to be representative for a cluster of receptors which have the same or similar background characteristics in terms of environmental noise levels. Moreover, the receptor points are also expected to have the highest possibility to be exposed to noise due to complex operations. The monitoring points are described below:

- Receptor Location 1 (R1): around one of the nearest residential area to the North-West of the Project site (Kurtpınar, Karatepe);
- Receptor Location 2 (R2): at the village to the South-West of the Project site (Kurtpınar, Esentepe);
- Receptor Location 3 (R3): at the village to the South-West of the Project site (Kurtpınar, Esentepe)
- Receptor Location 4 (R4): within the nearest residential area to the South-West of the Project site (Kurtpınar, Esentepe);
- Receptor Location 5 (R5): within the nearest residential area to the North-East of the Project site (Kurtpınar).

The distance of the monitoring points to the Project site boundary are presented in Table 10-11. The second insitu monitoring study included 2 day-long measurements at five monitoring points and measurement durations for each day were selected to comply with the durations required by the international guidelines (i.e, L_{day} for 07:00-22:00 hrs and L_{night} for 22:00-07:00 hrs).

The results of the baseline noise level measurements and comparison with national and international noise limits are provided in Table 10-12.

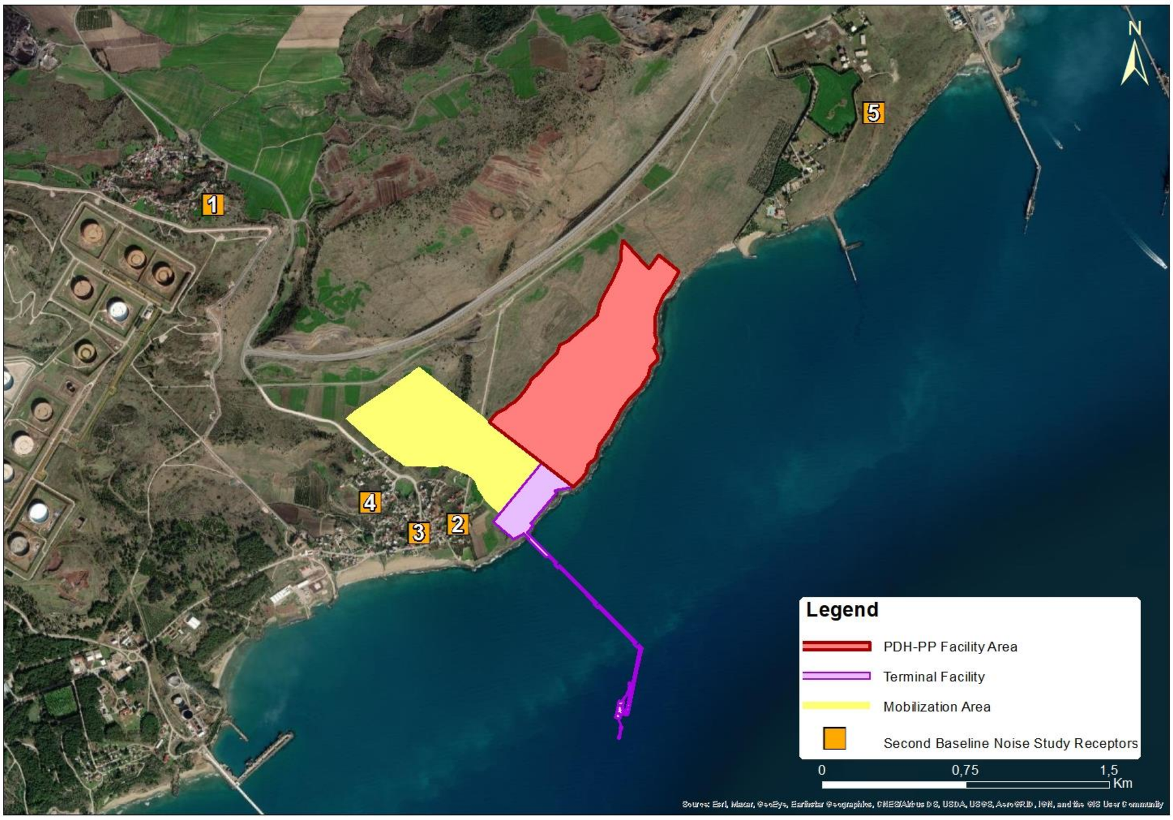

Figure 10-3. Representative receptor points within the Scope of Second Monitoring Study

Table 10-11. Distance of measurement locations to the boundary of the Project Site

Receptor (R) No	Distance to project border (m)	Coordinate, X (decimal degrees)	Coordinate, Y (decimal degrees)
R1	1435	36.907205	35.934833
R2	200	36.892394	35.949960
R3	360	36.892656	35.948108
R4	660	36.894238	35.944635
R5	1465	36.911943	35.975076

Table 10-12. Results of baseline noise measurements

Receptor No	Noise – A weighted								
	Baseline Leq (dBA)				National Limit Values (i.e., RAMEN) (dBA)			International Limit Values (i.e., IFC / WHO) (dBA)	
	L_{day} 07:00-22:00 (dBA)		L_{night} 22:00-07:00 (dBA)		L_{day}	L_{eve}	L_{night}	L_{day}	L_{night}
	First Day	Second Day	First Day	Second Day					
R1	54.9	53.2	46.6	45.7	70.0	65.0	60.0	55.0	45.0
R2	53.1	54.2	46.7	46.9	70.0	65.0	60.0	55.0	45.0
R3	53.3	53.6	47.7	46.7	70.0	65.0	60.0	55.0	45.0
R4	48.5	45.1	43.3	43.6	70.0	65.0	60.0	55.0	45.0
R5	46.3	49.3	44.7	45.8	70.0	65.0	60.0	55.0	45.0

The results of the second baseline noise level measurements revealed the following:

- Day -time noise levels at all measurement locations during the first and second day are below the national and international standards. Although baseline noise levels at monitoring points R1, R2 and R3 are only slightly lower than the international limit values.
- Night-time noise levels at all measurement locations during the first and second day are below the national standards. However, with respect to the international standards noise levels at all points except for R4 exceed the international limit values for measurements at both of the days. Day-time noise levels are relatively higher than night-time noise levels. This difference is attributed mostly to the daily traffic noise in addition to activities by local residents.

10.5 Noise and Vibration Sources

This section provides information on the noise sources during construction and operation phases of the Project.

10.5.1 Construction Noise

The numbers of machinery and equipment that will be required for construction activities are given in *Chapter 2: Project Description Including Alternatives*. According to the construction schedule provided by the Ceyhan Polipropilen Üretim A.Ş. (Ceyhan PP A.Ş. or Project Company) (as illustrated in *Chapter 2: Project Description Including Alternatives*), site preparation activities at the Project site (excavation, filling, disposal, construction of temporary facilities such as mobilization area, etc.) will continue for Phase-1 6 months and for Phase-2 10 months. Following that, construction works will be conducted including but not limited to civil works, structural works, building works, mechanical, electrical and instrumentation works. The construction will take place in Phase-2 of the project and it is expected to last for 38 months.

The objective of the noise modelling study is to define potential maximum noise levels that could occur at receptors during the construction period, enabling assessment of the worst-case scenario during each phase of construction.

Table 10-13 provides information on the acoustical traits and Table 10-14 shows calculated sound power levels of the machinery and equipment. Sound power level calculations were conducted based on the noise levels of each item of machinery/equipment, obtained from Roadway Construction Noise Model User's Guide (RCM) of the U.S. Federal Highway Administration. Machinery and equipment information is gathered from the design documentation provided by the Project Company. The Project Company currently plans to undertake pile driving activities during daytime. Therefore, construction noise modelling, was done with the assumption that pile driving activities will continue only during daytime. If these activities are conducted during night time, then necessary permit will be obtained from PDoEUCC and the nearby communities will be informed about the timing and duration of the works.

Table 10-13. Construction Machine and Equipment Reference Acoustical Traits

Sound Power Level for Each Machine/Equipment					
Machine/Equipment	Impact	LAmax	Reference Distance (m)	% Operation Time	Lw (dBA)
Tower Crane (1000-1500 ton)	No	85	15	16	100.6
Crawler (600-800 ton)	No	85	15	16	100.6
Crawler (300-400 ton)	No	85	15	16	100.6
Crawler (160-250 ton)	No	85	15	16	100.6
Mobile Telescopic (150-200 ton)	No	85	15	16	100.6
Mobile Telescopic (60-100 ton)	No	85	15	16	100.6
Mobile Telescopic (25-50 ton)	No	85	15	16	100.6
Tower Crane (10 ton)	No	85	15	16	100.6
Trailer (10-60 ton)	No	84	15	40	103.5
Boom Truck (10 ton)	No	84	15	40	103.5
Forklift (5 ton)	No	55	15	40	74.5
Manlift (40 meter)	No	85	15	20	101.5
Excavator	No	85	15	40	104.5
Truck	No	84	15	40	103.5
Dozer	No	85	15	40	104.5
Vacuum Street Sweeper	No	80	15	10	93.5
Mixer	No	80	15	50	100.5

Table 10-14. Construction Machine and Equipment Calculated Sound Power Levels

Sound Power Level for Equipment		
Machine / Equipment	Earthworks Phase (Lw dBA)	Main Construction Phase (Lw dBA)
Tower Crane (1000-1500 ton)	-	103.5
Crawler (600-800 ton)	-	104.5
Crawler (300-400 ton)	-	101.5
Crawler (160-250 ton)	-	93.5
Mobile Telescopic (150-200 ton)	-	100.6
Mobile Telescopic (60-100 ton)	-	102.5
Mobile Telescopic (25-50 ton)	-	92.5
Tower Crane (10 ton)	-	99.5
Trailer (10-60 ton)	-	104.5
Boom Truck (10 ton)	-	100.5
Forklift (5 ton)	-	100.5
Manlift (40 meter)	-	96.5
Excavator	116.3	-
Truck	115.3	-
Dozer	109.3	-

Sound Power Level for Equipment		
Machine / Equipment	**Earthworks Phase (Lw dBA)**	**Main Construction Phase (Lw dBA)**
Vacuum Street Sweeper	93.5	-
Mixer	107.5	-
Total Lw (dBA)	**119.3**	**121.3**

10.5.2 Construction Vibration

During the construction phase, considering the distances of the major construction activities to the receptors, the most significant vibration sources are expected to be blasting and pile driving activities. Therefore, in order to simulate maximum vibration that may be transmitted to the sensitive receptors, vibration impact of blasting and pile driving activities were taken into consideration for the calculation and assessment of environmental vibration. Experimental reference values were used from similar activities in order to calculate the vibration impact from these activities.

Vibration risk analysis report was prepared by Istanbul University for blasting activities. The reports provides calculation of the quantity of maximum explosive use specific to the blasting areas planned within the scope of Project construction in order to avoid any related adverse impacts.

10.5.3 Operation Noise

The site layout (as provided in *Chapter 2: Project Description Including Alternatives*) has been used to identify all noise sources associated with operational activities in the numerical noise model. The operational machinery and equipment list, as provided by the Project Company, is given in Table 10-15.

In order to avoid underestimation of potential noise generated from the operation the main assumption for the operational noise model is that all noise sources are operational at full performance at all times. Modelled worst-case scenario conditions does not include operation of emergency equipment or maintenance/substitute lines.

Table 10-15. Operation machine and equipment list and the types of the noise sources

Source	Source Type
PDH Plant	Area Source
PP Plant	Area Source
Fresh Solvent Tank	Area Source
BOG	Point Source
Truck	Road Noise Source
Heating and Cooling Systems	Area Source
Generator	Point Source
Flare	Point Source

Source	Source Type
PP Storage	Area Source
Oxygen Scavenger	Area/Point Source
Reactor Effluent Contact Cooler	Area Source
Reactor Effluent Interstage Contact Cooler	Area Source
Regenerant Gas Scrubber	Area/Point Source
De-ethanizer Stripper	Area/Point Source
De-ethanizer Rectifier	Area/Point Source
Regeneration Tower	Area/Point Source
Reactor Effluent Compressor Discharge Drum	Point Source
Chloride Treater	Area Source
Reactor Effluent Driers	Area Source
Reactor	Area/Point Source
Hydrogen Compressor First Stage Suction Drum	Point Source
Cooler	Area Source
Heater	Area Source
Vaporizer	Area Source
Cold Flare Superheater	Point Source
Steam Generator Blowdown Cooler	Area Source
Inter heater	Area/Point Source
Compressor	Point Source
Pumps	Point Source
Separation System	Area Source
Chlorination System	Area Source
Steam Jet Ejector	Point Source
Mixers	Area Source
Blowers	Point Source
Steamer Scrubber	Area/Point Source
Dryer Scrubber	Area/Point Source
Tanks	Area/Point Source
Separators	Area/Point Source
Collector	Area/Point Source
Grease Melter	Area/Point Source
Vaporizer	Area/Point Source

10.5.4 Operation Vibration

Operational vibration risks mostly occur due to operation of stationary machine and equipment. In ISO 10816-3 standard, vibration from machine and equipment is defined as shown in Figure 10-4.

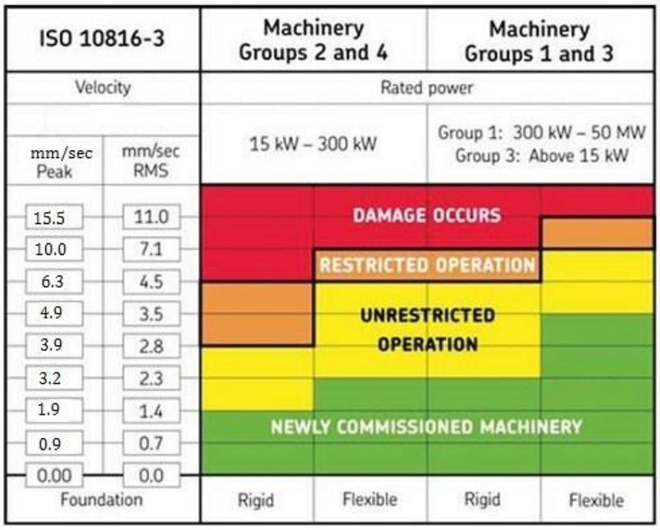

Figure 10-4. Machine equipment damage criteria

Accordingly, the maximum vibration level that a machine can produce before damaging itself is 15.5 mm/sec peak. While determining and evaluating operational vibration impacts it was assumed that the vibration producing machine is operating at the damage threshold.

10.6 Blasting Preliminary Models

10.6.1 Bench Blasting Preliminary Models

According to the risk analysis, three different preliminary blasting models were proposed to be applied considering the risk factors at the Project Site.the relevant details are shown in Table 10-16.

Table 10-16. Proposed Bench Blasting Preliminary Design Models for Project Site

	Design 1	Design 2	Design 3
Explosive Type	ANFO	ANFO	ANFO
Explosive Density (kg/dm^3)	900	900	900
Hole Slope (°)	85	85	85
Charge Concentration, Ib (kg/m)	5	5	5
Hole Diameter, (mm)	89	89	89
Bench Height, K (m)	5	5	10
Hole Base Allowance, U (m)	-	-	-
Hole Length, H (m)	5	5	10

	Design 1	Design 2	Design 3
Slice Thickness, B (m)	1.0	1.5	2.0
Distance Between Holes, S (m)	1.5	2.0	2.5
Tightening Length, h0 (m)	3.0	3.0	3.0
Intermediate Tightening Length (m)	1	-	-
1st Stage Baiting (kg)	0.5	0.5	0.5
2nd Stage Baiting (kg)	0.5	-	-
1st Stage Charge Length, h_2 (m)	0.5	2.0	7.0
2nd Stage Charge Length, (m)	0.5	-	-
Hole Charge Amount Q (kg)	6.6	11.8	39.9
Maximum Charge Amount Per Delay (kg)	3.3	11.8	39.9
Specific Charge (kg/m^3)	0.88	0.79	0.80
Specific Drilling	0.70	0.35	0.21
The Closest Distance to the Ancient Waterway (m)	30-56	56-100	100>

The plans for the proposed blasting design parameters for the Project site are given in Figure 10-5, Figure 10-6 and Figure 10-7 below. The plan map showing the blasting areas/zones for each blasting design is given in Figure 10-11.

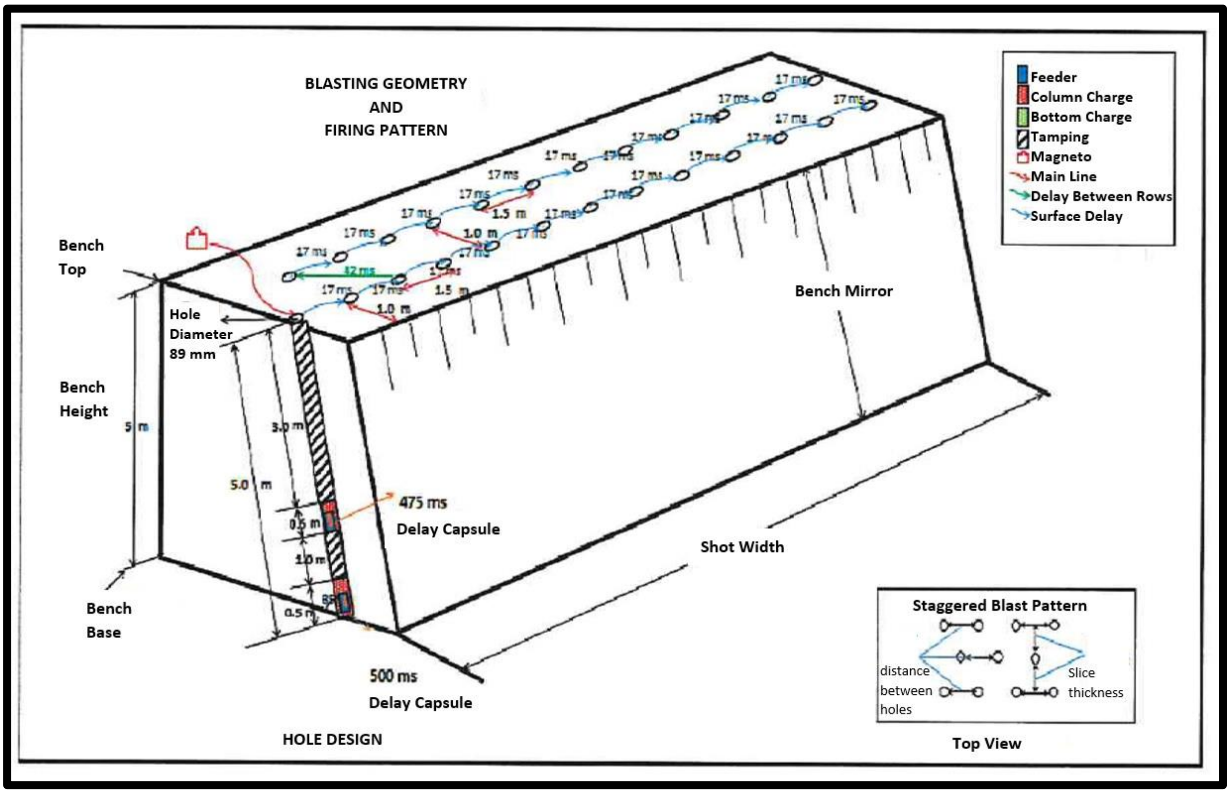

Figure 10-5. Proposed Bench Blasting Design-1

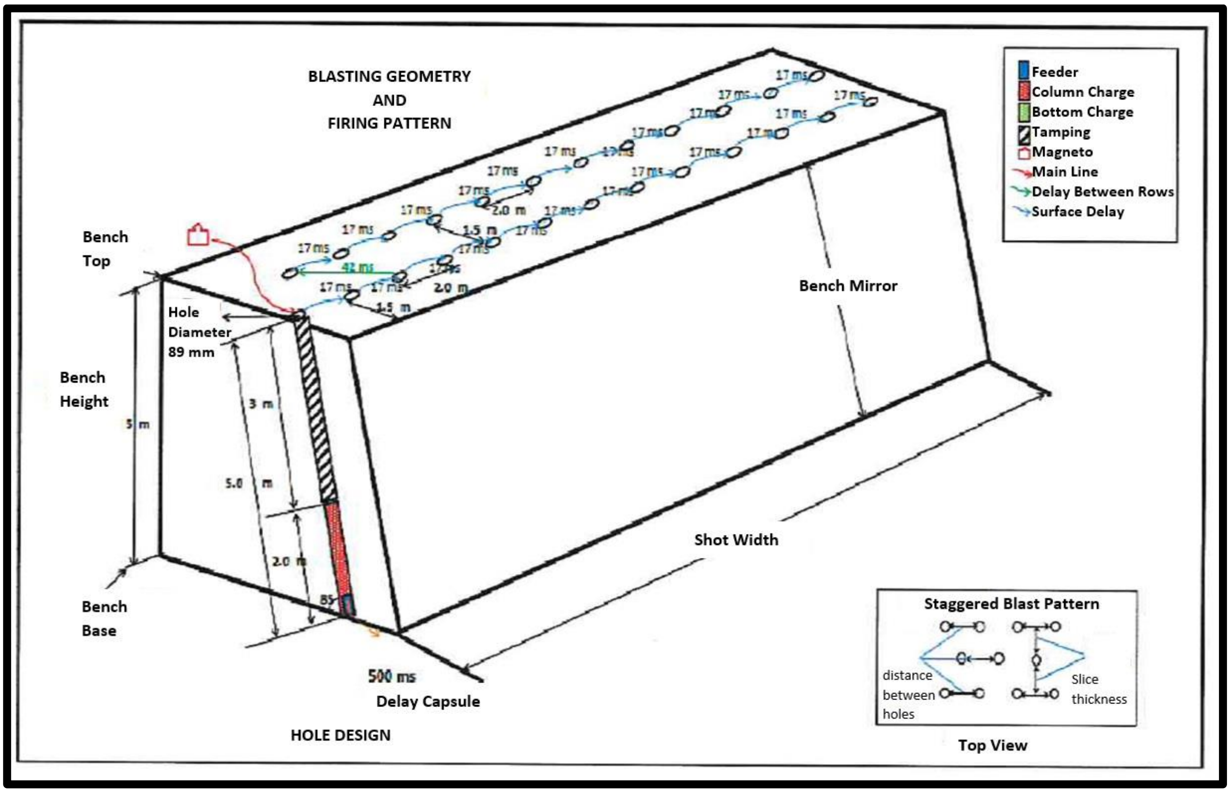

Figure 10-6. Proposed Bench Blasting Design-2

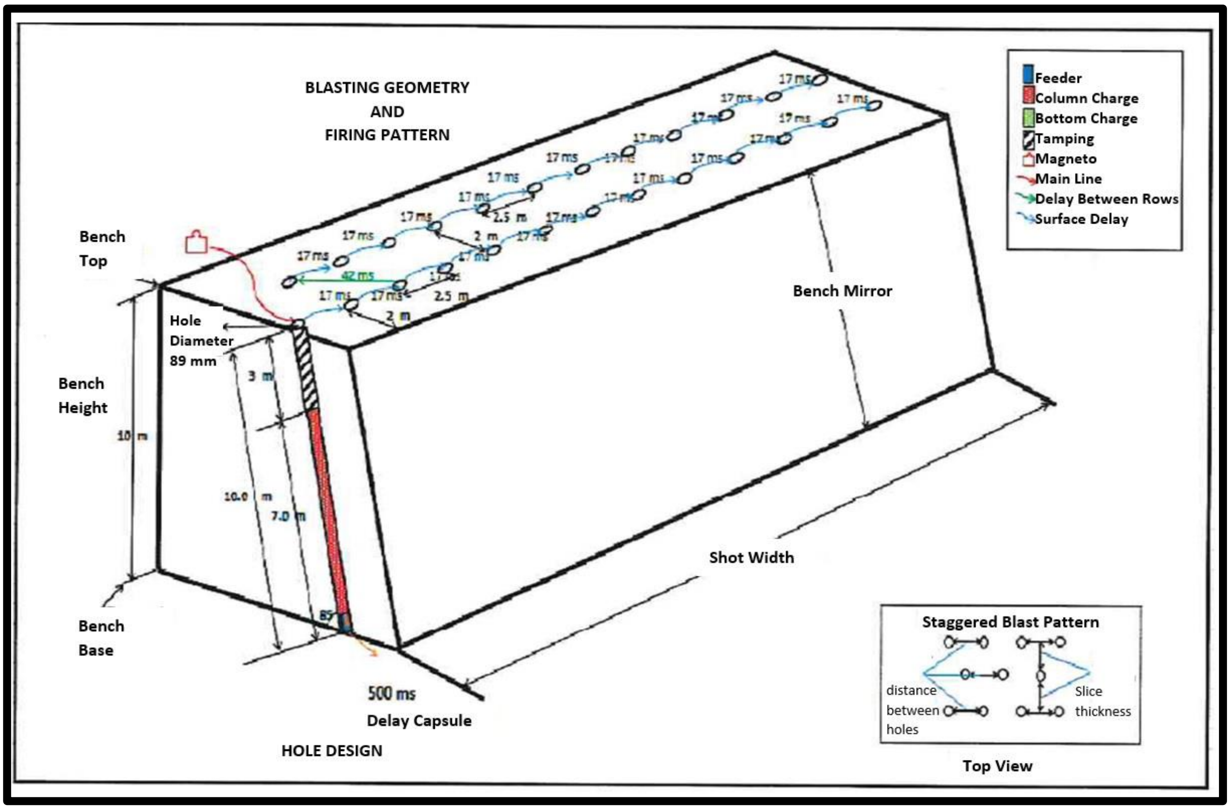

Figure 10-7. Proposed Bench Blasting Design-3

10.6.2 Pre-Split Blasting Preliminary Design

Pre-split blasting is planned to be used in order to produce a stable face that requires little or no maintenance during construction. Pre-splitting can be defined as ‘a technique using lightly charged, closely spaced holes to induce a fracture plane along a required design profile, which isolates the rock to be blasted from the surrounding rock mass’. Pre-split blasting is commonly used for cuttings required in road and rail road construction and to ensure safety of excavations as well as to have good-quality final rock faces.

The design models that can be applied in pre-split blasting for the Project site in accordance with the risk analysis, are given in Table 10-17.

Table 10-17. Proposed Pre-Split Blasting Preliminary Design Models for the Project Site

	Design 1	Design 2	Design 3
Hole Diameter, (mm)	89	89	89
Bench Height, K (m)	5	5	10
Hole Slope (°)	72	72	72
Hole Length, H (m)	10	10	10
Charge Concentration, Ib (kg/m)	5.6	5.6	5.6
Explosive Density (kg/dm^3)	900	900	900
Distance Between Holes, S (m)	0.9	0.9	0.9
Slice Thickness, B (m)	1.0	1.5	2.0
Inflated Suppository Charge Amount (gr/m)	80	80	80
Hole Load (blown cord) (gr/hole)	800	800	800
Charge Amount Per Hole (baiting) (gr/hole)	500	500	500
Number of Holes to blast together	5	5	5
Charge Amount Per Delay (kg)	6.5	6.5	6.5
Delay between Groups (ms)	17	17	17
The closest distance to the Ancient Waterway (m)	30-56	56-100	100>100

The plans for the proposed pre-split design parameters for the Project site are presented in Figure 10-8, Figure 10-9 and Figure 10-10.

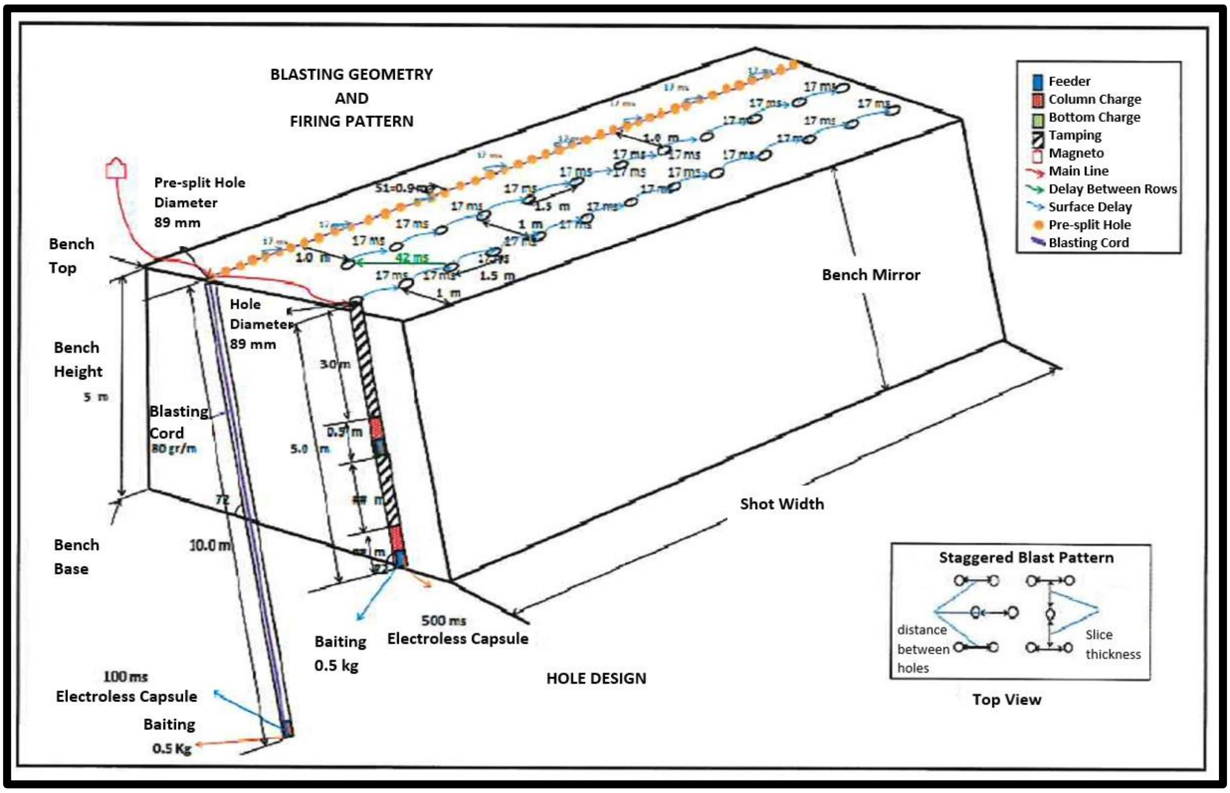

Figure 10-8. Pre-Split Blasting Design-1

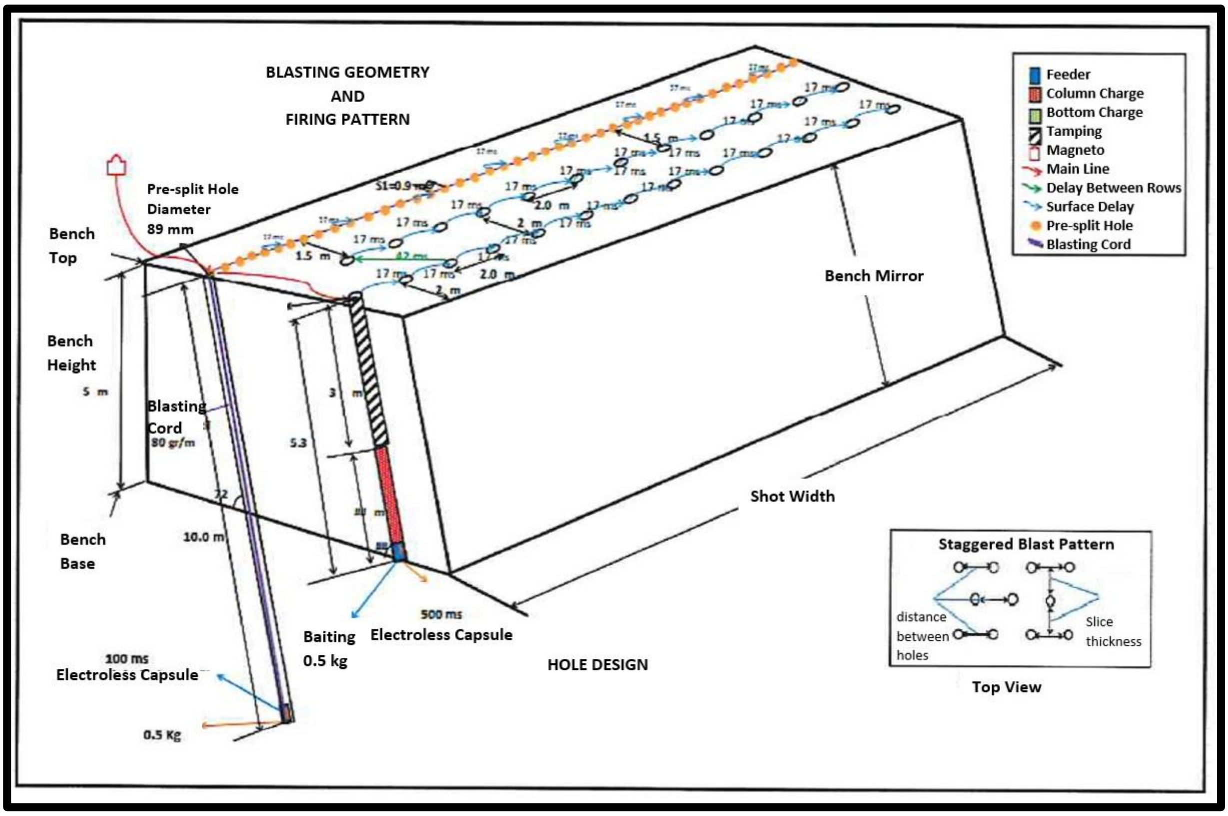

Figure 10-9. Pre-Split Blasting Design-2

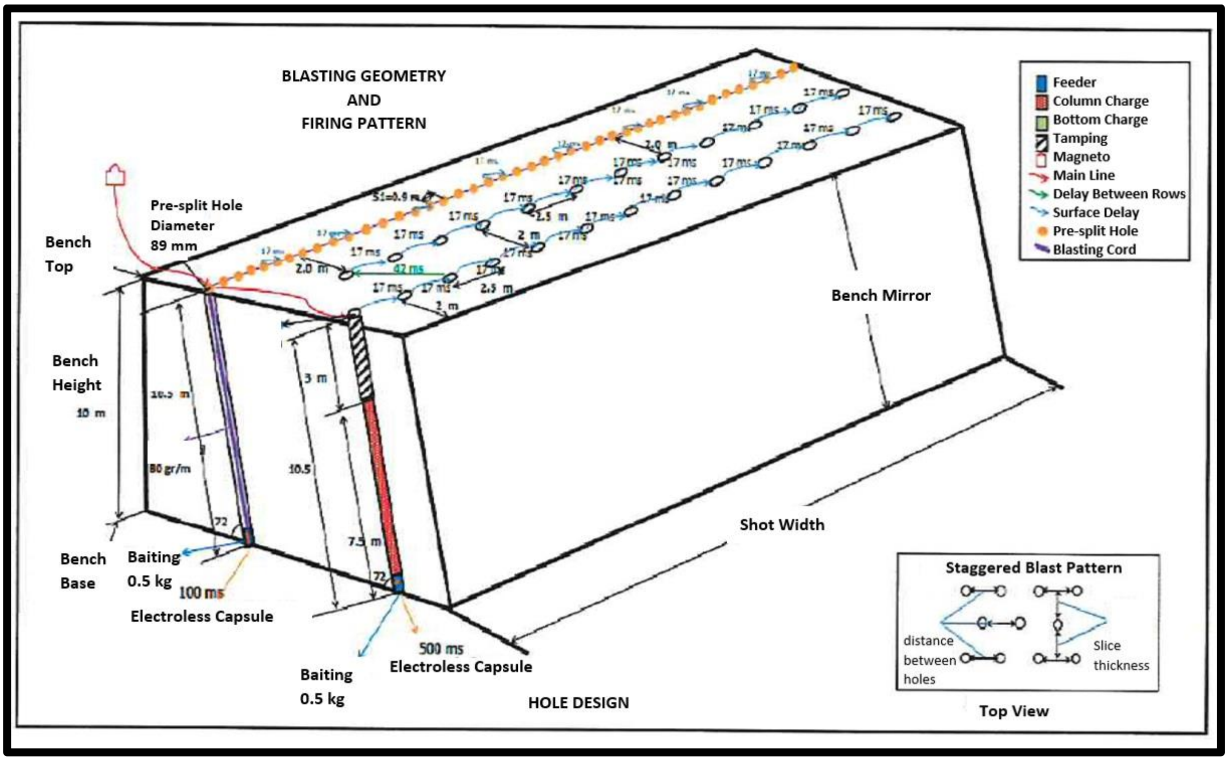

Figure 10-10. Pre-Split Blasting Design-3

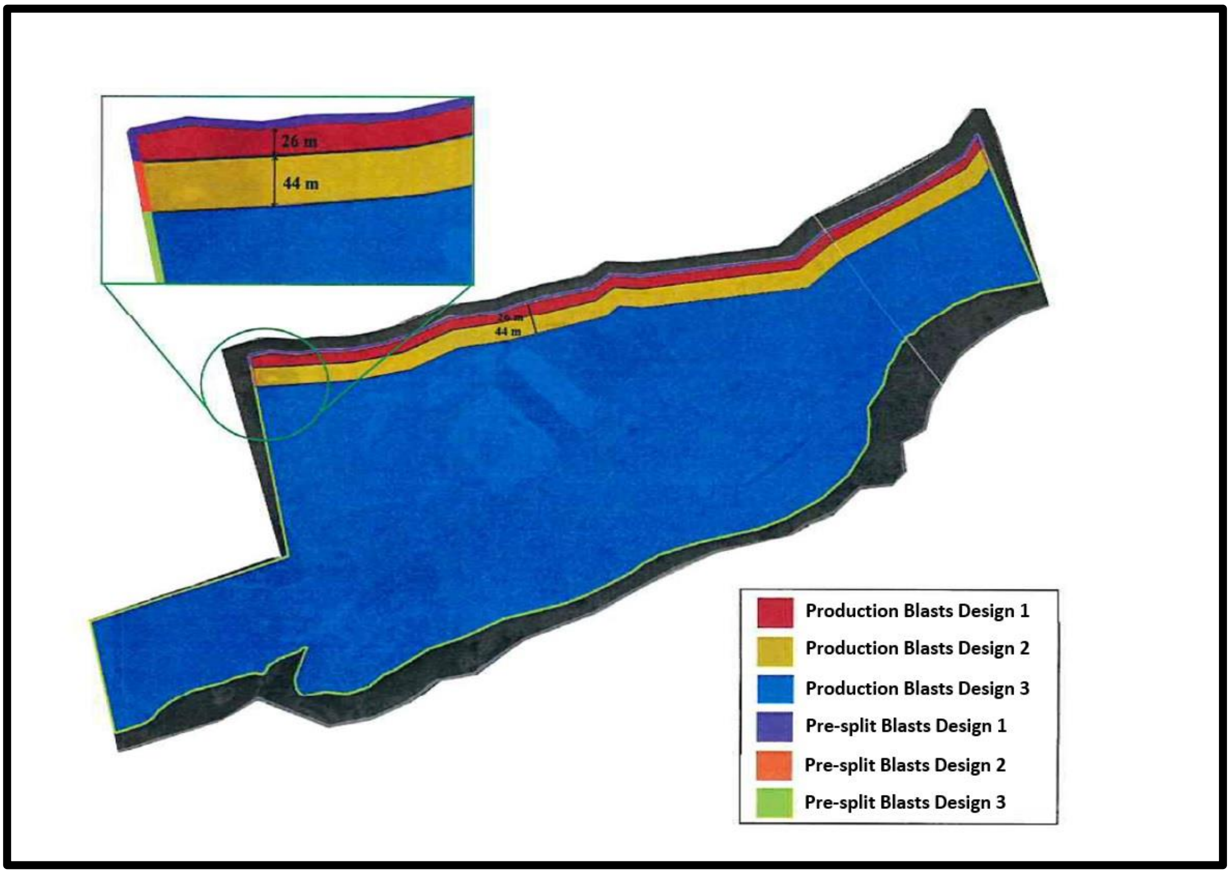

Figure 10-11. The Plan Map showing the blasting zones for the use of for proposed blasting designs

According to the risk analysis, considering the highest amount of explosive use per delay at different distances, the proposed blasting models in Table 10-16 can be used at the Project site. The results indicate that blasting can be conducted by using blasting model “Design 1” in the excavation area with highest sensitivity for being up to 30 m close to the ancient waterway (the critical zone) (see Figure 10-11). Blasting model “Design 2” can be used at locations more than 56 m away from the ancient waterway near the northern border of the excavation site and “Design 3” can be used at locations more than 100 m away from the ancient waterway near the northern border of the excavation site.

10.7 Noise Mapping, Noise Modelling and Vibration Levels

Based on the implementation schedule of the Project and the construction and operation noise sources as explained in the previous sections, noise modelling was conducted for the construction and operation phases.

10.7.1 Construction Phase Noise Modelling

Construction works are significant noise sources for neighbouring communities. Sources of noise from construction of the Project will include earthworks (i.e., excavation, blasting, filling, etc.) as well as the machinery and equipment. The major noise sources during the construction phase are pile driving activities and noise from service roads belonging to the Project.

Three different scenarios were developed for construction phase noise modelling. These are (i) construction activities without piling; (ii) construction with piling at the closest location to the residential areas; and (iii) construction with piling near the middle section of the Associated Facility (Terminal Facility). During the construction phase the aim is to determine the impact at the nearest point of piling. In order to account for impact reduction as the distance between receptor and the source increases, piling activities are modelled at two different regions. The receptors are selected at the baseline noise monitoring points as shown above in Figure 10-2. The model results for different scenarios on estimated noise levels at receptors are given in Table 10-18.

Table 10-18. Construction Noise Levels at Receptors

Receptor	Scenario 1. Construction Only					Scenario 2. Construction + Closest Piling					Scenario 3. Construction + Mid-Range Piling				
	Ldn (dBA)		Lden (dBA)			Ldn (dBA)		Lden (dBA)			Ldn (dBA)		Lden (dBA)		
	L_{day}	L_{night}	L_{day}	L_{eve}	L_{night}	L_{day}	L_{night}	L_{day}	L_{eve}	L_{night}	L_{day}	L_{night}	L_{day}	L_{eve}	L_{night}
R1	37.4	39.0	37.4	38.3	39.0	38.8	40.4	38.8	39.7	40.4	42.6	44.2	42.7	43.5	44.2
R2	52.2	53.5	52.2	52.9	53.5	74.7	75.7	74.7	75.3	75.8	61.2	62.3	61.2	62.0	62.6
R3	55.8	56.3	55.8	56.1	56.3	58.5	59.4	58.5	59.0	59.4	57.5	58.4	57.5	58.0	58.4
R4	51.9	53.1	51.9	52.6	53.1	59.3	60.7	59.4	60.1	60.7	54.8	56.1	54.8	55.5	56.1
R5	48.1	49.5	48.1	48.8	49.5	52.1	53.6	52.1	52.9	53.6	52.0	53.5	52.0	52.8	53.5

Noise maps have been created for daytime, evening and night-time construction activities. The noise maps are illustrated in Figure 10-12 through Figure 10-14. As the main construction activities (excavation, filling and machinery and equipment) are assumed to continue 24 hours a day, the difference between daytime, evening and night-time noise maps is due to meteorological effects, which are found to be minor. Moreover, since pile driving activity for the Associated Facility construction is assumed to be undertaken only during daytime, the evening and night-time noise maps of Scenario 2 and Scenario 3 are identical to that of Scenario 1 (Construction Only). Therefore, in this section, only daytime noise maps for all three scenarios are presented.

Based on the noise maps, it is observed that the noise levels at the nearest sensitive residential buildings vary between 55 to 65 dBA for Scenario 1, 55 to 90 dBA for Scenario 2 and 55 to 65 dBA for Scenario 3.

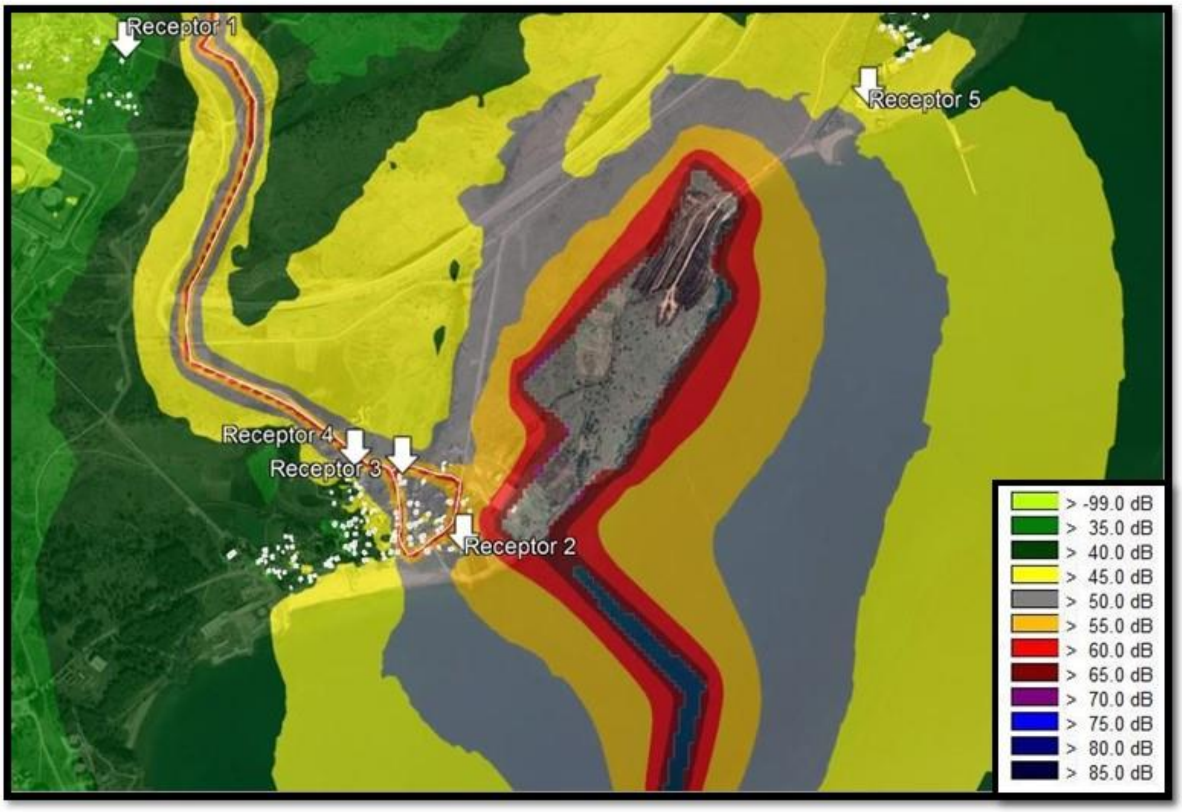

Figure 10-12. Scenario 1: Construction – Noise Map Daytime

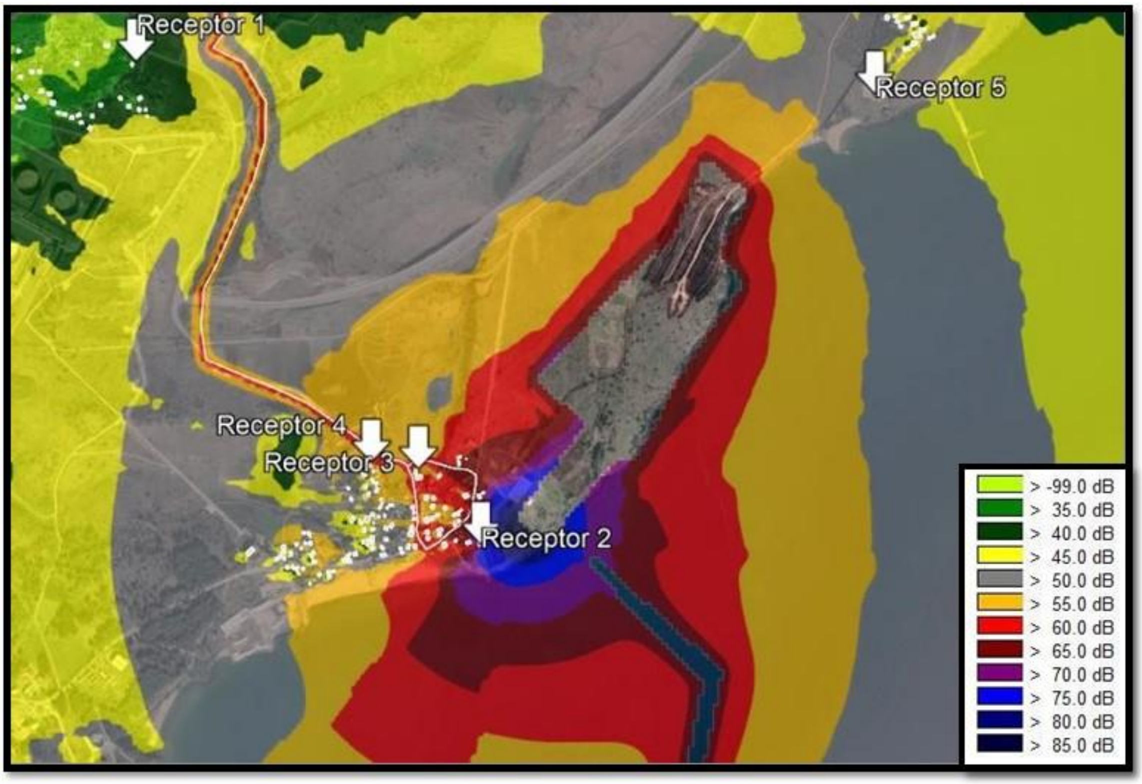

Figure 10-13. Scenario 2: Construction + Closest Piling – Noise Map Daytime

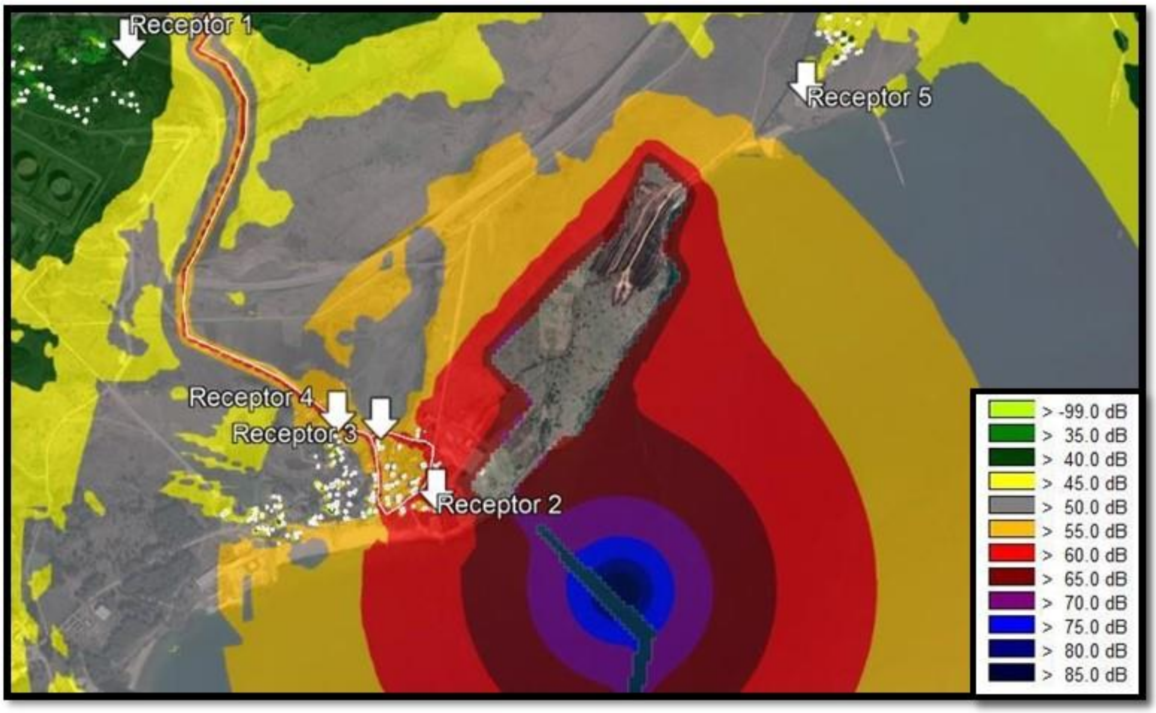

Figure 10-14. Scenario 3: Construction + Mid-Range Piling – Noise Map Daytime

10.7.2 Construction Vibration Levels

Calculations were carried out based on the reference source vibration measurements conducted for similar type of construction activities. The reference value is obtained from numerous experiments conducted during similar pile driving activities. Reference piling vibration level at 15 metre distance was taken as 9 mm/s. The vibration effect with respect to the distance and limit value is shown in the graph below (see. Figure 10-15).

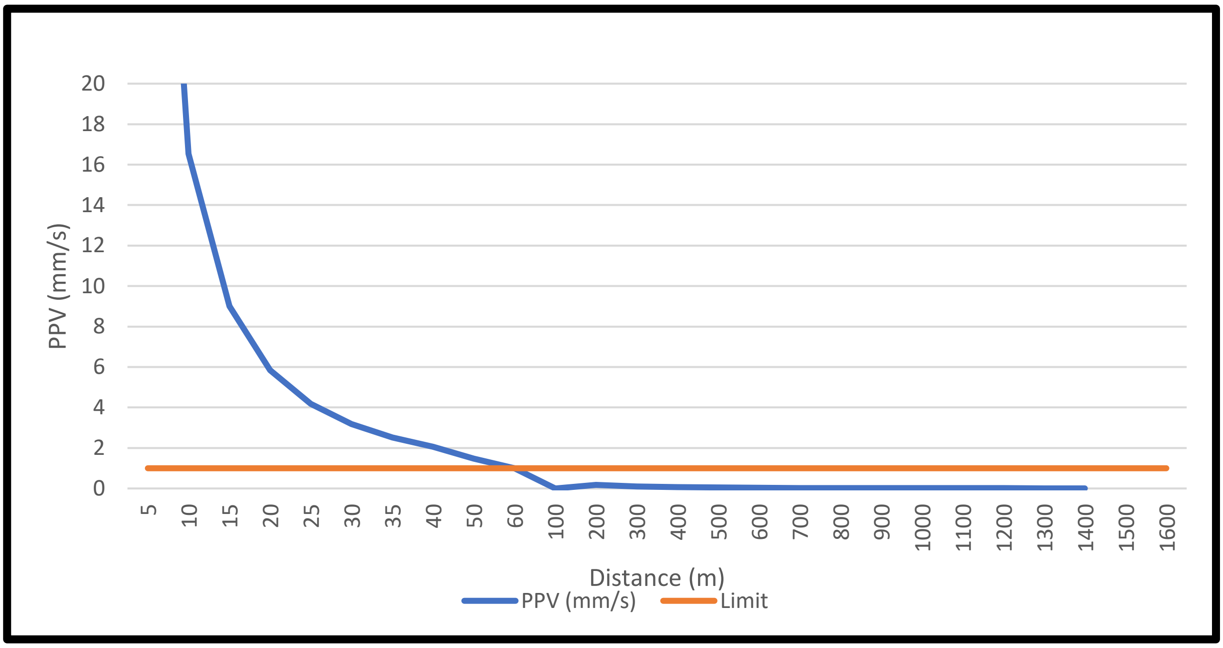

Figure 10-15. Vibration critical distance for construction activities

Based on the critical distance assessment, the construction vibration levels at nearby sensitive receptors are given in Table 10-19.

Table 10-19. Construction vibration levels at receptors

Receptor	Distance to the Jetty (m)	PPV (mm/s)
R1	2300	0.0095
R2	100	0.5229
R3	400	0.0654
R4	580	0.0374
R5	1780	0.0070

According to the RAMEN the maximum admissible limit value for discontinuous vibration is 10 mm/s. However, the lowest tolerable vibration limit value of this Project is taken as 1 mm/s for residential locations (as defined in BS 5228-2:2009. Code of practice for noise and vibration control on construction and open sites -see Table 10-7 above). In addition, the ancient waterway located 30 meters from the Project site is also taken into consideration for vibration impact assessment. As seen in the Figure 10-15 above, the vibration level at 30 meters is between 2-4 mm/s, which is significantly below the RAMEN limit value.

Vibration calculations reveal the safe distance before vibration level reach 1 mm/s level is 65 meters for construction activities (i.e., pile driving). Thus; no impact is expected from constructional vibration as long as necessary precautions are taken and proper warnings are given as there are no receptors identified closer than 65 meters from the Project Site.

10.7.3 Blasting Activities Vibration Levels

Blasting activities will be carried out instead of piling at locations where the ground structure comprises hard rock. The blasting area is shown in Figure 10-16 distance of nearest structures to the blasting area are shown in Table 10-20.

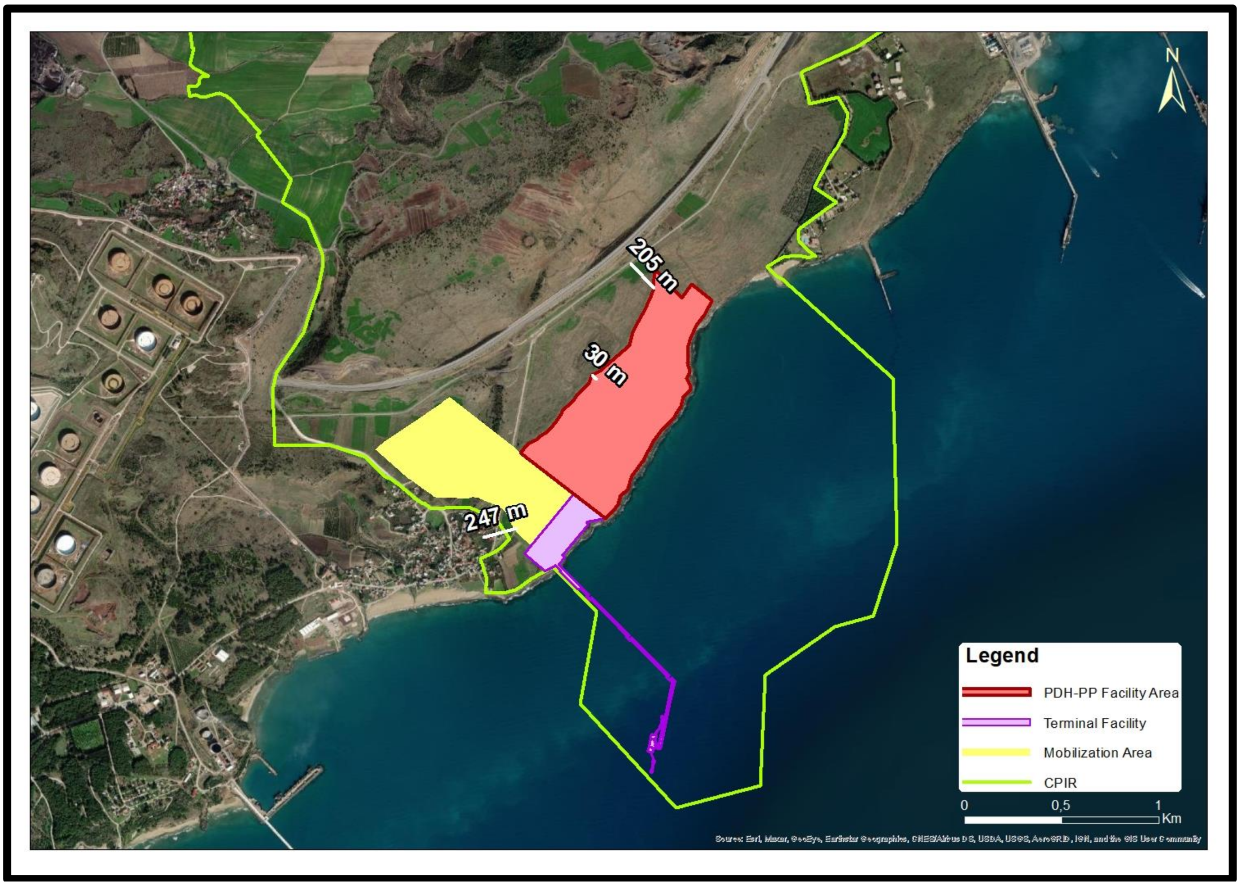

Figure 10-16. Blasting Area

Table 10-20. Nearest Structures around the Blasting Area

Sensitive Structures	Remark	Distance(m)
Botaş Pipeline	Closest point of the blasting region to the pipeline is north-west	205
Antique Waterway	Closest point of the blasting region to the antique waterway is north-west	30
Residential Buildings	Closest point of the blasting region to the Incirlik locality	247

Many localised factor affect the transmission of vibration through the ground. Therefore, for the prediction of vibration impacts from blasting site specific data is necessary. The most accurate predictions can be made with all the site relevant data available. In the absence of site data, ground borne vibration levels are estimated according to the formula by Nichols et al (1971) [1]:

$$ppv = K * \left(\frac{R}{\sqrt{W}}\right)^{-B}$$

Where;

ppv: ground vibration maximum particle velocity (mm/sec.)

R: receiver's distance to blasting area (m)

W: charge per delay or total charge for an instantaneous blast, (kg)

K and B are empirical constants related to site and rock properties. Where 'K' refers to the site confinement conditions (i.e. free face, quarry, heavily confined blasting) and 'B' refers to expected rock types.

Based on the site characteristics the following equation wasused to calculate potential effect of blasting activities at the nearest structures to the Project site :;

$$ppv = 15{,}301 * \left(\frac{R}{\sqrt{W}}\right)^{-2.4027}, (r = 0.8662$$

In the modelling study, the maximum amount of explosive use per delay was determined for blasting activities at different distances to the Antique waterway stretching along the northern boundary of the Project site. According to the report prepared by Istanbul University, vibration frequencies of the blasting areas containing basalt will generally be medium and high. Therefore, relevant maximum allowable limit value for particle velocity is 19 mm/sec according to the Turkish Regulation (i.e., RAMEN). Accordingly, maximum charge amount allowed per hole to remain below the legislative limit value was calculated . The maximum amount of explosive per hole and graph of explosive amount with respect to distance are provided in Table 10-21 and Figure 10-17 respectively.

[1] Square Root scaling of charge per delay. (Nichols et a.,l 1971) (Nichols, H.R., Johnson, C.F., and Duvall, W.I., 1971. Blasting Vibrations and their effects on structures, Bureau of Mines bulletin 656, US Government Printig Office).

https://www.resolutionmineeis.us/sites/default/files/references/nicholls-johnson-duvall-1971.pdf

Table 10-21. Maximum amount of explosive per hole

Distance(m)	Closest Risk Point	RAMEN Limit Value (mm/s)	Amount of explosives per hole(kg)
10	Antique Waterway	19	0.4
20			1.5
30			**3.4**
50			9.5
75			21.4
100			38.1
150			85.8
200			152.5
250			238.2
300			343.0
350			466.9
400			609.8

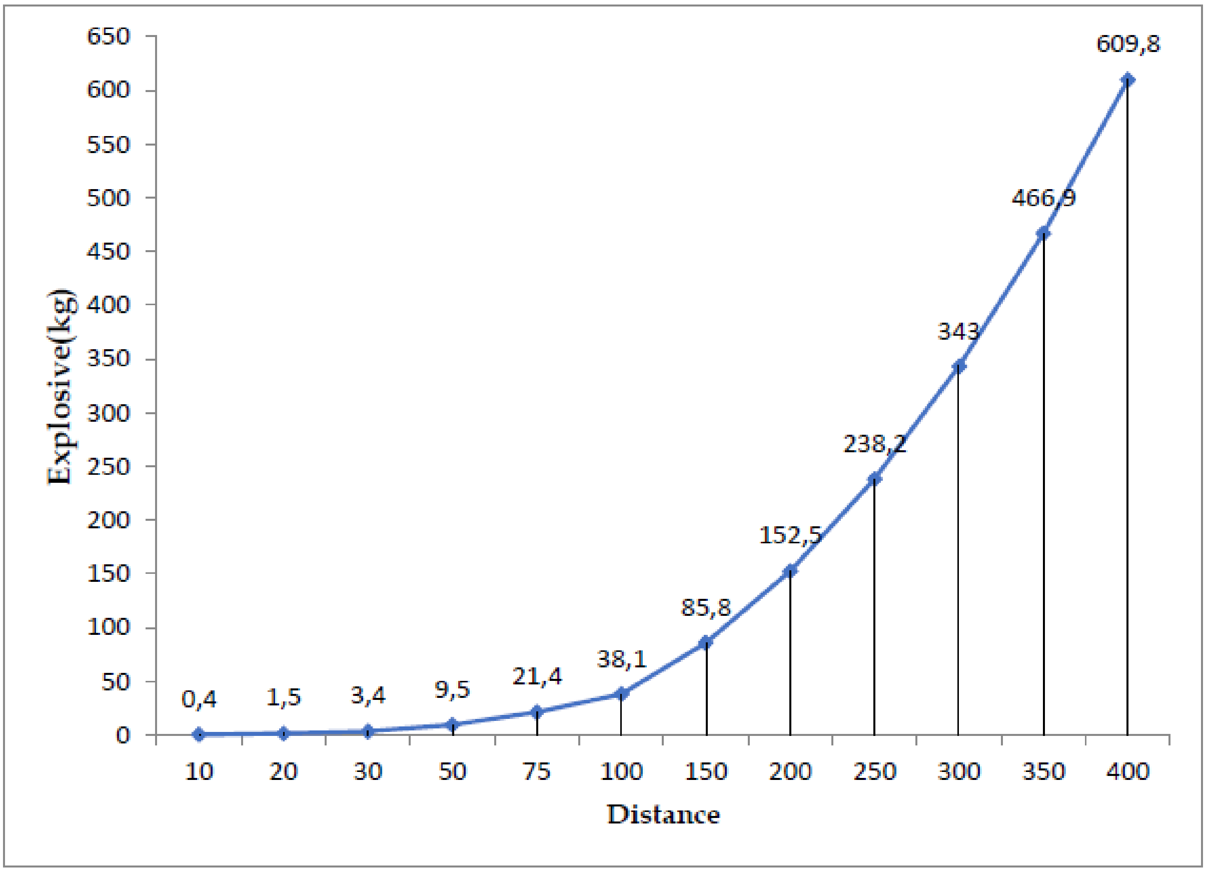

Figure 10-17. Graph of explosive amount with respect to distance

Table 10-21and Figure 10-17 show that maximum 3.4 kg explosives can be used at a distance of 30 meters from the antique water way, in order to sustain the vibration limit of 19 mm/s stipulated in RAMEN. Preliminary design models (detailed in Section 10.6) for step blasting and pre-split blasting were also prepared for Project construction.

Figure 10-18 shows the buffer zone (red area) of critical distance of 30 m to the blasting region.

Figure 10-18. Blasting Areas in Project

A summary of considerations for blasting activities is presented below;

- Since the ground structure of the excavation area is basalt, blasting activity is inevitable
- The vibration velocity estimation formula was used in the risk analysis study..
- In the risk analysis studies regarding the ancient waterway parallel to the Project site boundary, 19 mm/sec particle velocity limit value was taken into consideration according to Turkish Regulation on the Assessment and Management of Environmental. Noise (RAMEN) for analysis.
- The amount of explosive to be used per delay presented in Table 6-5 to avoid exceedance of RAMEN limit values.
- Safe distance for the closest sensitive structure to the blasting region (antique waterway) is calculated as 30 meters with the permitted amount of explosives of 3.4 kg per hole.

- Step blasting and presplit blasting ‘model 1’ can be used in the entire blasting area, as well as for blasts further than 30 meters away from antique waterway and outside critical zone.
- Step blasting and presplit blasting ‘model 2’ can be used at distances greater than 56 meters from antique waterway.
- Step blasting and presplit blasting ‘model 3’ can be used at distances greater than 100 meters from antique waterway.
- In the Step blasting model each hole will be exploded separately. The model is developed to keep the charge per delay to a minimum.
- Oblique hole application has been considered in order to ensure that energy is chanelled to breaking and translation of rock.

In terms of controlling environmental effects, vibration and air shock should be measured by using vibration meters in sufficient quality and quantity during blasting.

10.7.4 Operation Phase Noise Modelling

Information on ground topography is important to be included in the noise model since sound propagation is strongly affected by the terrain levels as obstacles. To develop the noise model of the Project, ground topography data was obtained from Digital Elevation Model Dataset from NASA, Reverb Earth Science Discovery tool as shown above in Figure 10-1.

In addition, 3D model of the PDH-PP facility was introduced to the software with the associated noise power levels. 3D view of the noise model set-up is given in Figure 10-19. Sources for noise power levels database used to define the noise elements of the Project are as follows:

- Information gathered from the Project Company;
- Literature values and formulations found in academic articles, etc.;
- Literature values gathered by Frekans with numerous experimental data;
- Datasheets of the machine/equipment planned to be used in the Project;
- Noise power levels defined by U.S. Department of transportation Federal Highway Administration for several equipment related with construction and operation of the Project;
- Limit of 80-85 dBA for homogeneous work environment limiting values (logically noise levels can not exceed depicted limiting values in the work environment, thus; noise sources can be modelled accordingly, especially in the lack of information about noise sources).

The industrial noise levels calculations were carried out by following ISO 9613-2 method which is the recommended standard by EU Noise Directive. Another important parameter for the noise model is the ground absorption (G). Ground absorption varies between 0 to 1 for hard - reflective surfaces and soft - absorptive surfaces, respectively. When calculating the noise propagation, G was assumed to be 0.9 for land.

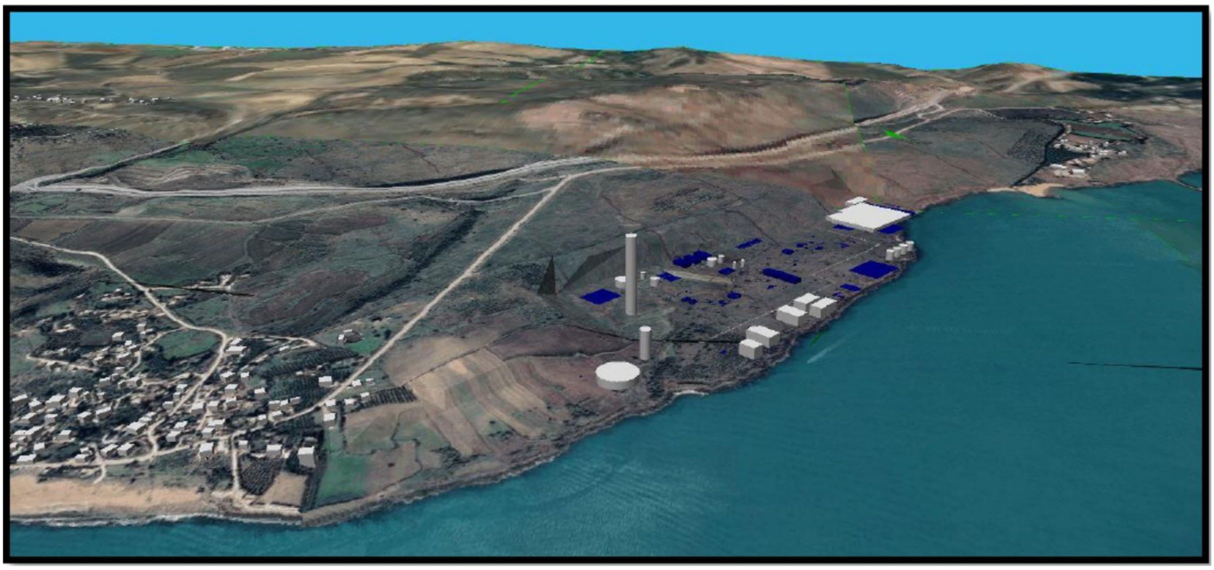

Figure 10-19. 3D Noise model set-up of the Ceyhan PDH-PP facility

Operation phase noise levels at the nearby sensitive receptors are presented in Table 10-22. Since; no variation is expected in terms of environmental acoustics in the operation dynamics of the Project, only one worst-case scenario is modelled where it was assumed that all the noise sources are operational at the same time.

Table 10-22. Operation phase noise levels at receptors

Receptor	Operation Phase				
	Ldn (dBA)		Lden (dBA)		
	Lday	Lnight	Lday	Levening	Lnight
R1	32,1	33,6	32,1	32,9	33,6
R2	45,2	46,5	45,2	45,9	46,5
R3	45,0	46,4	45,0	45,8	46,4
R4	44,9	46,4	44,9	45,7	46,4
R5	48,0	49,5	48,0	48,8	49,5

Noise maps were created for daytime, evening and night-time operation activities including 3D illustrations. The noise maps are illustrated in Figure 10-20 and Figure 10-21. Similar to the construction phase modelling, the operation activities are assumed to continue 24 hours, the difference among the daytime, evening and night-time noise maps is only due to meteorological data, which is found to be minor. Therefore, in this section, only daytime operational noise maps are presented.

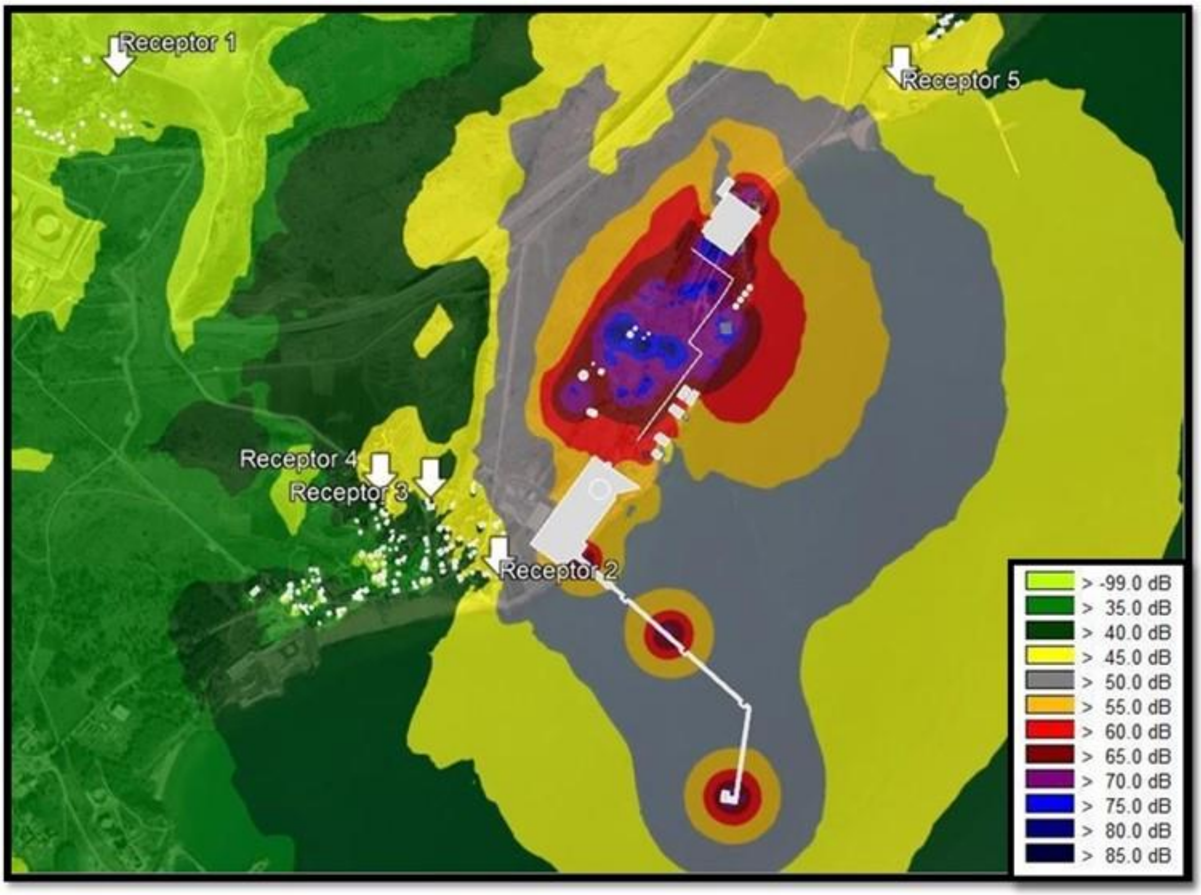

Figure 10-20. Operation noise map – Daytime

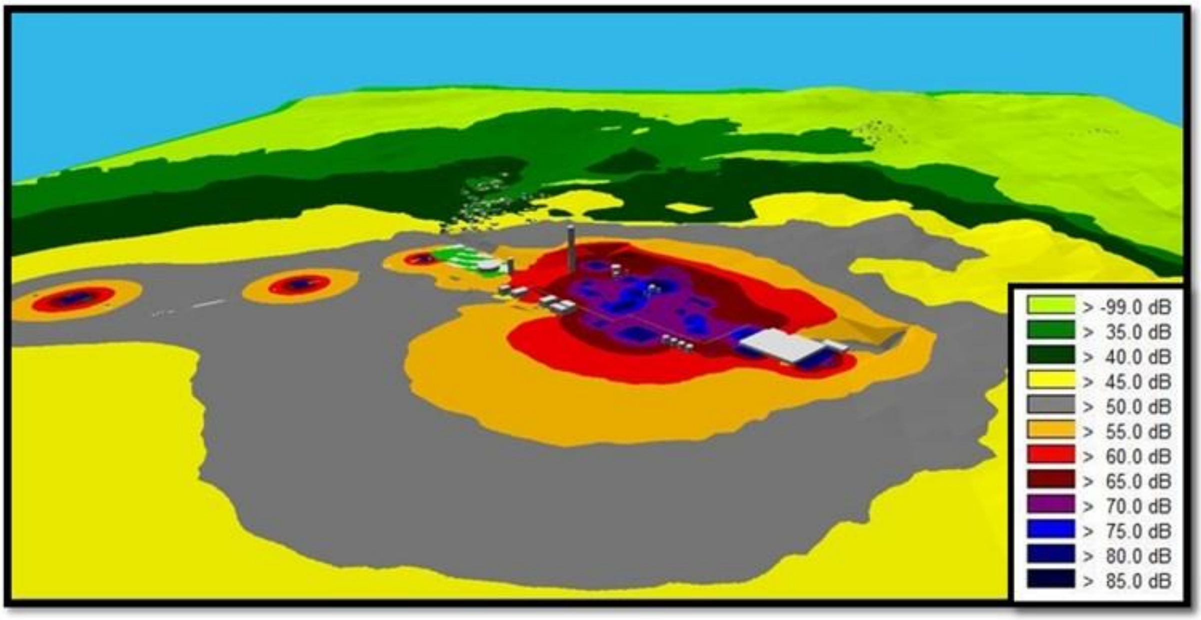

Figure 10-21. Operation 3D noise map – Daytime

10.7.5 Operation Phase Vibration Levels

Calculations were carried out according to the limiting vibration levels of ISO 10816 vibration estimation standard for machine and equipment. Reference vibration levels for the weakest mounting conditions were taken into consideration and calculations were conducted for the associated case. Reference vibration levels for machine and equipment at 0.5 meter distance is taken as 15.5 mm/s. The vibration effect with respect to the distance and limit value is shown in the below graph (see. Figure10-22).

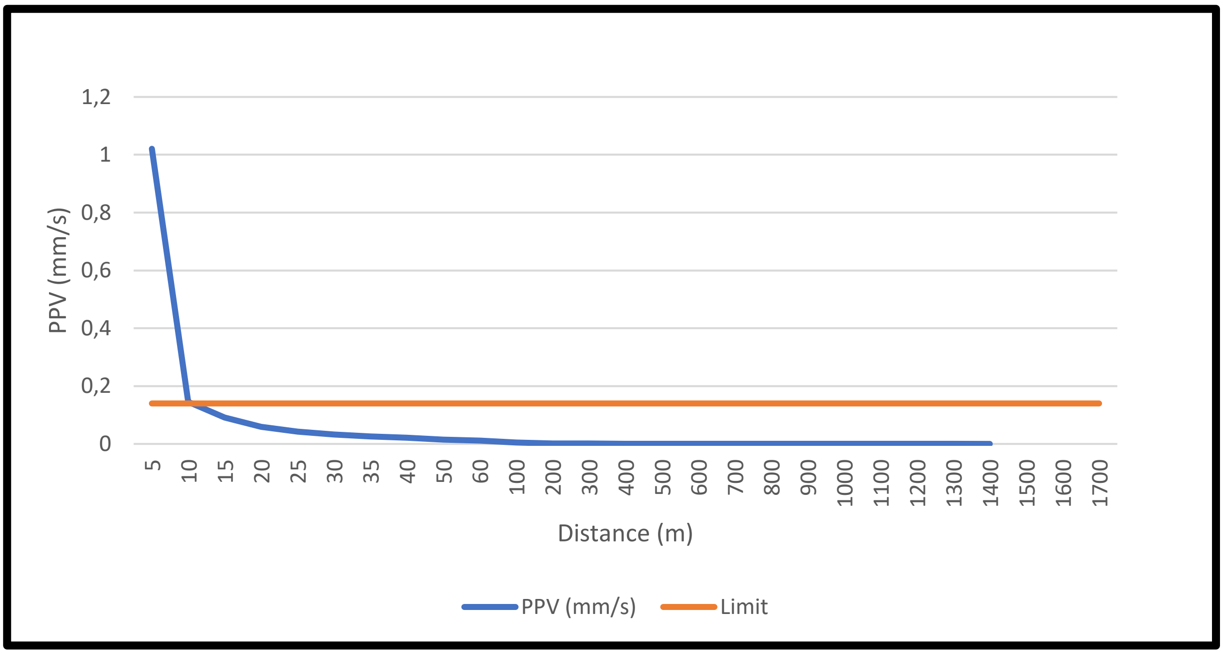

Figure10-22. Vibration critical distance for operation activities

Based on the critical distance assessment, the operation vibration levels at receiver points is given in Table 10-23 as above.

Table 10-23. Operation phase vibration levels at receptors

Receptor	Distance (m)	PPV (mm/s)
R1	1900	0,0001
R2	100	0,0053
R3	400	0,0005
R4	580	0,0004
R5	590	0,0004

According to the RAMEN the maximum admissible limit values for continuous and discontinuous vibration are 5 mm/s and 10 mm/s, respectively. However, the lowest tolerable vibration limit value of this Project is taken as 0.14 mm/s for residential locations (as defined in BS 5228-2:2009. Code of practice for noise and vibration control on construction and open sites in Table 10-7 above). Vibration calculations reveal that, safe distance before vibration levels reach to 0.14 mm/s level is 11 meters for operation activities. Thus; no impact is expected from operational vibration activities since, there are no receptors detected closer than 11 meters to the Project site.

10.7.6 Noise Modelling Results

Table 10-24 and Table 10-25 below present the results of the noise modelling study for the construction phase (for all three scenarios), which are compared with IFC / WHO limits and national limits.

Table 10-26 and Table 10-27 summarize the results for operation phase including cumulative noise levels,. taking into account both the modelled noise level as a result of the Project activities and the measured background noise level.

The modeling results given in Table 10-25 below indicate that during construction works, daytime and night-time cumulative noise levels can exceed the IFC / WHO standard values at receptors R2, R3, R4 and R5 for all scenarios. Within these receptor locations, potential noise standard exceedance at R2 is very high. Only at R1 potential exceedance is estimated to be lower than 3 dB.

In terms of national noise limits, modelling results show potential exceedance of national limits at R2 during construction works for Scenario 1 and 3 for evening and night-time periods. For Scenario 2, the potential exceedance of the national limits is estimated for all periods at R2 and for night-time periods at R3 and R4 during construction.

Operational noise modeling results in Table 10-27 indicate that only night-time cumulative noise levels are estimated to exceed IFC/WHO limit values with the limit exceedance higher than 3dBA at sensitive receptors R2, R4 and R5. In terms of national limits stipulated in RAMEN, modeling results for operation phase comply with the limits for all periods at sensitive receptors and no exceedance of day or night time noise level limits is expected at the receptor points.

Table 10-24. Construction noise modelling results in comparison to IFC / WHO limits

	Receivers	Source Leq (dBA)		Baseline Leq (dBA)		Cumulative Level (dBA)		Limit Value (dBA)		Limits WHO Exceedance	Magnitude Of Impact			Responsivity			Impact Significance
											Scale Of Impact	Extent	Impact Mag				
		Ld	Ln	Ld	Ln	Ld	Ln	Ld	Ln	Max				Importance	Sensitivity	Responsivity	
Only Construction	R1	37.4	39.0	54.1	46.2	54.2	46.9	55.0	49.2	0.0	No Impact	Local	No Impact	Medium	Medium	Medium	No Impact
	R2	52.2	53.5	53.7	46.8	56.0	54.3	55.0	49.8	4.5	S	Local	M	Medium	Medium	Medium	Moderate
	R3	55.8	56.3	53.5	47.2	57.8	56.8	55.0	50.2	6.6	M	Local	L	Medium	Medium	Medium	Major
	R4	51.9	53.1	47.1	43.5	53.1	53.5	55.0	45.0	8.5	M	Local	L	Medium	Medium	Medium	Major
	R5	48.1	49.5	48.1	45.3	51.1	50.9	55.0	48.3	2.6	N	Local	S	Medium	Medium	Medium	Minor
Construction + Worst Piling	R1	38.8	40.4	54.1	46.2	54.3	47.2	55.0	49.2	0.0	No Impact	Local	No Impact	Medium	Medium	Medium	No Impact
	R2	74.7	75.7	53.7	46.8	74.7	75.7	55.0	49.8	25.9	L	Local	L	Medium	Medium	Medium	Major
	R3	58.5	59.4	53.5	47.2	59.7	59.7	55.0	50.2	9.4	M	Local	L	Medium	Medium	Medium	Major
	R4	59.3	60.7	47.1	43.5	59.6	60.8	55.0	45.0	15.8	L	Local	L	Medium	Medium	Medium	Major
	R5	52.1	53.6	48.1	45.3	53.5	54.2	55.0	48.3	5.9	M	Local	L	Medium	Medium	Medium	Major
Construction + Mid Piling	R1	42.6	44.2	54.1	46.2	54.4	48.3	55.0	49.2	0.0	No Impact	Local	No Impact	Medium	Medium	Medium	No Impact
	R2	61.2	62.3	53.7	46.8	61.9	62.4	55.0	49.8	12.6	L	Local	L	Medium	Medium	Medium	Major
	R3	57.5	58.4	53.5	47.2	58.9	58.7	55.0	50.2	8.5	M	Local	L	Medium	Medium	Medium	Major
	R4	54.8	56.1	47.1	43.5	55.5	56.3	55.0	45.0	11.3	L	Local	L	Medium	Medium	Medium	Major
	R5	52.0	53.5	48.1	45.3	53.5	54.1	55.0	48.3	5.8	M	Local	L	Medium	Medium	Medium	Major

* Since the Source Leq values are higher than the limit value, the limit value is taken as “baseline value + 3dBA”

Table 10-25. Construction noise modelling results in comparison to national limits

* cumulative level for Le was not calculated because baseline Le values were not measured at the receptors.

	Receivers	Source Leq (dBA)			Limit Value (dBA)			Limits RAMEN Exceedance
		Lday	Levening	Lnight	Lday	Levening	Lnight	Max
Only Construction	R1	37.4	38.3	39.0	65.0	60.0	55.0	0.0
	R2	52.2	52.9	53.5	65.0	60.0	55.0	0.0
	R3	55.8	56.1	56.3	65.0	60.0	55.0	0.0
	R4	51.9	52.6	53.1	65.0	60.0	55.0	0.0
	R5	48.1	48.8	49.5	65.0	60.0	55.0	0.0
Construction + Worst Piling	R1	38.8	39.7	40.4	65.0	60.0	55.0	0.0
	R2	74.7	75.3	75.8	65.0	60.0	55.0	15.8
	R3	58.5	59.0	59.4	65.0	60.0	55.0	4.9
	R4	59.4	60.1	60.7	65.0	60.0	55.0	4.3
	R5	52.1	52.9	53.6	65.0	60.0	55.0	0.0
Construction + Mid Piling	R1	42.7	43.5	44.2	65.0	60.0	55.0	0.0
	R2	61.2	62.0	62.6	65.0	60.0	55.0	7.6
	R3	57.5	58.0	58.4	65.0	60.0	55.0	3.4
	R4	54.8	55.5	56.1	65.0	60.0	55.0	1.1
	R5	52.0	52.8	53.5	65.0	60.0	55.0	0.0

Table 10-26. Operation noise modelling results in comparison to IFC / WHO limits

Receptor	Distance (m)	Source Leq (dBA)		Baseline Leq (dBA)		Cumulative Level (dBA)		Limit Value (dBA)		Limits WHO Exceedance
		Ld	Ln	Ld	Ln	Ld	Ln	Ld	Ln	Max
R1	1435	32.1	33.6	54.1	46.2	54.2	46.4	55.0	49.2*	0.0
R2	200	45.2	46.5	53.7	46.8	54.3	49.7	55.0	49.8*	0.0
R3	360	45.0	46.5	53.5	47.2	54.0	49.9	55.0	50.2*	0.0
R4	660	44.9	46.4	47.1	43.5	49.2	48.2	55.0	45.0*	3.3
R5	1465	48.0	49.5	48.1	45.3	51.0	50.9	55.0	48.3*	2.6

* Since the Source Leq values are higher than the limit value, the limit value is taken as "baseline value + 3dBA"

Table 10-27. Operation noise modelling results in comparison to national limits

Receptor	Distance (m)	Source Leq (dBA)			Limit Value (dBA)			Limits RAMEN Exceedance
		Ld	Le	Ln			Ld	Le
R1	1435	32.1	32.9	33.6	65.0	60.0	55.0	0.0
R2	200	45.2	45.9	46.5	65.0	60.0	55.0	0.0
R3	360	45.0	45.8	46.4	65.0	60.0	55.0	0.0
R4	660	44.9	45.7	46.4	65.0	60.0	55.0	0.0
R5	1465	48.0	48.8	49.5	65.0	60.0	55.0	0.0

10.8 Impacts

The significance criteria that were used for assessing noise impacts are established by evaluating the magnitude of the impacts together with the sensitivity/vulnerability/importance of the receptors. Impact significances are determined based on the methodology given in Chapter 4 of this ESIA Report with more detailed descriptions of the impact intensity types that are used for the determination of the impact magnitudes and receptor sensitivities given in the Table 10-28 to Table 10-29 below.

Table 10-28. Intensity of Noise Impact on Receptors

Magnitude	Description
Negligible	- Increase in average sound pressure levels between 0 and 3 dB from the expected construction activity induced ambient sound level (proposed rating level). - No change in ambient sound levels discernible. Noise impact can be heard, but does not cause any change in behaviour or attitude - Total projected noise level is less than the Zone Sound Level in no blasting conditions.
Low	- Increase in average sound pressure levels between 3 and 5 dB from the (expected) ambient sound level (proposed rating level). - The change is barely discernible, but the noise source might become audible.
Moderate	- Increase in average sound pressure levels between 5 and 10 dB from the (expected) ambient sound level (proposed rating level). - Sporadic complaints expected. Causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in character of the area - Any point where the zone sound levels are exceeded during no blasting conditions.
High	- Increase in average sound pressure levels higher than 10 dBA from the (expected) ambient sound level (proposed rating level). - Change of 10 dBA is perceived as ‘twice as loud’, leading to widespread complaints and even threats of community or group action. Significant changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects - Any point where noise levels exceed 65 dBA at any receptor.

Table 10-29. Receptor Sensitivity to Noise Impact

Value	Description
Low	- Commercial and residential areas where workplaces dominate. - Users of the agricultural lands to the west of the Project Site .
Medium	- Commercial and residential areas where residential buildings dominate.
High	- Areas where sensitive receptors are located including education, culture, health, summer houses and camping areas.

Construction Phase

The main noise sources during construction activities include use of construction machinery and equipment during earthworks and other construction activities, construction traffic related to the transportation of excavated soils and construction materials as well as pile driving activities at the Associated Facility (Jetty construction in Terminal Facility). Increased noise levels during construction activities have the potential to create negative impacts on the background noise levels which may lead to further impacts on sensitive receptors such as, health risks at nearest sensitive receptors. The actual impact level due to construction activities will also depend on other parameters such as the type of equipment to be used, time period and duration, and the perception of specific noise patterns (e.g., continuous, regular intervals, irregular).

Potential vibration impacts will be related to site levelling activities, truck movements, use of construction machinery,and blasting activities at the Project site and pile driving for the construction of the Jetty section of the Associated Facility (Terminal Facility). Increase in vibration may result in disturbance to the occupiers of dwellings and other noise sensitive buildings that are close to the Project site boundaries. The frequent truck movements due to haulage of construction and fill materials at the site, potential off-site transfer of excavated materials for disposal, and blasting activities for preparation of the Project site during construction may cause disturbance particularly to the residents of nearby neighbourhoods .

As described in detail in the sections above, in order to predict the impacts of the Project on the existing background noise levels, baseline noise level measurements and a sound propagation modelling study were conducted.

Insitu baseline noise monitoring at five receptor points identified in the vicinity of the Project site revealed the following:

- Baseline background daytime noise levels are below the IFC / WHO standards and national limits at all background noise measurement locations.
- Night-time baseline noise levels at all monitoring points are below the national standards. However, with respect to the IFC / WHO standards noise levels at all points except for R4 exceed the limit values.

The results of the noise modelling revealed the following:

- According to modelling study results, predicted daytime and night-time cumulative noise levels exceed the IFC / WHO standards at R2, R3, R4 and R5 for all scenarios.
- For all scenarios, modelling results show that all daytime and night-time cumulative noise levels at R2 exceed the IFC / WHO standards to much greater extent than the levels predicted for other receptor locations.
- According to the estimated cumulative noise levels potential exceedance of IFC / WHO standards is lower than 3 dBA only for R1, while it is higher than 3 dBA for other receptor points; R2, R3 R4 and R5.
- Modelling results indicate that in terms of national limits, exceedance is estimated at R2, R3 and R4 for Scenario 2 and 3 at evening and night-time periods. For Scenario 2, exceedance (over 10 dBA) is estimated at R2 during daytime, evening and night-

time periods and at R3 and R4 during night-time. Furthermore, with respect to the calculated cumulative noise levels the increase in the baseline noise levels at R2 is estimated to exceed 5 dBA for all scenarios.

- Vibration calculations for the construction phase reveal that safe distance before vibration levels reach the 1 mm/s level is 65 meters for pile driving activities during construction. Thus no impact is expected from constructional vibration as long as necessary precautions are taken and proper warnings are delivered, since there are no identified receptors closer than 65 meters to the Project site.
- Since the formation of the construction area ground is basalt, blasting activity is inevitable for excavation during contruction. Regarding the blasting design 30 m safe distance to the closest sensitive structure (antique waterway) from the blasting region is met on the condition that maximum 3.4 kg explosive use based on the maximum allowable vibration limit of 19 mm/s stipulated in RAMEN for the protection of nearest sensitive and very sensitive structures.

Impact significances are determined based on the methodology given in Chapter 4 and magnitude and sensitivity criteria summarised in Table 10-32 and in Table 10-32.

Table 10-30. Construction Phase Impact Magnitudes

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Noise Impacts due to Site Preparation Activities	Negative Direct	Definition	Considering potential impacts during the Site Preparation Activities (excavation, filling, disposal, construction of temporary facilities such as mobilisation area, etc.) the geographical extent of the impact is expected to be local.	Site preparation activities at the Project site will continue for 6 months during Phase-1, and for 10 months during Phase-2 (i.e., in total for 16 months).	Noise impacts in the region is not estimated to exceed medium intensity since the potential impact is expected to be mostly limited to machinery and equipment in the case that no measures are taken during construction. R1: No impact; R2: Very high; R3: High for the night time and low to medium for the day time depending on the construction components and location (i.e., Terminal Facility construction included or not); R4: Medium to Very high fort he night time and negligible to low for the day time depending on the construction components and location (i.e., Terminal Facility construction included or not); R5: Low to medium for the night time depending on the construction components and location (i.e., Terminal Facility construction included or not), particularly fort he night time, and no impact fort he day time. Taking the worst case scenario into consideration (i.e., night time operation at the highest impact point) Very high	Machinery and equipment will be used during site preparation activities generally in the day-time. Pile driving for the construction of the Associated Facility's Jetty will be done during site preparation activities generally in the day-time	NA	Due to the potential nature and intensity, the relevant impacts are expected to be reversible in the short term when the land preparation is completed.
		Score	Local	Medium	Very High	Recurrent	-	Short-term
		Value	2	3	5	3	-	1

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
	Impact Magnitude (G+D+I+F (or L)) x R		13					
Noise Impacts due to Construction	Negative Direct	Definition	Considering potential impacts during the Construction Activities (civil works, structural works, building works, mechanical, electrical and instrumentation works etc.) the geographical extent of the impact is expected to be local.	Site preparation activities at the Project site will continue for 38 months.	Based on the results of the modeling study, it can be concluded that the IFC / WHO noise limit values will be exceeded during construction phase at the nearest sensitive receptors. Depending on different receptor points the magnitude will change as follows: R1: No impact; R2: Very high for the night time and high for the day time; R3: High for the night time and negligible for the day time; R4: Medium for the night time; R5: Low for the night time. Taking the worst case scenario into consideration (i.e., night time operation at the highest impact point) Very high	Machinery and equipment will be used during construction activities generally in the day-time.	NA	Due to the potential nature and intensity, the relevant impacts are expected to be reversible in the short term when the construction is completed.
		Score	Local	Long	Very High	Recurrent	-	Short-term
		Value	2	4	5	3	-	1
	Impact Magnitude (G+D+I+F (or L)) x R		14					

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Vibration Impacts due to construction Activities	Negative Direct	Definition	Based on the critical distance assessment, the construction vibration levels at nearby sensitive receptors under limit values at 60 m. Considering potential vibration impacts during the Construction Activities (site preperation) the geographical extent of the impact is expected to be local.	Site preparation at the Project site will continue for 6 months during Phase-1 and blasting will be done in this phase.	The most significant vibration sources are expected to be blasting and pile driving activities. Vibration calculations reveal the safe distance before vibration level reach 1 mm/s level (well below the 19 mm/s limit value defined by RAMEN is 65 meters for construction activities (i.e., pile driving). For blasting the design and charge limit calculations are done according to the safe distance for the closest sensitive structure to the blasting region (antique waterway 30 m away from the Project site boundary). Hence, there no impact with high intensity that may create damages to sensitive structures are expected. However, the impact might be still perceivable by the receptors.	Blasting and pile driving will be done during site preparation activities generally in the day-time.	NA	Due to the potential nature and intensity, the relevant impacts are expected to be reversible in the short term when the construction is completed.
		Score	Local	Very-Short	Medium	Recurrent	-	Short-term
		Value	2	1	4	3	-	1
	Impact Magnitude (G+D+I+F (or L)) x R		**10**					

Table 10-31. Vulnerabilities and Receptor Sensitivity

Potential Receptor	Sensitivity		
	Sensitivity Score	Description of the Sensitivity	Sensitivity Value
Residential areas and residential buildings in the vicinity including Kurtpınarı neighbourhood, İncirli, and Karatepe localities.	**High (for Noise and vibration)**	The receptor monitoring locations R1 to R5 described in Section 10.4 are representative points to identify potential noise impact at the closest residential areas. These points are: • R1: Kurtpınar, Karatepe village 1.8 km to the NW of the Project site; • R2: Kurtpınar, Esentepe village 530 m to the SW to the Project site; • R3: Kurtpınar, Esentepe village 680 m to the SW to the Project site; • R4: Kurtpınar, Esentepe village 750 m to the SW to the Project site; • R5: Kurtpınar 1.3 km to the NE to the Project site. Closest point of the blasting region to the Incirli locality is 247m. These areas are all where sensitive receptors are located including education and health facilities.	**5**
Housing facilities of the industrial facilities in the vicnitiy	**Medium (for Noise, no impact expected regarding vibration)**	Additionally, there are housings of surrounding industrial/commercial facilities, including: • Housing facilities of BOTAŞ including, a kindergarden and a primary school to the west of the Project site at approximately 1.8 km; • Housing faiclities of Toros Agri Industrial plant to the east of the Project site at 0.7 km of distance. These areas include commercial and residential areas where residential buildings dominate.	**3**
Industrial Facilities in the surrounding area	**Low (for Noise, no impact expected regarding vibration)**	The surrounding area is dominantly used for commercial/industrial purpose. The closest facilities are as follows: • Ceyhan Petrochemical Industrial Region (CPIR) premises which is planned to be developed with the primary aim of attracting potential investors within the petrochemical sector; • BOTAŞ Ceyhan Marine Oil Terminal to the southwest at approximately 1.5 km and Toros Agri-Industry to the east at approximately 2 km distance to Project site boundaries. BOTAŞ Facility/campus approximately 1.5 km to the west end of the Project site boundaries; • Coal storage facilities to the northwest approximately 2.5 km away from the Project site. These are commercial and industrial areas with low sensitivity to noise impact.	**1**
Agricultural lands	**Low (for Noise, no impact expected regarding vibration)**	Users of the agricultural lands to the west of the Project Site .	**1**
Antique Waterway	**High (for Vibration)**	Waterway extends parallel to the Project site boundary to the N-NW of the site. Closest point of the blasting region to the antique waterway is north-west 30 m sensitive to vibration impact due to potential damage on the structure induced by ground vibration.	**5**
Botaş Pipeline	**Low (for Vibration)**	Closest point of the blasting region to the pipeline is north-west is 205 m	**1**

Table 10-32. Impact Significances for Construction Phase

Potentail Impact	Potential Receptor	Impact Magnitude	Sensitivity	Impact Significance		
				Value	Score	Description
Noise Impacts Due to Site Preparation Activities	Residential areas and residential buildings in the vicinity (represented by receptor monitoring points R2 to R5)	13	5	**65**	**Low**	The intermittent character and short duration of the impact are expected to keep the impact significance low. Additionally, the impact will directly cease with the stoping of the activities.
	Housing facilities of the industrial facilities in the vicinity	13	3	**39**	**Low**	The intermittent character and short duration of the impact are expected to keep the impact significance low.
	Agricultural lands	13	1	**13**	**Negligible**	Such impacts are expected to be insignificant regarding the users of the agricultural lands.
	Industrial Facilities in the surrounding area	13	1	**13**	**Negligible**	The relevant receptors are not expected to be significantly impacted by the noise impact. Furthermore, for industrial facilities impacts are expected to indistinguishable from natural background variations.
Noise Impacts Due to Construction	Residential areas and residential buildings in the vicinity (represented by receptor monitoring points R2 to R5)	14	5	**70**	**Low**	The intermittent character and short duration of the impact are expected to keep the impact significance low. Additionally, the impact will directly cease with the stoping of the activities.
	Housing facilities of the industrial facilities in the vicinity	14	3	**42**	**Low**	The intermittent character and short duration of the impact are expected to keep the impact significance low.
	Agricultural lands	14	1	**14**	**Negligible**	Such impacts are expected to be insignificant regarding the users of the agricultural lands.
	Industrial Facilities in the surrounding area	14	1	**14**	**Negligible**	The relevant receptors are not expected to be significantly impacted by the noise impact. Furthermore, for industrial facilities impacts are expected to indistinguishable from natural background variations.
Vibration Impacts due to	Residential areas and residential buildings in the vicinity	10	5	**50**	**Low**	The design of blasting and the pile driving activities are not expected to create vibration levels above

Potentail Impact	Potential Receptor	Impact Magnitude	Sensitivity	Impact Significance		
				Value	Score	Description
construction Activities	including closest houses in the İncirli locality					the limit values defined by the national legislation.
	Antique Waterway	10	5	**50**	**Low**	The design of blasting and the pile driving activities are not expected to create vibration levels above the limit values defined by the national legislation.
	Botaş Pipeline	10	1	**10**	**Negligible**	No significant vibration impact is expected regarding the Botaş Pipeline.

Based on the results of the modeling study, it can be concluded that the IFC / WHO noise limit values will be exceeded during the construction phase at the nearest sensitive receptors. However, this impact will be temporary and observed only during the construction period. As discussed, the noise modelling study considered operation of all types of equipment and machinery at the same time to assess the worst-case conditions. Considering this approach, the exceedance of background noise levels is expected to be lower than the calculated values.

It is important to note that there may be other noise sources that were not foreseen at this stage and may have an additional impact on noise levels. For this reason, it is important that regular monitoring is conducted, particularly at sensitive receptor points during high noise generating activities including pile driving for the construction of the Associated Facility and during blasting for potential vibration impact to understand whether any changes occur with respect to modelling results.

Operation phase:

The main noise sources during the operational phase include the operation of machinery and equipment in the petrochemical facility (e.g., PDH and PP plant, flares, cooler, gas scrubber, heater, etc.) and the increase in road traffic from the operation of the facility.

In view of the above, in order to predict the impacts of the Project on the baseline background noise conditions, a noise level monitoring and a sound propagation modelling study were conducted as described in detail in the sections above. The results of the noise modelling which were done with the assumption that the condition of operational activities to continue for 24 hours a day, revealed the following:

- Noise modelling study results regarding the operational phase shows that only night-time cumulative noise levels are exceeded in terms of the IFC/WHO standards with the exceedance higher than 3dBA at sensitive receptors R4 and R5;

- In terms of national limits, modelling results indicate that all daytime and night-time cumulative noise levels comply with the limits for all sensitive receptors;
- Vibration calculations for the operational phase reveal that the safe distance before vibration levels reach to 0.14 mm/s level is 11 meters for operational activities. Thus; no impact is expected from operational vibration activities since there are no identified receptors closer than 11 meters to the Project site.

For the operational phase, IFC / WHO noise limit values will be exceeded at the nearest sensitive receptors. There may be other sources that were not foreseen at this stage that may have an additional impact on noise levels. For example, there is no detailed information currently available relating to other potential facilities planned within the CPIR. For this reason, it is important that regular monitoring is conducted, particularly at the sensitive receptor points during the operation phase to understand whether any changes occur with respect to modeling results.

Impact significances are determined based on the methodology given in Chapter 4 and magnitude and sensitivity criteria summarised in Table 10-33 and Table 10-34.

Table 10-33. Operation Phase Impact Magnitudes

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Noise Impacts Due to Operation Activities	Negative Direct	Definition	Considering potential impacts and modelling results during the Operation Activities the geographical extent of the impact is expected to be local.	Noise impacts will continue throughout the life of the project.	The most significant noise sources are expected to be indoor machinery and equipment activities. Modeling results indicate cumulative noise levels may exceed IFC/WHO limit values. The exceedance IFC/WHO limits at R2, R4, and R5 receptor points is identified to be below 5 dBA.	Noise impacts will continue throughout the life of the project.	NA	Due to the potential nature and intensity, the relevant impacts are expected to be reversible in the short term when the land preparation is completed.
		Score	Local	Very-Long	Medium	Continuous	-	Short-term
		Value	2	5	**3**	5	-	1
	Impact Magnitude (G+D+I+F (or L)) x R		**15**					
Vibration Impacts Due to Operation Activities	Negative Direct	Definition	Considering potential vibration impacts during the Operation Activities and modelling results impact is below the limit values at 10 meter so the geographical extent of the impact is expected to be local.	Vibration impacts will continue throughout the life of the project.	The most significant vibration sources are expected to be indoor machinery and equipment activities.	Vibration impacts will continue throughout the life of the project.	NA	Due to the potential nature and intensity, the impacts are expected to be reversible in the short term.
		Score	Project Site	Very-Long	Low	Continuous	-	Short-term
		Value	1	5	2	5	-	1
	Impact Magnitude (G+D+I+F (or L)) x R		**13**					

Table 10-34. Impact Significances for Operation Phase

Potentail Impact	Potential Receptor	Impact Magnitude	Sensitivity	Impact Significance		
				Value	Score	Description
Noise Impacts Due to Operation Activities	Residential areas and residential buildings in the vicinity (represented by receptor monitoring points R2 to R5)	15	5	**75**	**Medium**	The cumulative noise impact (sum of the background and operation-originated noise) calculated by the modelling remains within the national regulatory limit values, however, exceeds the IFC and WHO guideline values. The impact is expected to be below 5 dBA. Hence, medium significance of impact is expected at the sensitive receptors including the closest residential areas.
	Housing facilities of the industrial facilities in the vicinity	15	3	**45**	**Low**	For the receptors with relatively lower sensitivity the impact significance is expected to be low.
	Agricultural lands	15	1	**15**	**Negligible**	Such impacts are expected to be insignificant regarding the users of the agricultural lands.
	Industrial Facilities in the surrounding area	15	1	**15**	**Negligible**	The relevant receptors are not expected to be significantly impacted by the noise impact.
Vibration Impacts Due to Operation Activities	Residential areas and residential buildings in the vicinity including closest houses in the İncirli locality	13	5	**65**	**Low**	The impact intensity is expected to be significantly low based on the vibration modelling results indicating no significant vibration impact beyond 10 m from the Project site. Although the impact might be detectable considering the closest sensitive receptor is located farther than 10 m, impact is expected to be with minimum significance.
	Antique Waterway	13	3	**39**	**Low**	The impact intensity is expected to be significantly low based on the vibration modelling results indicating no significant vibration impact beyond 10 m from the Project site. Although the impact might be detectable considering the closest sensitive receptor is located farther than 10 m, impact is expected to be with minimum significance.
	Botaş Pipeline	13	1	**13**	**Negligible**	Such impacts are expected to be insignificant regarding the Botaş pipeline.

10.9 Mitigation Measures

Construction Phase

The following mitigation measures will be implemented during the construction phase in order to ensure that noise limit values set in the standards are met and the noise impacts are minimised as much as possible:

- ‘Low-noise’ equipment will be used during the construction phase as far as possible. Where construction equipment is provided with sealed acoustic covers or enclosures, the covers will be kept closed whenever the machines are in use.
- Machines will be shut down or throttled down to a minimum when not in operation.
- Maintenance procedures will be implemented in order to keep equipment in good working condition to minimise extraneous noise caused by poor performance.
- Necessary consent will be obtained from Adana PDoEUCC for undertaking construction activities including pile driving activities if planned to conduct during evening and night-time, even if there is no planned noisy activities during evening and night time at this stage.
- Noisy activities taking place within construction sites will be located away from the residential areas and kept short as much as possible. The activities should be conducted only during daytime.
- Noise related to traffic during construction will be properly managed through implementation of a Construction Traffic Management Plan.
- On-site structures such as containers, offices, hoardings will be used to screen sensitive receptors from noise sources as far as possible. Where necessary movable noise barriers (2-2.5 m high) will be used to ensure receptor noise levels are less than the limit values adjacent to noisy activities.
- Nearby communities will be contacted especially prior to pile driving activities to inform them about the timing and duration of piling.
- Awareness will be increased among construction workers regarding noise mitigation.
- A Noise Control and Monitoring Plan will be set up during the construction phase to measure noise levels at the closest sensitive receptors except R1. It is suggested that noise monitoring measurements are conducted monthly in the first 3 months of construction to identify the need for noise barriers. If levels at receptors exceed the standards, the noise monitoring measurements will continue to be conducted monthly and measures will be taken to reduce noise levels so that the limit values are met during all phases of construction. If the results of noise monitoring in the first 3 months of construction are observed to be below limit values, measurements will continue to be

conducted quarterly. It is important to note that noise monitoring may be undertaken more frequently if there is significant number of complaints from stakeholders.

- According to the modelling study, calculations show that the safe distance before vibration levels drops under the 1 mm/s level is 65 meters for construction activities. Thus no impact is expected from constructional vibration as long as necessary mitigations are taken and proper warnings are delivered, since, there will be no receptors closer than 65 meters to the Project site. Vibration levels will be monitored upon a grievance made by the nearby residents and if the standards are exceeded, measures will be taken to reduce vibration.

According to Excavation Design Report prepared for the Project, the following mitigation measures will be taken during the blasting activities during the construction phase in order to minimise environmental and social impact as much as possible:

- In the proposed pre-split blasting design, it is recommended that the pre-split holes are blasted in groups of 5 with a delay of 17 ms between groups in order to minimise environmental disturbances in terms of air shock and noise.
- In the blasting design, "Controlled bench Blasting" is foreseen as a blasting model for the Project in order to enable the use of energy in breaking works without creating seismic waves and without causing environmental impact. In determining the height of the bench, the boom length of the loader machines to be used, the bucket capacities and the amount of charge per delay that should be used are taken into consideration.
- During blasting, it is envisaged that each hole will be detonated separately, thus keeping the charge per delay to a minimum.
- An oblique hole application has been considered in order to ensure that the energy is used in breaking and translation.
- Two-row shots are envisaged in the models. However, it can be applied in 3 or more sequential shot and it will be necessary that each hole be fired at separate delays.
- In terms of controlling environmental impacts, vibration and air shock measurements should be made using vibration meters in adequate quality and quantity during the application.
- Protocols in respect to shots should be duly kept and archived.
- The firing is aimed to be carried out with delayed capsules (without electricity). It will be ensured that the charge per delay is kept to a minimum.
- In terms of environmental impacts it is important to keep the amount of explosives that can explode at a time to a minimum.

- After trial shots, it is anticipated that necessary corrections and renewals will be conducted, taking into account rock behaviour and environmental impacts, and the records will be taken with sufficient number of vibration meters.
- An appropriate public relations program should be developed and the public in close settlements should be informed.

Operation Phase

The following mitigation measures will be taken during the operation phase in order to ensure that noise limit values set in the standards are met:

- ‘Low-noise’ equipment will be used during operation phase as far as possible. Depending on technical suitability, noise generating equipment will be kept in confined spaces to the extent possible.
- Equivalent sound pressure level for 8 hours, superimposed on the existing background noise level, in the work area within the new facilities will not exceed 85 dB(A) at any point 1 meter away from any equipment surface. Sound pressure level in restricted areas, those work areas in the plant where it is not reasonably practicable to reduce the noise level below the work area limit, may be between 85 and 115 dB(A). In all cases, the absolute limit of 115 dB(A) remains valid in such areas. If it is unavoidable that the work area limit will be exceeded around particular equipment, action will be taken to reduce the area involved as much as feasible; this may include the installation of an acoustical enclosure.
- For R4, the major contributors to the total operational noise comprise a large amount and variety of machinery and equipment (for instance; heaters, compressors, pumps, etc.) thus, it is not feasible to reduce the noise at source. In order to overcome noise impact at this receptor 5 dB of noise mitigation measures should be considered. Noise mitigation structures such as noise berms or noise barriers should be considered. Final decisions and detailed design for these mitigation measures will be detailed in Noise Management Plan.
- For R2, major contributor to the total operation noise is Jetty (Associated Facility) machine and equipment. In order to overcome noise impact at this receptor 5 dB of noise insulation measures at source (at machine and equipment itself) need to be achieved. Details of the needed insulation should be ensured and detailed in Noise Management Plan.
- Receptors R2, R4 and R5 will be included in a continuous monitoring noise measurement campaign for the first three years of the operation. Noise measurments will be performed for 24 hours at week and weekend days in order to sustain national and international requirements.

10.10 Residual Impacts

Construction phase noise impacts will be temporary and can be mitigated with the implementation of measures mentioned above. It is expected that the residual impact would be minimised to low and negligible through the mitigation measures. However this will be confirmed based on the results of noise monitoring during construction. Table 10-37 shows the residual impact significances.

Residual impact is expected as “Low” and “Negligible” at nearest receptors by the operation of the facility after implementation of the mitigation measures mentioned Section 10.8 (i.e., buildings with isolated walls, noise berms or noise barriers). Table 10-38 shows the residual impact significances.

Table 10-35. Construction Phase Residual Impact Magnitude

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Noise Impacts due to Site Preparation Activities	Negative Direct	Definition	Considering potential impacts during the Site Preparation Activities (excavation, filling, disposal, construction of temporary facilities such as mobilisation area, etc.) the geographical extent of the impact is expected to be local.	Site preparation activities at the Project site will continue for 6 months during Phase-1, and for 10 months during Phase-2 (i.e., in total for 16 months).	By ensuring the high noise generating activities such as pile driving are performed and heavy machinery are operated during the day-time and by application of the mitigation measures exceedance of the guideline values and national legislative limit values will be prevented and the intensity of impacts will be minimised as much as possible.	Machinery and equipment will be used during site preparation activities generally in the day-time. Pile driving for the construction of the Associated Facility's Jetty will be done during site preparation activities generally in the day-time	NA	Due to the potential nature and intensity, the relevant impacts are expected to be reversible in the short term when the land preparation is completed.
		Score	Local	Medium	Low	Recurrent	-	Short-term
		Value	2	3	**2**	3	-	1
	Impact Magnitude (G+D+I+F (or L)) x R		**10**					

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Noise Impacts due to Construction	Negative Direct	Definition	Considering potential impacts during the Construction Activities (civil works, structural works, building works, mechanical, electrical and instrumentation works etc.) the geographical extent of the impact is expected to be local.	Site preparation activities at the Project site will continue for 38 months.	By ensuring the high noise generating activities are performed and heavy machinery are operated during the day-time and by application of the mitigation measures exceedance of the guideline values and national legislative limit values will be prevented and the intensity of impacts will be minimised as much as possible.	Machinery and equipment will be used during construction activities generally in the day-time.	NA	Due to the potential nature and intensity, the relevant impacts are expected to be reversible in the short term when the construction is completed.
		Score	Local	Long	Low	Recurrent	-	Short-term
		Value	2	4	2	3	-	1
	Impact Magnitude (G+D+I+F (or L)) x R		**11**					

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Vibration Impacts due to construction Activities	Negative Direct	Definition	Based on the critical distance assessment, the construction vibration levels at nearby sensitive receptors under limit values at 60 m. Considering potential vibration impacts during the Construction Activities (site preparation) the geographical extent of the impact is expected to be local.	Site preparation at the Project site will continue for 6 months during Phase-1 and blasting will be done in this phase.	The most significant vibration sources are expected to be blasting and pile driving activities. By the application of the suitable blasting design and use of low vibration generating vehicles and equipment the impact intensity will be minimised as much as possible.	Blasting and pile driving will be done during site preparation activities generally in the day-time.	NA	Due to the potential nature and intensity, the relevant impacts are expected to be reversible in the short term when the construction is completed.
		Score	Local	Very-Short	Low	Recurrent	-	Short-term
		Value	2	1	2	3	-	1
	Impact Magnitude (G+D+I+F (or L)) x R		**8**					

Table 10-36. Construction Phase Residual Impact Significance

Potentail Impact	Potential Receptor	Impact Magnitude	Sensitivity	Impact Significance	
				Value	Score
Noise Impacts Due to Site Preparation Activities	Residential areas and residential buildings in the vicinity (represented by receptor monitoring points R2 to R5)	10	5	**50**	**Low**
	Housing facilities of the industrial facilities in the vicinity	10	3	**30**	**Low**
	Agricultural lands	10	1	**10**	**Negligible**
	Industrial Facilities in the surrounding area	10	1	**10**	**Negligible**
Noise Impacts Due to Construction	Residential areas and residential buildings in the vicinity (represented by receptor monitoring points R2 to R5)	11	5	**55**	**Low**
	Housing facilities of the industrial facilities in the vicinity	11	3	**33**	**Low**
	Agricultural lands	11	1	**11**	**Negligible**
	Industrial Facilities in the surrounding area	11	1	**11**	**Negligible**
Vibration Impacts due to construction Activities	Residential areas and residential buildings in the vicinity including closest houses in the İncirli locality	8	5	**40**	**Low**
	Antique Waterway	8	5	**40**	**Low**
	Botaş Pipeline	8	1	**40**	**Negligible**

Table 10-37. Operation Phase Residual Impact Magnitudes

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Noise Impacts Due to Operation Activities	Negative Direct	Definition	Considering potential impacts and modelling results during the Operation Activities the geographical extent of the impact is expected to be local.	Noise impacts will continue throughout the life of the project.	The most significant noise sources during the operation phase will be operated indoors. Additionally, through the application of the mitigation measures the intensity of the noise impact is expected to be decreased to negligible.	Noise impacts will continue throughout the life of the project.	NA	Due to the potential nature and intensity, the relevant impacts are expected to be reversible in the short term when the land preparation is completed.
		Score	Local	Very-Long	Negligible	Continuous	-	Short-term
		Value	2	5	1	5	-	1
	Impact Magnitude (G+D+I+F (or L)) x R		**13**					
Vibration Impacts Due to Operation Activities	Negative Direct	Definition	Considering potential vibration impacts during the Operation Activities and modelling results impact is below the limit values at 10 meter so the geographical extent of the impact is expected to be local.	Vibration impacts will continue throughout the life of the project.	The most significant vibration sources are expected to be indoor machinery and equipment activities. Additionally, through the application of the mitigation measures the intensity of the vibration impact is expected to be decreased to negligible.	Vibration impacts will continue throughout the life of the project.	NA	Due to the potential nature and intensity, the impacts are expected to be reversible in the short term.
		Score	Project Site	Very-Long	Negligible	Continuous	-	Short-term
		Value	1	5	1	5	-	1
	Impact Magnitude (G+D+I+F (or L)) x R		**12**					

Table 10-38. Residual Impact Significances for Operation Phase

Potentail Impact	Potential Receptor	Impact Magnitude	Sensitivity	Impact Significance	
				Value	Score
Noise Impacts Due to Operation Activities	Residential areas and residential buildings in the vicinity (represented by receptor monitoring points R2 to R5)	13	5	**65**	**Low**
	Housing facilities of the industrial facilities in the vicinity	13	3	**39**	**Low**
	Agricultural lands	13	1	**13**	**Negligible**
	Industrial Facilities in the surrounding area	13	1	**13**	**Negligible**
Vibration Impacts Due to Operation Activities	Residential areas and residential buildings in the vicinity including closest houses in the İncirli locality	12	5	**60**	**Low**
	Antique Waterway	12	3	**36**	**Low**
	Botaş Pipeline	12	1	**12**	**Negligible**

10.11 Summary of Analysis Outcome

The assessment of noise impacts that will be generated during the construction and operation phases of the Project are presented in this Chapter. The assessment included: (i) baseline environmental noise level measurements at five locations; and (ii) noise modeling study for construction and operation phases. Based on the baseline measurements and modeling study, cumulative noise levels were calculated.

Based on the results of the modelling study, it can be concluded that IFC / WHO noise limit values will be exceeded during the construction phase at the nearest sensitive receptors except for R1, creating an increase in baseline noise level by more than 3 dBA. For the operation phase, it is also found that the IFC / WHO noise limit values will be exceeded by more than 3dBA at all nearest sensitive receptors at night-time only, except for R1 and R3.

In general, mitigation reagrdin best practice such as regular maintatnce of the noisty equipments, proving a sufficient distance between sensitive receptors and noisy activities (i.e. location of the electricity generators, pumps and motors etc.), contrcution planning of noisy activities, and training of the workers etc. are considered sufficient for minimization of the noise. Additionally, regular monitoring of noise is necessary to understand the effectiveness of the mitigations.

Vibration calculations for the construction phase reveal that the safe distance before vibration levels reach the 1 mm/s level is 65 meters for construction activities. Thus no impact is expected from constructional vibration activities as long as necessary precautions are taken and proper warnings are delivered, since there are no identified receptors closer than 65 meters from the Project site. On the otherhand, blasting as the major construction activity, have risks in terms of Health and Safety. Ih general, impact calculations shows that implementation of the mitigations provided in Subsection 10.9, will minimize the risk. However, continuous monitoring of vibration and noise are required to understand the real impact and to perform perecousitons in time.

Similarly to construction phae, vibration calculations reveal that the safe distance before vibration levels reach 0.14 mm/s level is 11 meters for operational activities. Thus no impact is expected from operational vibration activities since there are no receptors closer than 11 meters from the Project site. Additionally, potential vibration impacts from blasting are estimated to be negligible as long as the blasting designs developed for the Project to protect the nearby sensitive receptors are followed.

CEYHAN PROPANE DEHYDROGENATION - POLYPROPYLENE PRODUCTION PROJECT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT

(CHAPTER-11)

FEBRUARY 2023

ANKARA

CEYHAN PROPANE DEHYDROGENATION - POLYPROPYLENE PRODUCTION PROJECT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT

Version	Revision	Date	Prepared By	Quality Management By	Checked By		Approved By
Draft	A.0	March 2021	Açelya Duman (2U1K)	Esra Okumuşoğlu (2U1K)	D. Emre Kaya (2U1K)	Simon Taylor (RINA)	Elif Doğru (RINA)
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ABBREVIATIONS

BIL	BOTAŞ International
BOTAŞ	Turkish Petroleum Pipeline Company
BTC	Baku-Tbilisi-Ceyhan Crude Oil Pipeline
Ceyhan PDH-PP Project / Project	Ceyhan Propane Dehydrogenation - Polypropylene Production Facility and Jetty Project
Ceyhan PP A.Ş. or Project Company	Ceyhan Polipropilen Üretim A.Ş.
CPIR	Ceyhan Petrochemical Industrial Region
CPIR Port	Raw Material Supply, Storage and Port Facility Project
DWT	Deadweight tonnage
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
HCM	Highway Capacity Manual
LOA	Length Overall
LPG	Liquified Petroleum Gas
NE	Northeast
NNE	North-northeast
O.G.	Official Gazette
OIZ	Organized Industrial Zone
PS	Performance Standards
SE	Southeast
SSE	South-southeast
SW	Southwest
TC	Traffic count
TUIK	Turkish Statistical Institute
VLCC	Very Large Crude Carriers

11 TRAFFIC

11.1. Introduction

This chapter describes the potential terrestrial and marine traffic impacts during the construction and operation phases of the Ceyhan Propane Dehydrogenation - Polypropylene Production Facility Project and Project associated facility.

The Project does not have a marine part. A separate Terminal Facility including a jetty will be constructed to supply raw materials to the Project. The Terminal Facility will operate exclusively for the Project. Therefore, the Terminal Facility is considered as a Project associated facility (see *Chapter 2: Project Description)*.

The following are discussed in this chapter:

- Existing terrestrial and marine traffic conditions and transportation infrastructure;
- Future road network and transportation infrastructure planning for the region and Project Area vicinity;
- Future developments and marine transportation planning in the region;
- Expected traffic volume during the construction and operation phases of the Project and associated facilities.

The assessment is based on the information from the following sources:

- Official Website of General Directorate of Highways (www.kgm.gov.tr) for road network and traffic values for state roads and motorways in and around Adana province;
- Official Website of Ministry of Transportation and Infrastructure (https://atlantis.udhb.gov.tr/istatistik/) for maritime statistics based on administrative borders of Port Authorities;
- Turkish Statistical Institute (TUIK) (www.tuik.gov.tr);
- Terrestrial Traffic Study conducted for Ceyhan PDH-PP Project, prepared by HARTEK Harita Teknoloji İnşaat ve Dış Tic. Ltd. Şti (HARTEK) (17 September 2020);
- A vessel manoeuvring risk assessment and modelling study (Adana Ceyhan Port Modelling Report) prepared by Maritime Faculty, Dokuz Eylül University (10 August 2020).

The Project Company assigned HARTEK Harita Teknoloji İnşaat ve Dış Tic. Ltd. Şti (HARTEK) to undertake a terrestrial traffic assessment study in order to establish the existing baseline conditions and assess future increase in the traffic loads related to the Project and associated facility (jetty & storage facility) activities during both construction and operation phases. These studies were carried out on the date that the Jetty and storage facilities were included in the scope of the Project, and are currently considered as associated facilities within the scope of the Project Environmental and Social Impact Assessment (ESIA). The assessment identified the traffic conditions in the study area as well as the planned developments to be undertaken to improve the transport system in the region. The study area for the traffic assessment in this chapter covered the Project site, its vicinity as well as the entire Adana province.

Considering the marine traffic assessment, the Project Company assigned experts from Maritime Faculty, Dokuz Eylül University in order to conduct risk assessment and modelling regarding vessel manoeuvring for "Raw Material Supply, Storage and Port Facility Project (CPIR Port)" Project. Adana Ceyhan Port Modelling Report was prepared by Maritime Faculty, Dokuz Eylül University on 10 August 2020. Risk assessment and modelling regarding vessel manoeuvring were undertaken within the scope of the study of the CPIR Port Project. The study was performed in three stages: i) 3-D Site model development, ii) Preliminary modelling, and iii) Modelling considering the size of the CPIR Port next to the Project site, number of berths, variety of vessels to be served. In this ESIA study, Jetty, which will provide raw materials to the Project, is considered as the associated facility according to IFC PS1. The Jetty that forms the Marine Section of Ceyhan PDH-PP Project subject to assessment in this Environmental and Social Impact Assessment (ESIA).

11.2. Legal Context

The Project will comply with the following national regulations to mitigate the potential traffic impacts of the Project on Terrestrial Section and Marine Section.

Public Health Law (No. 1593)
(Official Gazette date/no: 06.05.1930/1489);
Zoning Law (No. 3194)
(Official Gazette date/no: 09.05.1985/18749);
Law on Ports (No: 618);
Law on Industrial Region (No. 4737)
(Official Gazette date/no: 19.01.2002/24645);
Coastal Law (No. 3621)
(Official Gazette date/no: 17.4.1990/20495);
Public Health Law (No. 1593)
(Official Gazette date/no: 06.05.1930/1489);
Regulation on Workplace Opening and Working Permission
(Official Gazette date/no: 10.08.2005/25902).

In addition to the European Union Directives, European Bank for Reconstruction and Development (EBRD) Performance Requirements and International Finance Corporation (IFC) Performance Standards, and well as General Environmental, Health and Safety Guidelines will also need to be followed.

IFC's General EHS Guidelines on Community Health and Safety highlight the Traffic Safety as one of the major issues to be assessed and provide mitigation measures for relevant risk mitigation. Transport of Hazardous Materials is also highlighted in the same EHS Guideline as another subject of concern for the risk minimisation from the project activities. Furthermore, IFC's General EHS Guidelines on Construction and Decommissioning highlight the Traffic Safety as one of the major issues to be assessed and provide mitigation measures for relevant risk mitigation.

Of particular relevance to this Project is the IFC's 2016 Enviromental, Health and Safety Guidlines: Industry Sector Guidelines. Details are given below:

- Environmental, Health, and Safety Guidelines for Shipping;
- Environmental, Health, and Safety Guidelines for Fish Processing;
- Environmental, Health and Safety Guidelines for Petroleum-based Polymers Manufacturing

Along with the PSs (Performance Standards, detailed in Chapter 3: *Institutional and Regulatory Framework*), the IFC guidelines detail provisions of the performance standards. Particularly relevant to this Project are IFC PS1: Assessment and Management of Environmental and Social Risks and Impacts and IFC PS4: Community Health, Safety, and Security.

Equator Principles (EP), IFC and EBRD request mitigation measures to manage risks in Projects and give relevant requirements/directions on how to do this. Turkish regulatory framework requirements follow the guidance documents and provide mitigation measures.

11.3. Terrestrial Part of the Project and Associated Facility

11.3.1. Baseline Conditions

Adana is the sixth biggest city in Turkey in terms of population, with a total of 2,237,940 inhabitants living within the city limits. The most densely populated district among the fifteen districts of Adana is Seyhan which represents approximately 35.6% of the total population of the city. Other populated districts of Adana are Yüreğir (414,574), Çukurova (376,390) and Sarıçam (181,610). Ceyhan district, where the Project Area is located, is the fifth biggest district in Adana in terms of population, with 160,977 inhabitants.

Roadway

The City has a number of main roads providing access from city centre to the districts as well as to neighbouring cities; Adana Osmaniye Road (D-400), Adana Ring Road (E-90) and intercity and existing roads within the urban setting. Seyhan River separates the city in the north-south direction. A low-density residential area has been developed to the south side of the city centre while high density area prevails to the north of the city.

The city of Adana falls within the jurisdictions of 57th Adana Branch, within 5th Regional Directorate of General Directorate of Highways-Mersin, which has an area of responsibility of 61,683 km^2 including Adana, Gaziantep, Hatay, Mersin, Kahramanmaraş, Kilis and Osmaniye and partially Malatya, Kayseri, Adıyaman provinces. The road network includes 141 km of motorway, 438 km of state roads and 453 km of provincial roads (i.e. 1,032 km in total) as reported in the official website of General Directorate of Highways for Adana and illustrated in Figure 11-1 and Figure 11-2. The annual average daily traffic volumes on the state roads and on the motorways within and around Adana province are shown in Figure 11-3 and Figure 11-4, respectively. As it can be inferred from the high daily traffic volumes, state roads and motorways play a significant role in transportation scheme of Adana:

- Figure 11-2 shows that connections between Adana city centre and its districts as well as neighbouring cities create moderate to high traffic volume (i.e., between 10,000-19,999 vehicle/day). Moreover, connections between Adana to Mersin and Adana to Ceyhan at certain parts of the roads are indicated with high traffic volumes (i.e., above 20,000 vehicle/day). Connection between Ceyhan district and Project Area is indicated as having moderate traffic volume (i.e., above 6,000 vehicle/day);
- In Figure 11-3, on the other hand, it can be seen that Adana Ring Road and Adana Şanlıurfa Motorway is significantly used by vehicles; especially towards the east and west direction of the city centre.

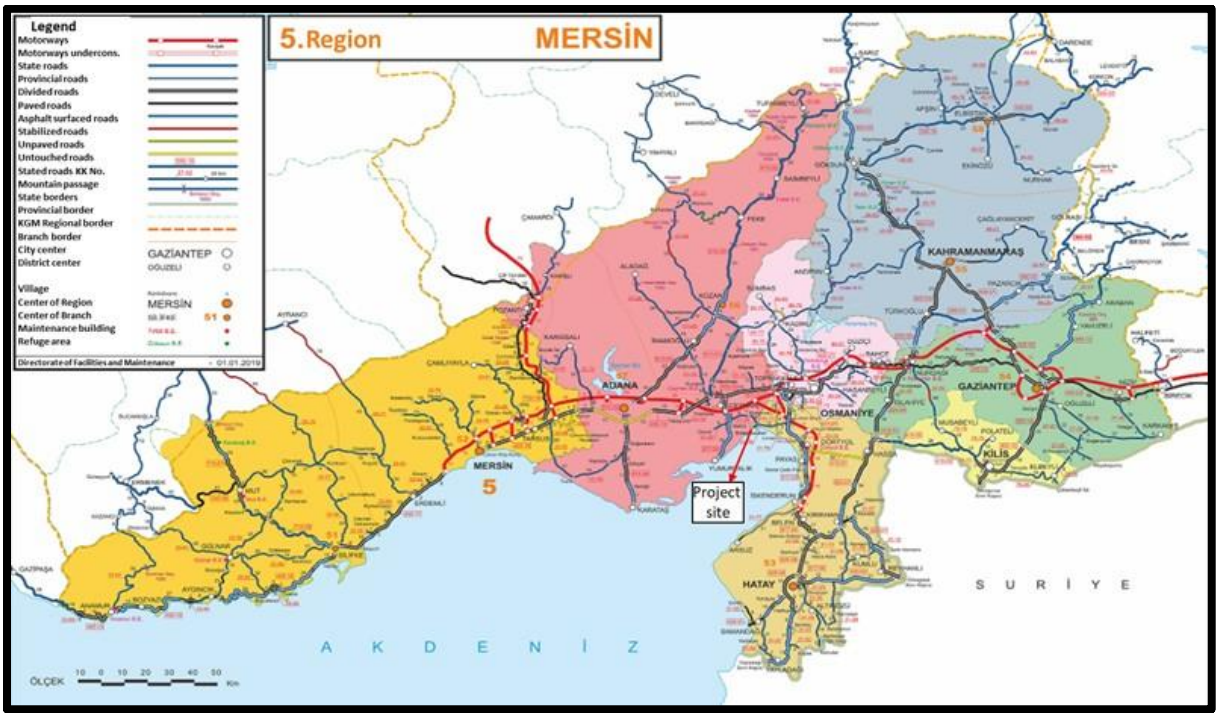

Figure 11-1. Regional road network – Mersin (Source: Official website of General Directorate of Highways[1])

[1] https://www.kgm.gov.tr/SiteCollectionImages/KGMimages/Bolgeler/5Bolge/Iller/5BolgeIller.jpg

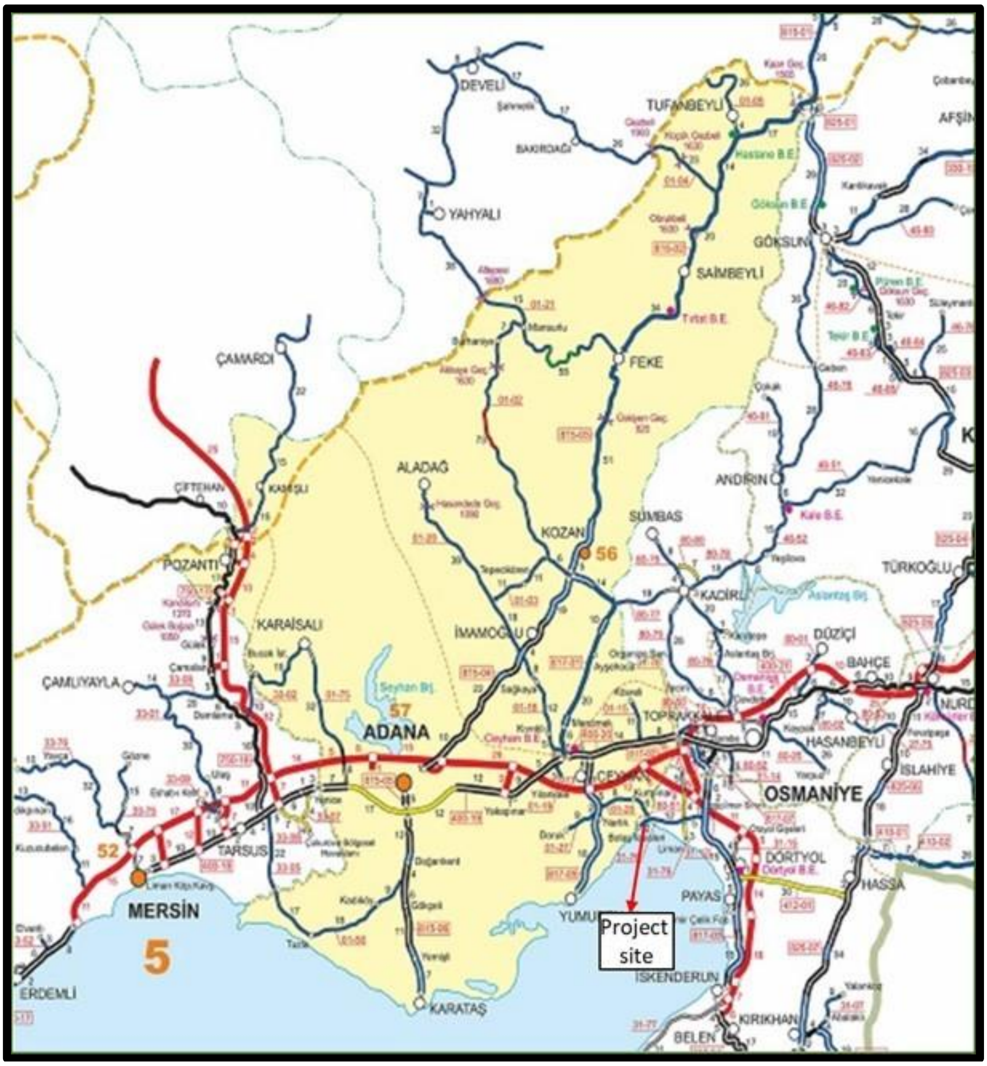

Figure 11-2. Road network in Adana Province (Source: Official website of General Directorate of Highways[2])

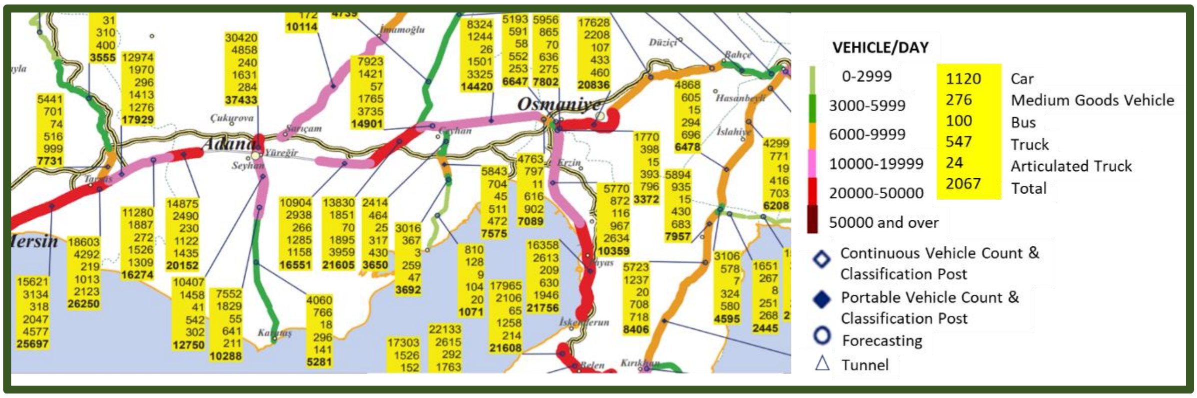

Figure 11-3. Daily traffic values (annual average) on state roads in and around Adana Province (Source: 2019 Motorways and State Roads Traffic Flow Map, General Directorate of Highways, Department of Traffic Safety, Division of Transport Surveys[3])

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[2] https://www.kgm.gov.tr/Sayfalar/KGM/SiteTr/Bolgeler/5Bolge/Iller/IlAdana.aspx

[3] https://www.kgm.gov.tr/SiteCollectionDocuments/KGMdocuments/Istatistikler/TrafikveUlasimBilgileri/19TrafikUlasimBilgileri.pdf

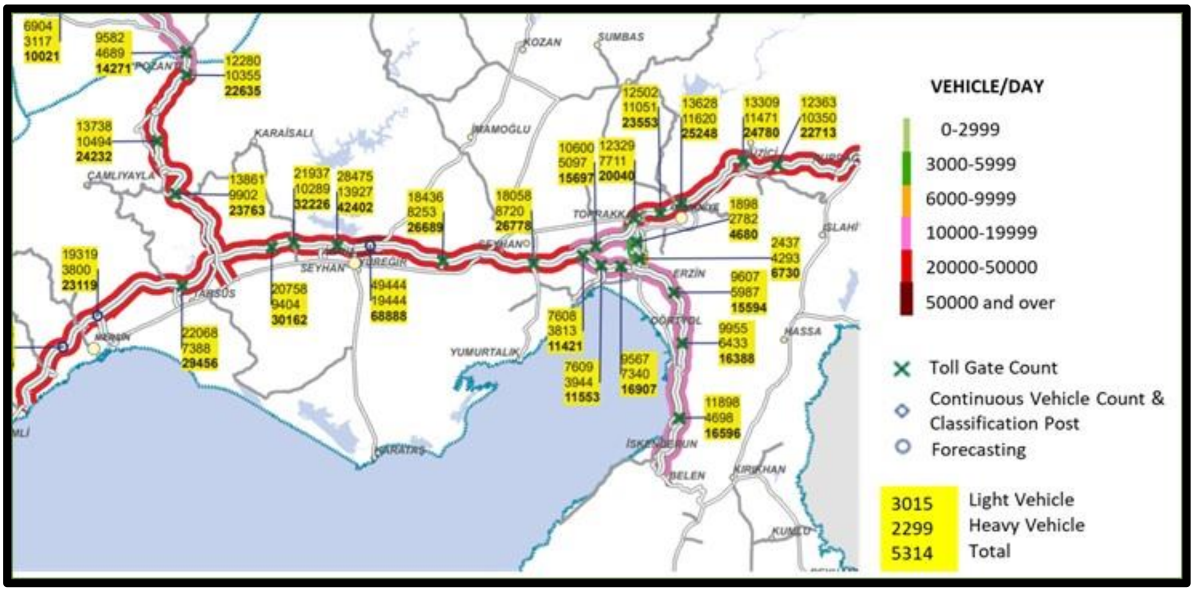

Figure 11-4. Daily traffic values (annual average) on motorways in and around Adana Province, (Source: 2015 Motorways and State Roads Traffic Flow Map, General Directorate of Highways, Department of Traffic Safety, Division of Transport Surveys[4])

The Project Area is located to the south of the E90 Motorway (i.e., Adana-Şanlıurfa Road) which has 6 lanes (2 direction with 3 lanes) and D-400 (Adana - Osmaniye Road) and to the southwest of the E91 Motorway (i.e., Ceyhan-Iskenderun Road) which has 4 lanes (2 direction and 2 lanes). There are two main junctions providing access to the Project Area which are Ceyhan Junction to the northwest and Free Trade Zone Junction to the northeast of the Project site. There are a number of alternative routes to access the Project site:

- From the centre of Adana province, it is possible to access the Project Area by following D400 (Adana-Osmaniye Road) until the intersection with D817 Highway (Ceyhan-Yumurtalık Road). After turning towards the D817 Highway, the Project Area can be reached through:
    - Alternative 1: D817 Highway and Ceyhan-Erzin Road and then following Ceyhan Dörtyol Road to reach to the Project site;
    - Alternative 2: D817 Highway until Ceyhan Junction, then following E90 Motorway until Iskenderun Junction and E91 Motorway until Free Trade Zone Junction (which has 2x2 width). Finally, Ceyhan-Iskenderun Motorway and Free Trade Zone Connection Road is followed to reach to the Project site;
- Adana Airport and Adana Bus Terminal are located in the city centre. The access from the Airport and Bus Terminal to the Project Area can be provided by following the aforementioned routes; and

[4] http://www.kgm.gov.tr/SiteCollectionDocuments/KGMdocuments/Trafik/trafikhacimharitasi/2015HacimHaritalari/1.4.14.BOLGE.pdf

- From the surrounding cities (i.e., Mersin, Osmaniye, etc.), it is possible to reach to the Project Area by following D400 Highway.

The road network around the Project Area is illustrated in Figure 11-5. The access to the Project Area is illustrated in a closer view in Figure 11-6.

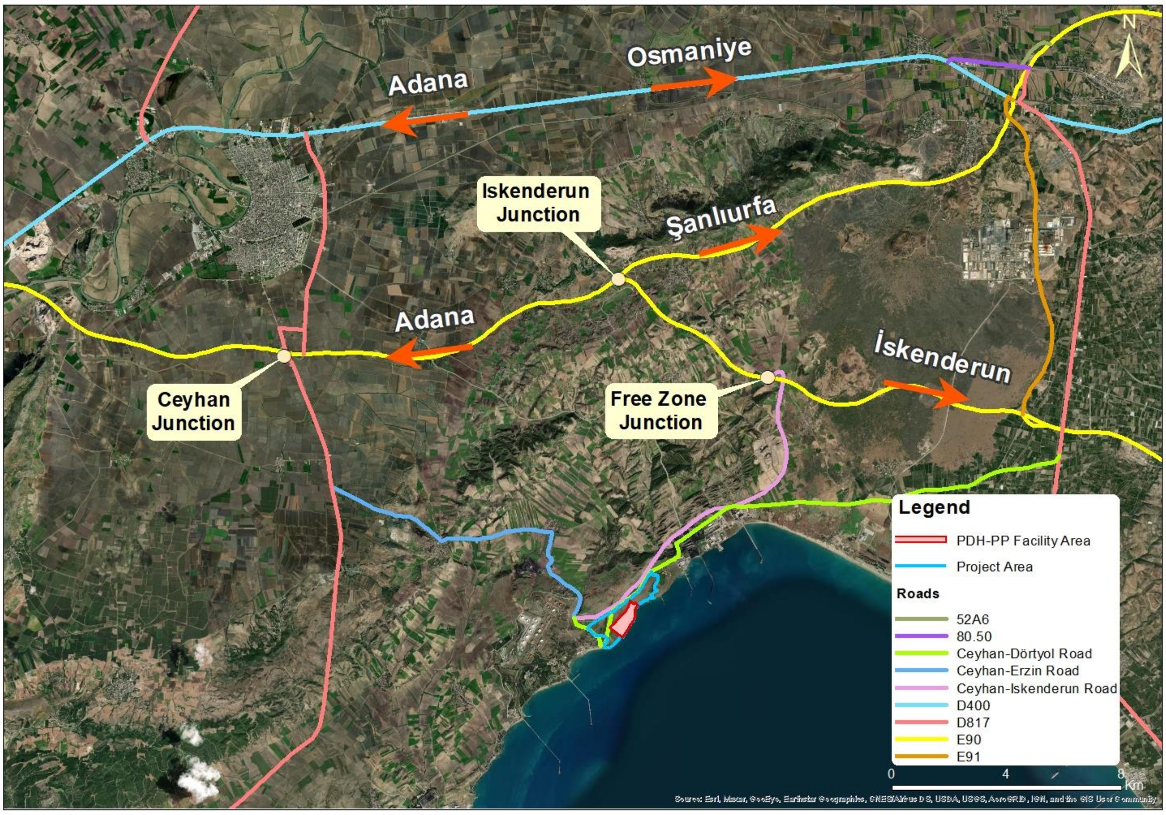

Figure 11-5. Road network around the Project site

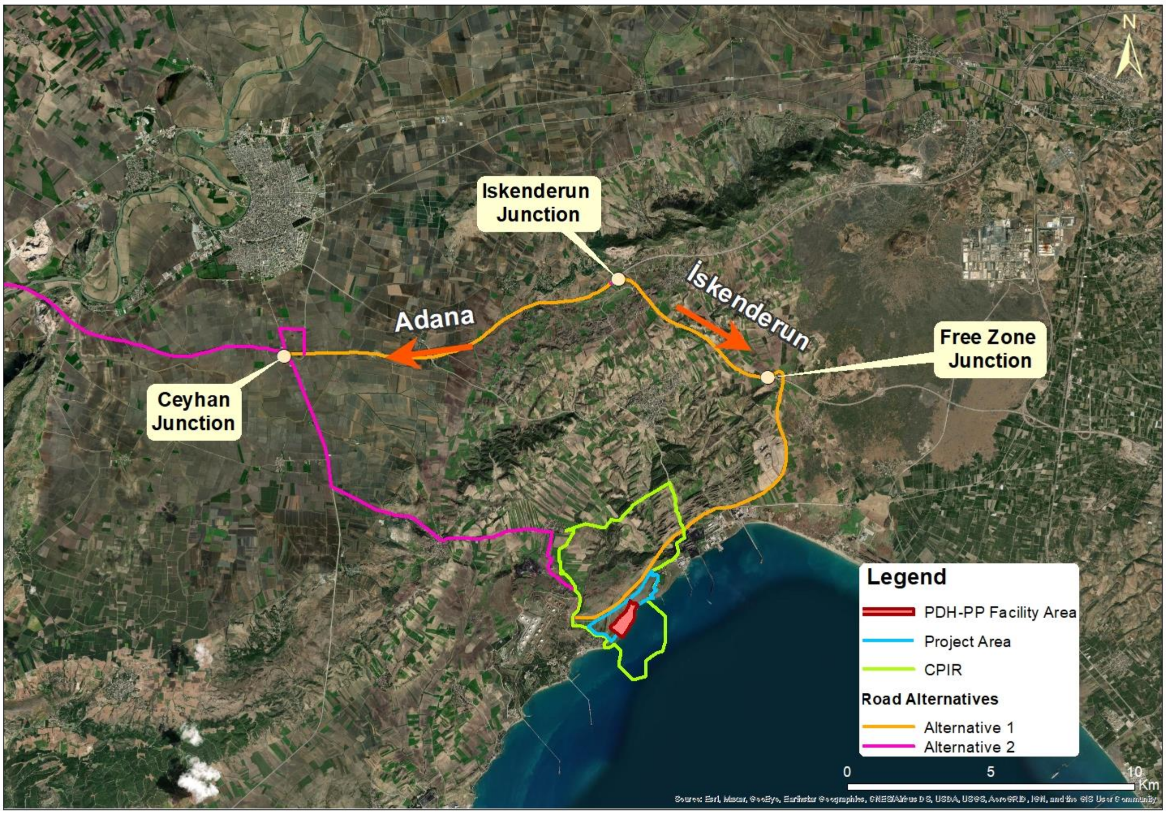

Figure 11-6. Access to the Project site

Public transportation is also available for the Project site. However, according to the information obtained during the social survey conducted on 10-12th February 2020 within the scope of the stakeholder engagement activities, the frequency of the buses operating between Ceyhan district and Project Area (via Kurtkulağı, Kurtpınarı, İncirli neighbourhoods) was low.

Although there are planned road developments in Adana province, such as Adana South Ring Road which is approximately 29 km long with 6 lanes (2 direction and 3 lanes), there is no traffic master plan prepared yet by the relevant public authorities (e.g., Adana Metropolitan Municipality or Directorate General of Highways). The construction phase of the road development was initiated on 11.08.2016. It is anticipated that the traffic density in the city centre will be reduced with the development of the Adana South Ring Road. Also, it is of great importance in terms of providing transit vehicle passage[5].

Railway

Since 2003, the existing railway network has been renovated throughout the country. As of 2012, the railway network has been renovated in Çukurova Region as reported in the Çukurova Regional Plan (2014-2023) prepared by Çukurova Development Agency. The railway network extends for 231 km in Adana province. Annually, 4,355,978 passenger and 225,314 tons of

[5] https://www.uab.gov.tr/uploads/cities/adana/01-adana.pdf

cargo are transported, mainly in Mersin, Kahramanmaraş and Hatay provinces.[6]. The main railway network is shown in Figure 11-7.

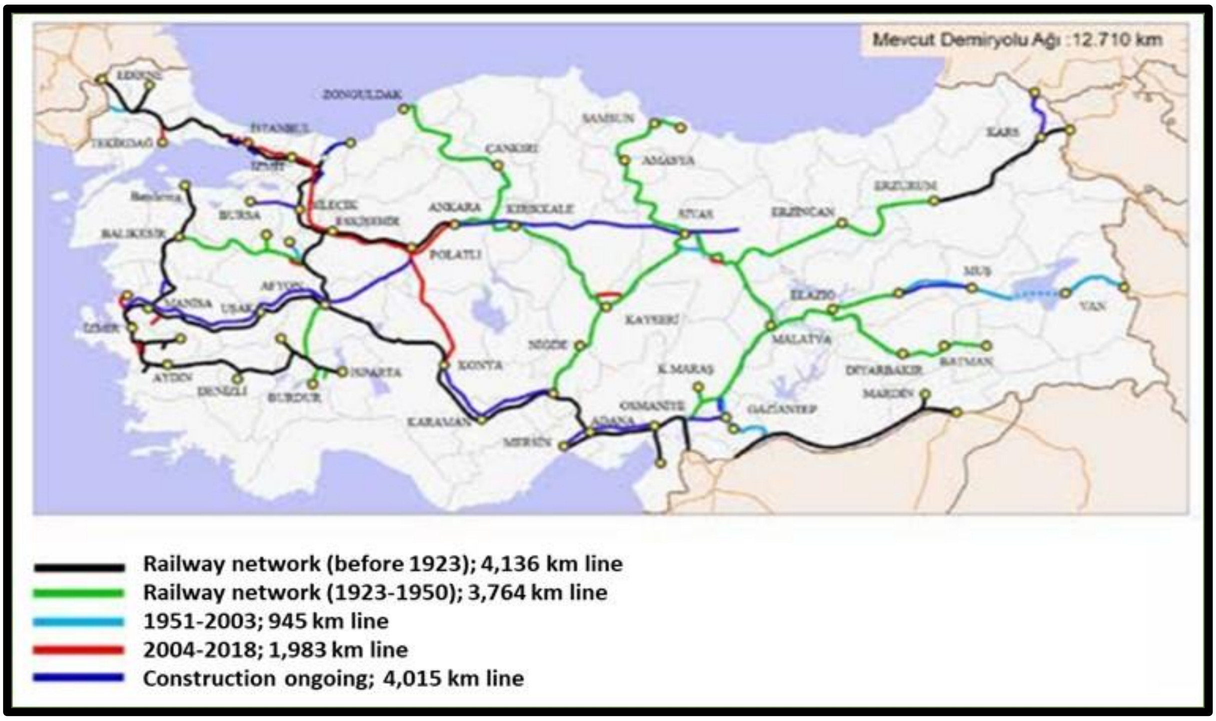

Figure 11-7. Railway Network[7]

The objective of the new railway project (i.e., Çukurova Region and İskenderun Bay Railway Connection Project), proposed by the Ministry of Transportation and Infrastructure to connect Çukurova Region with İskenderun Bay, which is planned for cargo and passenger transportation, will provide wider opportunities for import and export operations. The new railway project will include four lanes within the scope[8]. The railway will start from the existing Erzin Station and then continue parallel to the Toprakkale-Iskenderun Railway Line about 1,900 m to the south and continue to the West and end at Adana Yumurtalık Free Trade Zone. Two new stations are planned on this line (one is located to the north of Yukarıburnaz and the other is located in Yumurtalık Free Zone). Additionally, Organized Industrial Zone (OIZ)-Port Line is planned to be developed which will provide connection between Osmaniye OIZ and the new port to be located in Yukarıburnaz. Two new stations are planned on this line. Moreover, there will be two new lines providing connection between 1st and 2nd Line and OIZ-Port Connection Line.

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[6] Transportation and Telecomunication for Adana, 2003-2019, prepared by Ministry of Transportation and Infrastructure.

[7] https://www.uab.gov.tr/uploads/pages/demiryolu/demiryolu.pdf

[8] Cukurova Region and Iskenderun Bay Railway Connection Project Environmental and Social Impact Assessment Report.

11.1.1 Terrestrial Traffic Study

Traffic Counts

A traffic impact assessment study was carried out by HARTEK for the Project and associated facility in July, 2020. The study included site observations, traffic data (counts/assumptions) as well as information provided by the Project Company. Traffic counts (TC) were conducted at three locations as defined below and illustrated in Figure 11-8 to assess peak traffic volume during the day:

- TC-01: The location where Ceyhan Erzin Road and Iskenderun Motorway and Free Trade Zone Connection Road merges (approximately 0.9 km northwest to the northern boundary of the Project site);
- TC-02: The junction where Iskenderun Motorway and Free Trade Zone Connection Road merges with connection road to Ceyhan-Dörtyol Road (approximately 1.15 km northeast to the eastern boundary of the Project site);
- TC-03: The junction where connection road merges with Ceyhan-Dörtyol Road (approximately 0.9 km northeast to the eastern boundary of the Project site).

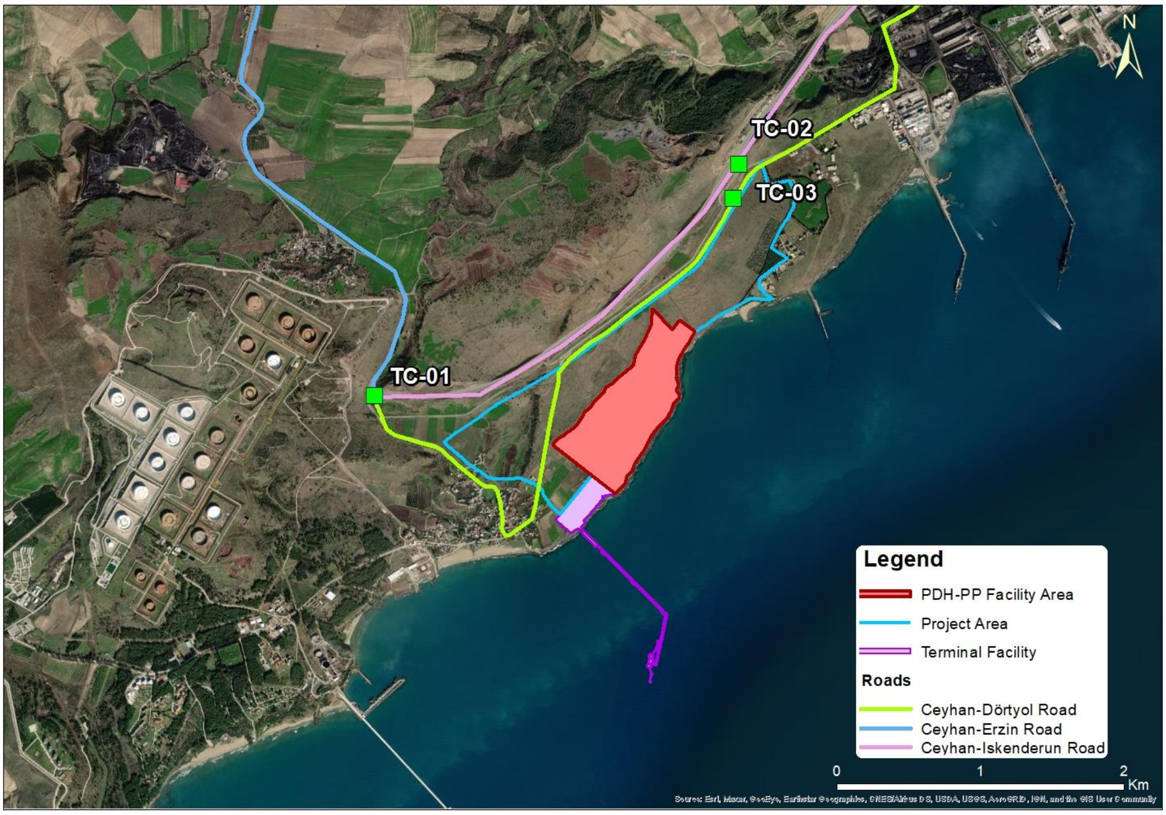

Figure 11-8. Locations for Traffic Counts

Traffic counts were performed on 20th July 2020 (Monday) within three different timeframes in a day; i) morning counts between 07:00-09:00, ii) noon counts between 12:00-14:00, and iii) evening counts between 17:00-19:00. Video records were kept during traffic counts and peak hours were identified through video records. The traffic directions were determined and collected data were converted to unit car values. Peak values for each junction were determined for four consecutive periods representing the highest counts. The following conversion ratios were used during the calculations: 1 for automobile/panel van, 1.5 for minibus, 2 for midibus, 2.5 for bus/truck, 3 for lorries and 0.5 for motorbikes. Each of junctions, where the traffic counts (TC-01, TC-02 and TC-03) were performed has three arms as illustrated in Figure 11-9 and Figure 11-10.

Figure 11-9. Directions regarding traffic flow for TC-01

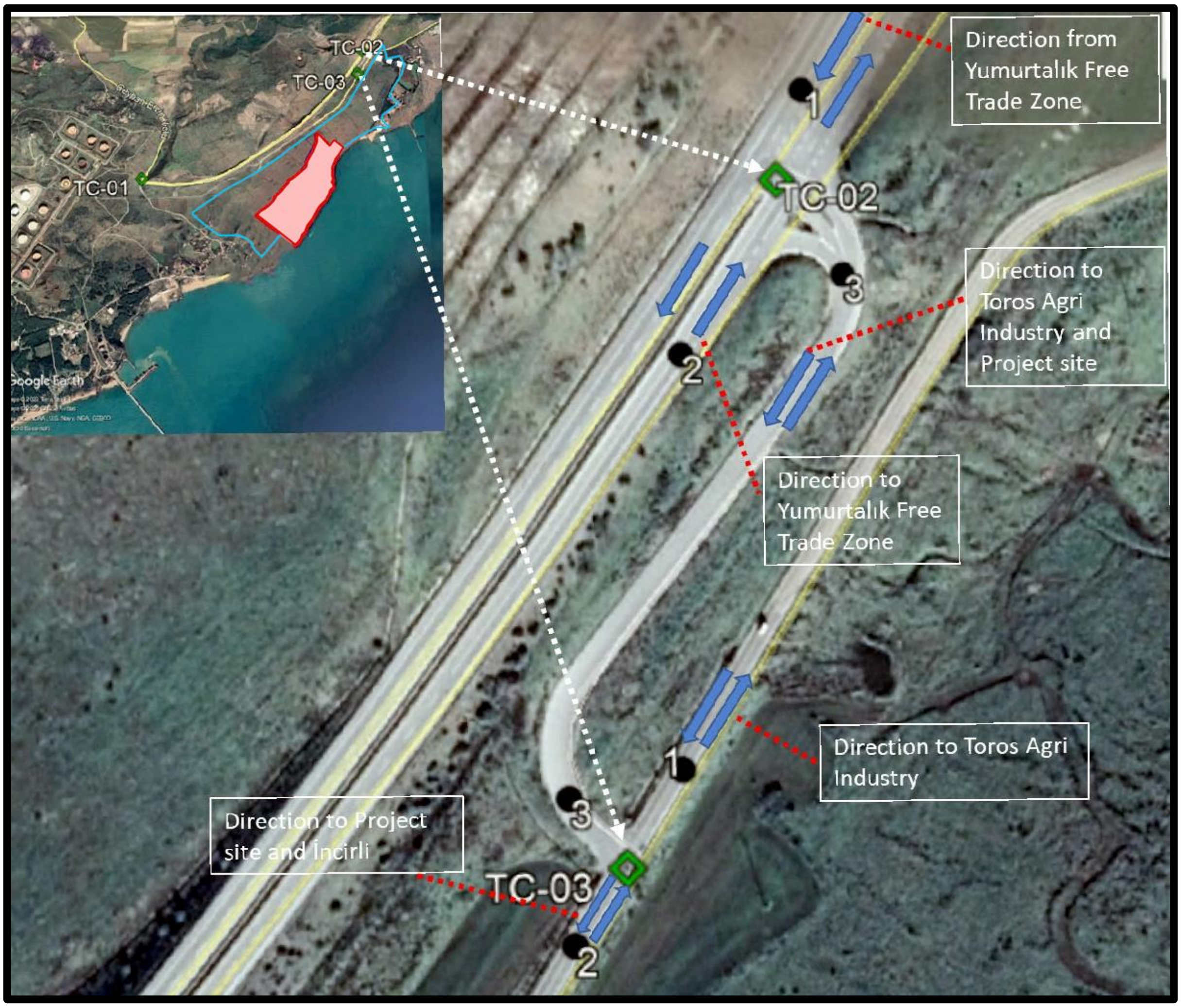

Figure 11-10. Directions regarding traffic flow for TC-02 and TC-03

The following results were obtained at the traffic count locations and associated traffic volume is illustrated in Figure 11-11. The detailed traffic count scheme as well as the directions and routes of vehicles are presented in Annex H of this ESIA Report.

TC-01:

Morning peak hour occurs between 07:30 and 08:30; whereas noon peak hour occurs between 12:00-13:00 and evening peak hour occurs between 17:30 and 18:30;

Total traffic volume at the junction (TC-01) was counted as 185 unit-vehicles during morning hours (07:30-08:30). The highest traffic volume was observed at arms #1 and #3;

62 out of the 98 total vehicles coming from the Kurtpınar Neighborhood direction turned to east direction (#3 arm) and 36 of the total vehicles continued to south direction (#2 arm); whereas 56 out of 57 total vehicles coming from #3 arm continued to Kurtpınarı neighbourhood direction (#1 arm) during morning hours;

Total traffic volume at the junction (TC-01) was counted as 149 unit-vehicles during noon hours (12:00-13:00). Similar to the morning peak hour, the highest traffic volume was observed at #1 arm (89 unit-vehicles) during noon peak hour;

Total traffic volume of the junction (TC-01) was counted as 162 unit-vehicles during evening hours (17:30 and 18:30). Similar to the morning peak hours, the highest traffic volume was observed at arms #1 and #3. 58 out of 63 vehicles (from #3 arm) continued to Kurtpınarı Neighborhood direction. Total number of vehicles that continued to Kurtpınarı Neighborhood direction was recorded as 93 (35 vehicles coming from İncirli direction);

Most of the traffic volume is generated by minibuses, automobiles/panel van. Trucks/buses (other than public buses)/trailers constitute small portion of the total traffic volume.

TC-02:

Total traffic volume at the junction (TC-02) was counted as 197 unit-vehicles during morning hours (07:30-08:30);

Morning peak hour is between 07:30 and 08:30; whereas noon peak hour is between 12:00-13:00 and evening peak hour is between 17:00 and 18:00;

The highest traffic volume was observed at arms #1 and #2 during morning peak hours.

48 out of 98 total vehicles coming from the Yumurtalık Free Trade Zone direction (through arm #1) turned to south direction (towards arm #3) whereas 42 of the total vehicles continued to the west direction (through arm #2). On the other hand, it was recorded that 37 out of 63 total vehicles coming from the opposite direction [through arm #2) turned to south direction (towards arm #3) whereas 31 of the total vehicles continued through arm #1;

Total traffic volume of the junction (TC-02) was counted as 114 unit-vehicles during noon hours 12:00-13:00. Highest traffic volume during noon peak hour recorded at arm #2;

Approximately 90% of the total vehicles coming from arm #2 continued to east direction (through arm #1);

Total traffic volume at the junction (TC-02) was counted as 129 unit-vehicles during evening hours (17:00 and 18:00). The main traffic volume was observed at arm #1 during evening peak hours;

78% of the total traffic volume coming from the east direction through arm #1 continued towards the west direction (through #2). A total of 47 vehicles came through the arm #3 (from the south direction); the traffic flow leaving the junction is evenly balanced between east and west direction (through arms #2 and #3);

Most of the traffic volume is generated by minibuses, automobiles/panel van. Trucks/buses (other than public buses)/trailers constitute small portion of the total traffic volume.

<u>TC-03:</u>

Morning peak hour is between 07:30 and 08:30; whereas noon peak hour is between 12:00-13:00 and evening peak hour is between 17:00 and 18:00;

Total traffic volume at the junction (TC-03) was counted as 156 unit-vehicles during morning hours (07:30 and 08:30). The main traffic volume is observed at arm #3 during morning peak hours;

During morning peak hour, 46 of the total vehicles (out of 81 unit-vehicles) continued towards east (Toros Agri Industry) and 35 to west (İncirli) direction;

Total traffic volume at the junction (TC-03) was counted as 84 unit-vehicles during noon hours (12:00-13:00). Highest traffic volume during noon peak hour was recorded at arm #1. 26 unit-vehicles of the traffic volume (70%) coming from arm #1 direction continued towards İncirli Direction (through arm #2); whereas 11 unit-vehicles (30%) continued towards the north direction (through #3);

Total traffic volume at the junction (TC-03) was counted as 107 unit-vehicles during evening hours (17:00 and 18:00). Highest traffic volume during evening peak hour was recorded at arm #1. According to the traffic counts, traffic flow is evenly balanced between north and west direction (through arms #3 and #2, respectively);

It can be said that most of the traffic volume is mainly generated by minibuses, automobiles/panel van. On the other hand, trucks/buses (other than public buses)/trailers constitute a small portion of the total traffic volume.

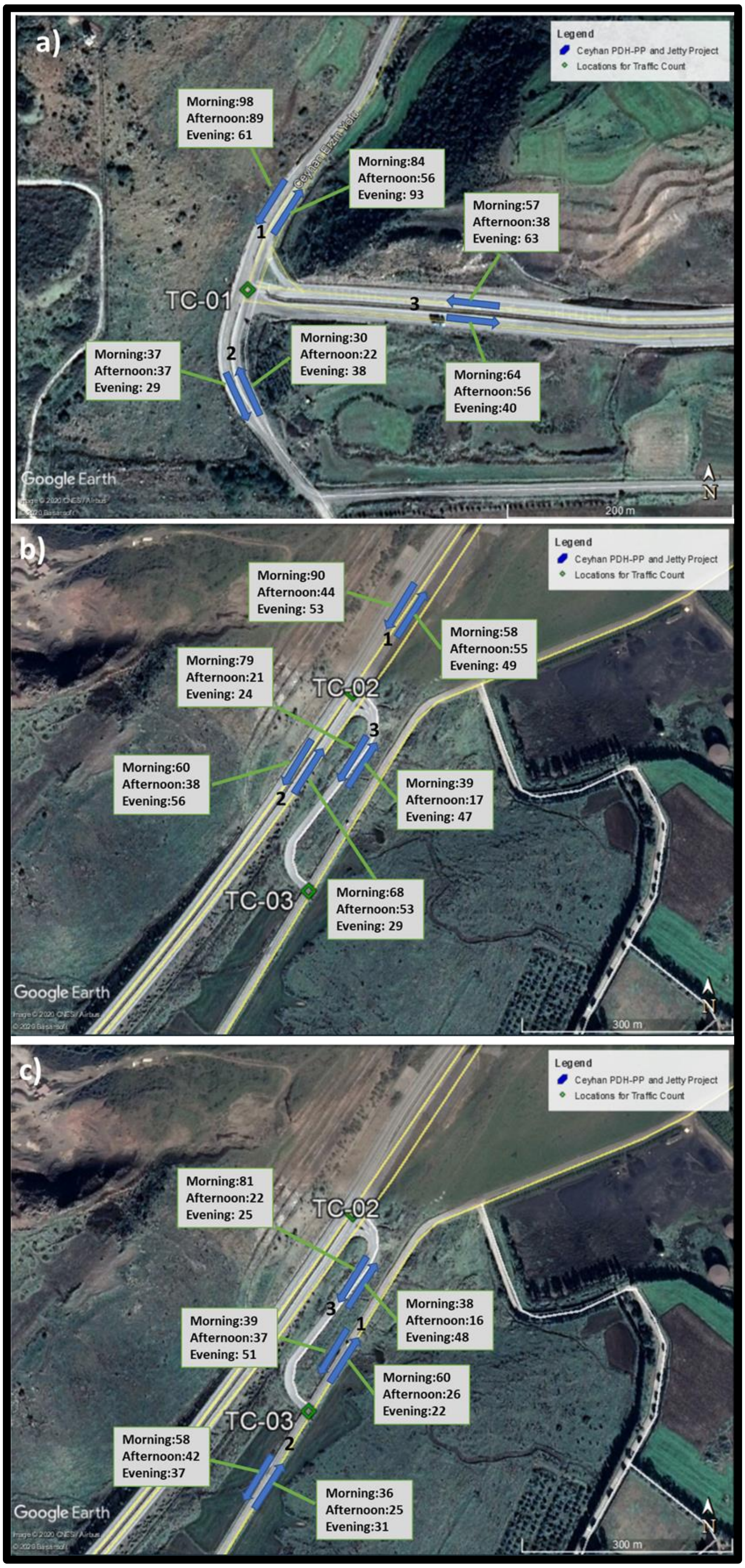

Figure 11-11. Morning, noon and evening peak hour traffic volume for a) TC-01, b) TC-02 and c) TC-03

Analysis of Baseline Traffic Load and Future Developments

The Project Area is located in the vicinity of major industrial settings. The Project Area neighbours Turkish Petroleum Pipeline Company (BOTAŞ) Ceyhan Marine Oil Terminal which is the terminus for Baku-Tbilisi-Ceyhan Crude Oil Pipeline (BTC) Project to the southwest at approximately 1.5 km and Toros Agri-Industry to the east at approximately 2 km distance to Project Area boundaries. To the west of the BOTAŞ Ceyhan Marine Oil Terminal, a coal fired thermal power plant (İsken Sugözü Thermal Power Plant) is located approximately 9 km to the southwest of the Project site. Yumurtalık Free Trade Zone is located to the east of Toros Agri-Industry at approximately 3.5 km to the Project site. Detailed information on the residential setting and existing and planned industrial developments in the region are presented in *Chapter 5: Land Use and Zoning*.

Baseline information on the existing facilities and planned developments were obtained through consultations with the representatives of the surrounding industrial facilities within the scope of the traffic impact assessment study by HARTEK. Reportedly:

There are currently 1,200 employees working in Yumurtalık Free Trade Zone and 75-85% of the employees are commuting from Ceyhan District. Approximately 500-600 heavy vehicles travel to Yumurtalık Free Trade Zone on a daily basis while 550 cars enter the zone daily.

Approximately 450-500 employees are currently working in Toros Agri Industry. The public housing and social facilities of Toros Agri Industry do not have the capacity to host all of the employees. Reportedly, 80% of the employees commute from Ceyhan District and approximately 50 cars travel to Toros Agri Industry daily. The facility provides shuttle services for the employees (4 buses, 4 midi-buses and 4 minibuses).

As discussed above, the Project is planned to be developed in the premises of Ceyhan Petrochemical Industrial Region (CPIR including Port). CPIR is planned to be developed with the primary aim of attracting potential investors in the petrochemical sector. Reportedly, approximately a total of 40,000 and 10,000 personnel is expected to be employed during construction phase (~10 years) and operation phase of the CPIR Project, respectively. Ceyhan PDH-PP Project will be one of the first investments to be realized within the CPIR. Additionally, there are other organized industrial zones (i.e., Ceyhan and Erzin OIZs) planned in the region. According to the information obtained through the consultations held within the scope of the traffic impact assessment study, the quality and standard of the Sarımazı village road is planned to be enhanced by the EPC Contractor (implementation of the measure is to be monitored by the Project Company), provided that the flow is be provided through that route.

Reportedly, construction activities have not been initiated for Ceyhan OIZ yet, whereas the construction activities have recently started for Erzin OIZ for which daily 900 heavy vehicle traffic is expected. In the light of the above mentioned baseline information, it is anticipated that approximately 35,000 employees will be occupied in the region considering the capacity increases/planned establishments in Yumurtalık Free Trade Zone (reaching 25% occupancy rate) and completion of planned developments. Once the planned railway is completed and capacity of the existing public transportation network (i.e., buses) is increased, it is assumed that 35-40% of the employees will be using public transport. The rest of the transportation is expected to be provided through shuttle services (45%) and private cars (10-15%). In summary, it is anticipated that daily 2,900 heavy vehicles, 900 shuttle services and 2,820 private cars (including visitors, guests, local residential use and seasonal use for the beaches) will be added to the baseline traffic load. These calculated numbers are based on potential increase due to completion of new establishments and assuming the 25% capacity increase. Apart from the assessment of the existing and planned facilities considering their current capacities/personnel and traffic volume that will be created during their operations, the existing and planned road developments were identified and included in the assessment. The operational and planned road network are shown in Figure 11-12.

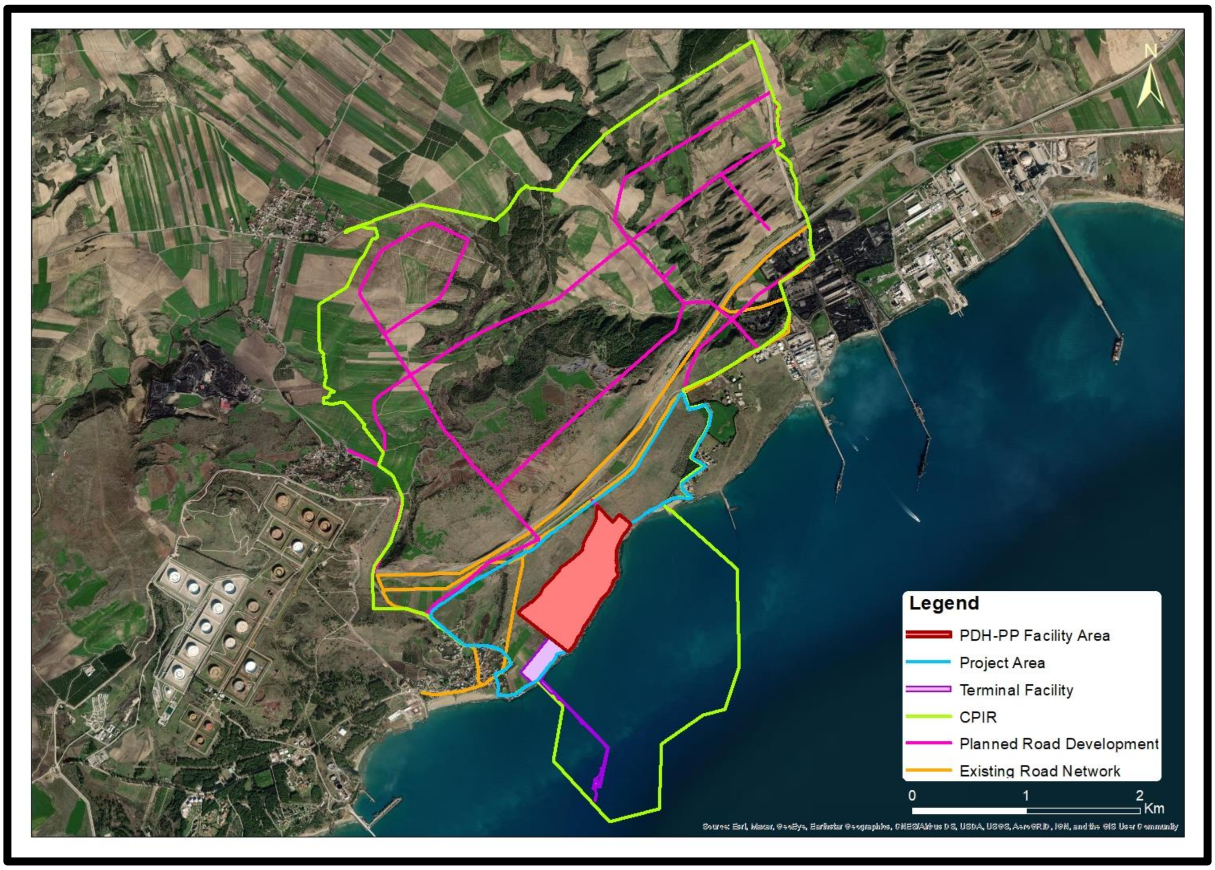

Figure 11-12. Existing and planned road network/developments in close surrounding of the Project

Junctions on the zoning roads are expected to be in the form of roundabouts. It is reported in the Traffic Study prepared by HARTEK that based on site observations necessary signalization for the existing road network is not available yet. Therefore, simulation tests were applied without signalization conditions.

Simulation Study

In order to determine traffic demand considering the direction and destination locations, two main directions (one to the east; one to the west) were determined as source of traffic flow based on the findings of the traffic counts, consultations and site observations. The directions are shown in Figure 11-13.

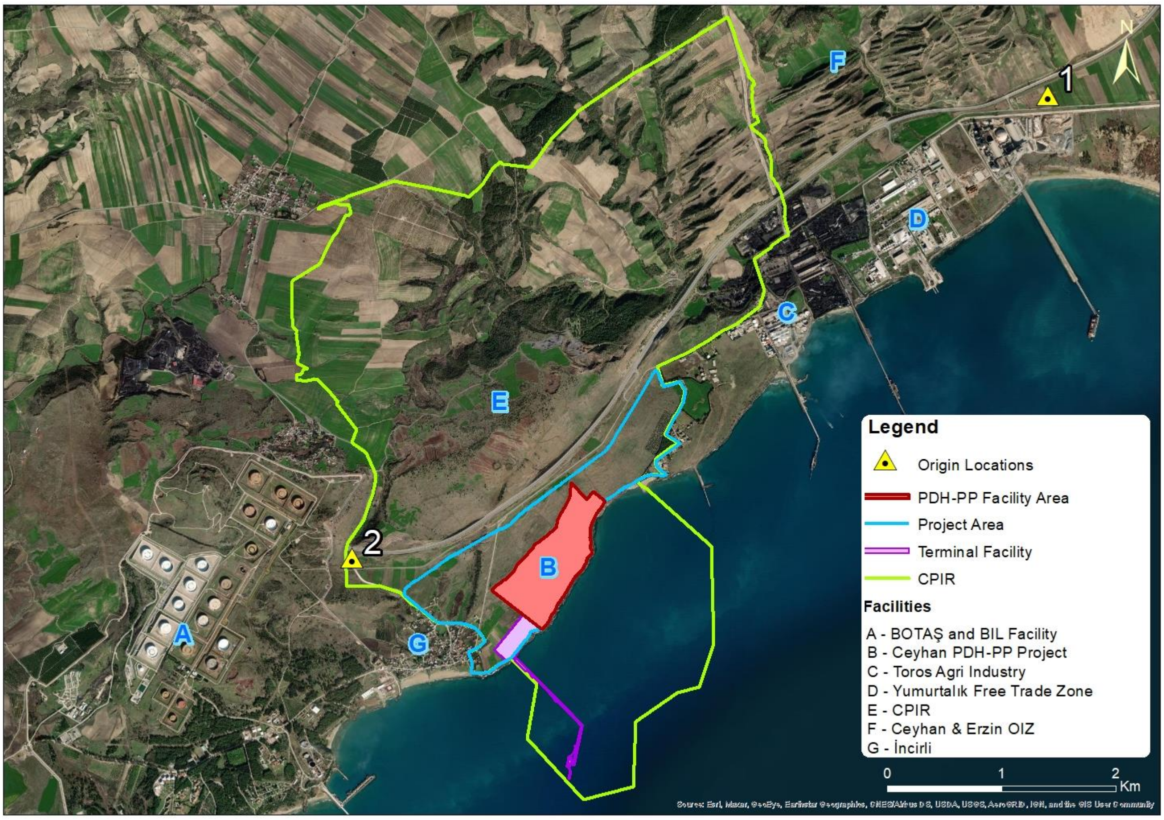

Figure 11-13. Directions determined for the main traffic flow of the Project Area and associated facility (origin locations are indicated with numbers #1 on the east and #2 on the west)[9]

As part of the Traffic Study, a traffic simulation was carried out in order to identify baseline conditions and determine impacts related with traffic load expected to be generated based on the planned developments and future expansions. PTV Vissim 2020 program was used during the simulation study. Heavy vehicles were included in the simulation study instead of using unit vehicle conversions and shuttle services were classified as "1.5 private cars" considering that there are a number of major industrial developments in the region. The simulation study was performed for morning peak hour (07.30-08:30). Due to the industrial nature of the region, it was assumed that similar traffic load will be observed during evening hour on the traffic in the opposite direction.

[9] Approximate locations of the nearby facilities and planned developments are shown in the figure. Since traffic flow from planned Erzin and Ceyhan OIZ are expected to be from the same direction, Ceyhan and Erzin OIZ are indicated with letter F as a destination location.

Considering the existing facilities, the planned Project, and the associated facility of the Project daily 2,900 heavy vehicles, 900 shuttle services and 2,820 private cars (including visitors, guests, local residential use and seasonal use for the beaches) are expected to increase traffic load.

These numbers are based on potential increase due to completed new establishments and assuming the 25% capacity increase. The breakdown of the anticipated traffic volume was also obtained based on the following conditions:

66% of daily shuttle service journeys are expected during morning peak hours whereas the remaining is expected to occur during noon and evening shifts (valid for the facilities working in three shifts); considering the continuous operation of the facilities (operating in three shifts), heavy vehicle traffic volume is assumed to continue approximately 20 hours a day (decreases during evening hours);

Considering the industrial nature of the region, the traffic load resulting from heavy vehicles of the Project is assumed to be 5% of the heavy vehicle traffic load during peak hours;

40% of private vehicle journeys are expected during peak hours (i.e., both during morning and evening peak hours as they are assumed to create same amount of traffic);

It is assumed that traffic volume (in the incoming direction) during morning peak hours as a result of personnel movement will be similar to the opposite/return direction during evening peak hours; it is assumed that the traffic volume to be generated by heavy vehicle movements will be similar during the rest of the day (i.e., 18 hours).

Considering the number of industrial developments/facilities in the region, unit vehicle conversion was not applied for heavy vehicles. The following conversion rates are used; 1 for automobile/panel van, 1.5 for minibus (shuttle service), 2 for midi-bus (shuttle service, private/public buses). Speed limits are assumed 50 km/h for private cars and 25 km/h for heavy vehicles.

As a result of the simulation studies, it is found that the traffic flow will occur in a controlled way and the flow will have optimum speed, time of delay and number of stops. The results of the simulation study for the whole transport network of the Project and associated facility are presented in Figure 11-14 and results of the simulation study are provided in Table 11-1 below.

Table 11-1. Results of simulation study – Delays During Morning Rush Hour

Duration at Morning Rush Hour (7:30 - 8:30)	Average Speed on Road (km/h)	Average delay per vehicle due to decrease in speed [a, b] (sec)	Number of stop per vehicle (#)	Average delay per vehicle as a result of stops [d] (sec)[10]	Total Delay (sec)
0-3600 sec	45.12	19.47	0.02	0.11	19.58

a) Delay: It is an important criterion for the performance of intermittent flow system. Main criteria for the determination of the level of performance on the junctions is the control delays which is the sum of delays caused by the presence of the traffic controls;

b) Control delay includes time related with slowdown of the vehicles before junctions, stops and their related time spending, movements in queue and gaining speed;

c) Stops result in delays, fuel consumption and costs associated with vehicle wear. It is important to assess the number of stops during evaluation of the performance and calculation of the costs related with road use. The average number of stops is the number of stops divided to total number of vehicles;

d) Average delay per vehicle as a result of stops shows the portion of the average delay per vehicle which is caused by stops.

There is a total of nine (9) different locations (including junctions and their associated arms) determined and selected on the total transportation network for the simulation study. Locations of the selected junctions are illustrated in Figure 11-14 below.

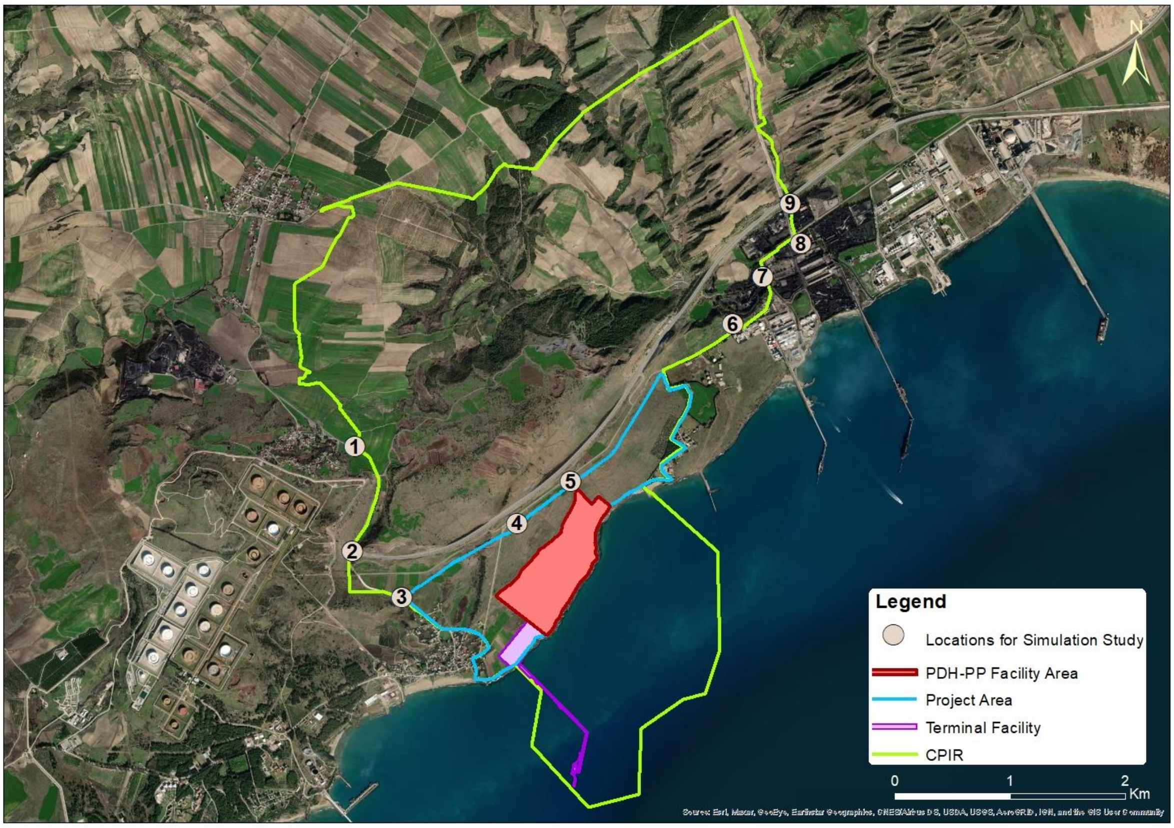

Figure 11-14. Position of the locations and associated arms assessed in the simulation study

[10] Average delay per vehicle as a result of stops shows the portion of the average delay per vehicle which is caused by stops.

Average delays are calculated for each determined location and thereby, service performance of the junctions and their associated arms are calculated accordingly. Highway Capacity Manual (HCM)[11] standards, which are accepted nationally and internationally, were used for the determination of service performances. The categorization of delays in line with the HCM Standards is presented in Table 11-2 and the categorization of each Location/Junction is in Table 11-3.

Table 11-2. Categorization of delays

Duration	Categorization
0-10 sec	A
10-20 sec	B
20-35 sec	C
35-55 sec	D
55-80 sec	E
80 sec and above	F

Table 11-3. Categorization of the locations

Location (See Figure 11-14 for locations)	Categorization	Delay (sec)
Location 1 - CPIR West Junction	A	0.6
Location 2 – BOTAŞ and İncirli Junction (North)	A	0.4
Location 3 – BOTAŞ and İncirli Junction (South)	A	0.8
Location 4 – CPIR South Junction	A	0.8
Location 5 – Train Station	A	0.4
Location 6 – CPIR East Junction	A	0.4
Location 7 – Toros Agri Industry Junction	A	0.2
Location 8 – Yumurtalık Free Trade Zone West Junction	A	0.6
Location 9 – Sarımazı Neighborhood Road Junction	B	10.5

It is reported that the main traffic movement at TC-01 includes shuttle services (i.e., BOTAŞ personnel shuttle services) during morning hours; on the other hand, the main traffic movement at TC-02 is from east (Erzin) to west (BOTAŞ direction). The main traffic movement during noon is from east (Yumurtalık Free Trade Zone and Toros Agri Industry) to west (İncirli).

According to the traffic counts and site observations made within the scope of the Traffic Study by HARTEK, it was understood that vehicles coming from Kurtpınarı direction and reaching TC-01, prefer to continue parallel to Ceyhan İskenderun Motorway and Free Trade Zone Connection Road and make a u-turn and continue to İncirli direction through the road that traverses the Project Area rather than moving directly to the south from TC-01 due to the stability of the road (illustrated in Figure 11-15). The vehicles that prefer the abovementioned route are mainly BOTAŞ shuttle services, heavy vehicles, public buses and long vehicles.

[11] The Highway Capacity Manual (HCM) is a publication of the Transportation Research Board of the National Academies of Science in the United States.

Therefore, it is recommended in the Traffic Study that the quality of the road (from BOTAŞ to Kurtpınarı neighbourhood through İncirli) to be improved by the EPC Contractor in order to decrease traffic to be affected by the construction activities of the Project (implementation of this measure is to be monitored by the Project Company).

On the other hand, it is also recommended that the best feasible option will be the construction of the planned road developments prior to the industrial developments in the region. Additionally, it is recommended that a signalization control shall be provided by the EPC Contractor (to be implemented in collaboration with the Project Company and supervised by the Project Company) at the location where Ceyhan Erzin Road ends up in İncirli to continue in the direction of the BOTAŞ Facility (to the west of BOTAŞ Port Authority).

The approximate location of the signalization control is indicated in Figure 11-15.

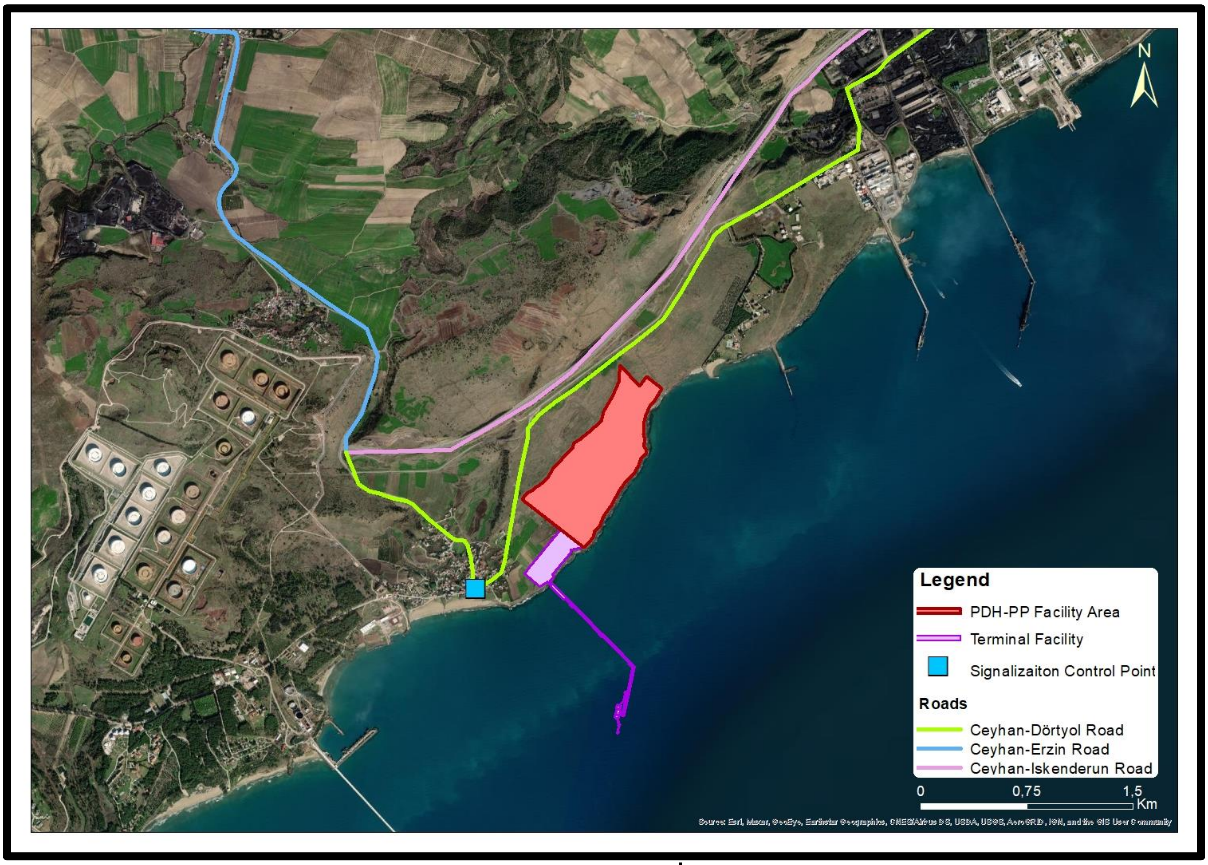

Figure 11-15. The preferred traffic movement to access İncirli (blue line is an unstable road providing access to İncirli; green line indicates the preferred access to İncirli; blue square is the recommended signalization control point)

In the current situation, Ceyhan-Erzin road divides the village into two different parts. The primary recommendation is to ensure that this road becomes safer in terms of traffic flow conditions (the measures are to be implemented by the EPC Contractor and monitored by the Project Company). The complete list of recommendations is presented in Section 11.6.

It is assumed that approximately 35,000 personnel will be employed in the region, provided that the existing facilities continue their operation and planned developments (as previously mentioned) become operational. The current operational road network which has already four lanes of paved road (2 direction x 2 lines) has sufficient capacity to carry the current traffic volume. Although the carrying capacity of one lane during dense traffic condition decrease to 600 vehicle, 800 to 900 vehicle/lane/day of capacity can be achieved when the average speed is increased. Therefore, it is reported in the Traffic Study that there will be no problem with the capacity of the existing roads.

The planned roads (as shown in Figure 11-12) are designed as 40 m x 25 m which can be established to have 2 x 3 lanes. It is assumed that the total capacity of the road for one direction will be designed to carry 2,000 vehicles/day. It is concluded that the planned roads will provide qualified and safe access to the region. Moreover, it is assumed in the simulation study that almost half of the total number of employees will use public transport (buses and train). For this reason, any delay in the development of planned road will cause lost time during personnel transfer between collection locations (i.e., train station, bus stop, etc.).

In case the construction phases of the Project and planned OIZs will be undertaken simultaneously, the capacity of the existing transportation network is found sufficient. However, it is reported that Project Company should take necessary mitigation measures for community health and safety considering the proximity of İncirli to Project area.

11.1.2 Traffic Management during Construction Phase

A Construction Traffic Management Plan will be prepared by the Project Company prior to construction phase of the Project. Construction Traffic Management Plan will include detailed safety measures for the activities related to (i) internal traffic management and personnel working on site, (ii) traffic management outside the Project Area and use of access roads, (iii) entrance and exit gates, (iv) regular trainings and health and safety induction, (v) regular maintenance of vehicles and roads and (vi) interactions with local public and their safety.

Toros Tarım Primary School and residential areas are located in the close surrounding of the Project site. The Construction Traffic Management Plan will set out measures to manage off-site traffic in order to minimize the impacts on the specified sensitive receptors (i.e., schools and residential areas) in the vicinity. The mitigation measures are listed in Section 11.6. The construction material required for the Project will be transported to the site via existing roads from selected suppliers. Additionally, there will be added traffic generated due to the transportation of the excavation material in the case that excess excavation material is required to be transferred to an offsite disposal facility or filling material are brought to the Project Area from licensed borrow pits depending on the characterization of the material. Considering the above, the average daily number of vehicles to be used during construction phase of the Project and Project' s associated facilty is 60 trucks (maximum 6 trucks/hour), 15 trailers (maximum 2 trailers/hour), 4 lorries (maximum 1 lorry/hour) and 100 cars (maximum 40 cars/hour). The excavation and filling works will be required to be undertaken for 7-8 months. It is concluded in the Traffic Study that the capacity of the transportation network (which is indicated in green and blue in Figure 11-16) is sufficient to carry traffic load caused by the construction activities of the Project during peak hours. The road traversing the Project Area (shown in green) will no longer be used after the construction activities start as it lies within the Project Area boundaries. The road shown in yellow can be regarded as an alternative; however, maintenance and improvement of the road conditions is necessary prior to its use by the construction vehicles and also by other users against the formation of impacts such as dust, noise and risk of accidents.

It is reported by the Project Company that the construction activities of the Project, Associated Terminal Facility and CPIR Port will be parallel. As a result of the assessment made by traffic consultants, the road network around the Project site, which has adequate capacity to carry current traffic load, will also be sufficient for future traffic load to be generated by the Project and Project associated facilty. With that, it is important to take necessary measures in coordination with public authorities in order to maintain safety of residents of the nearby communities, especially İncirli neighbourhood.

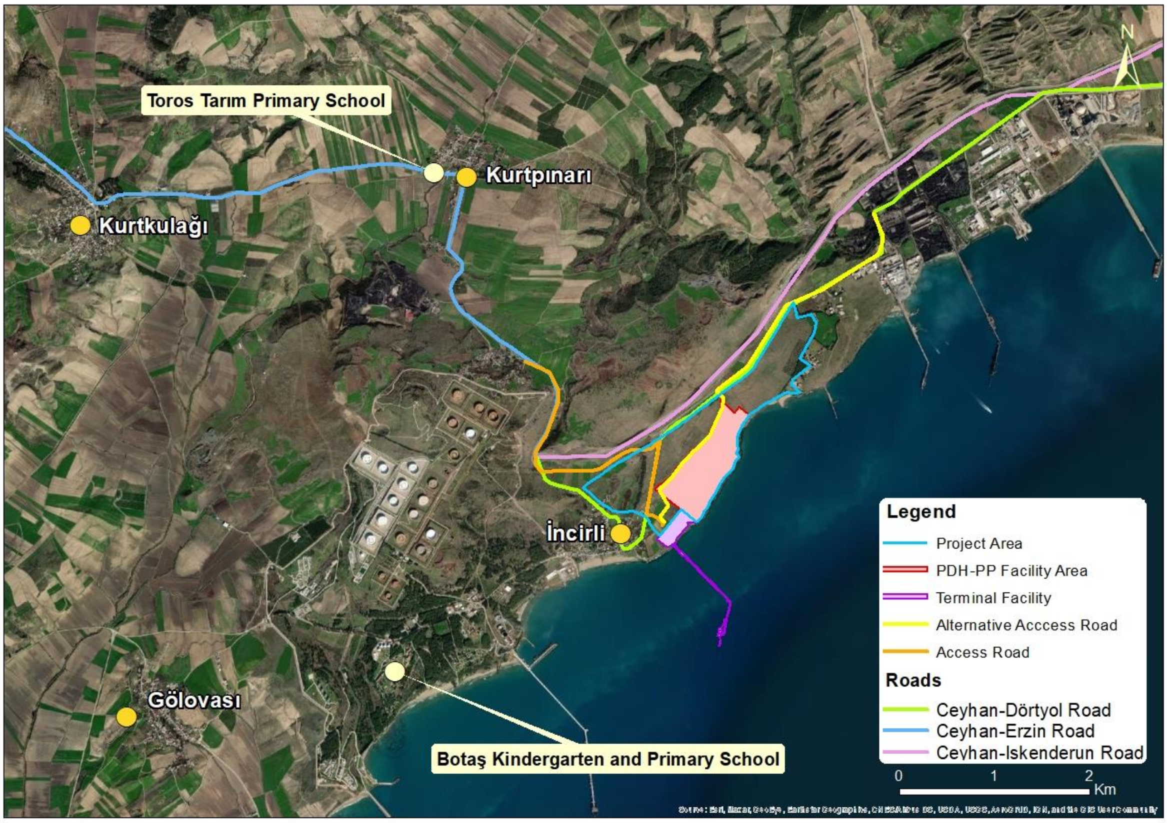

Figure 11-16. Road network near the Project Area

The number and locations of the gates to be used during the construction phase of the Project to allow construction personnel to enter to the Project Area is presented in Figure 11-17.

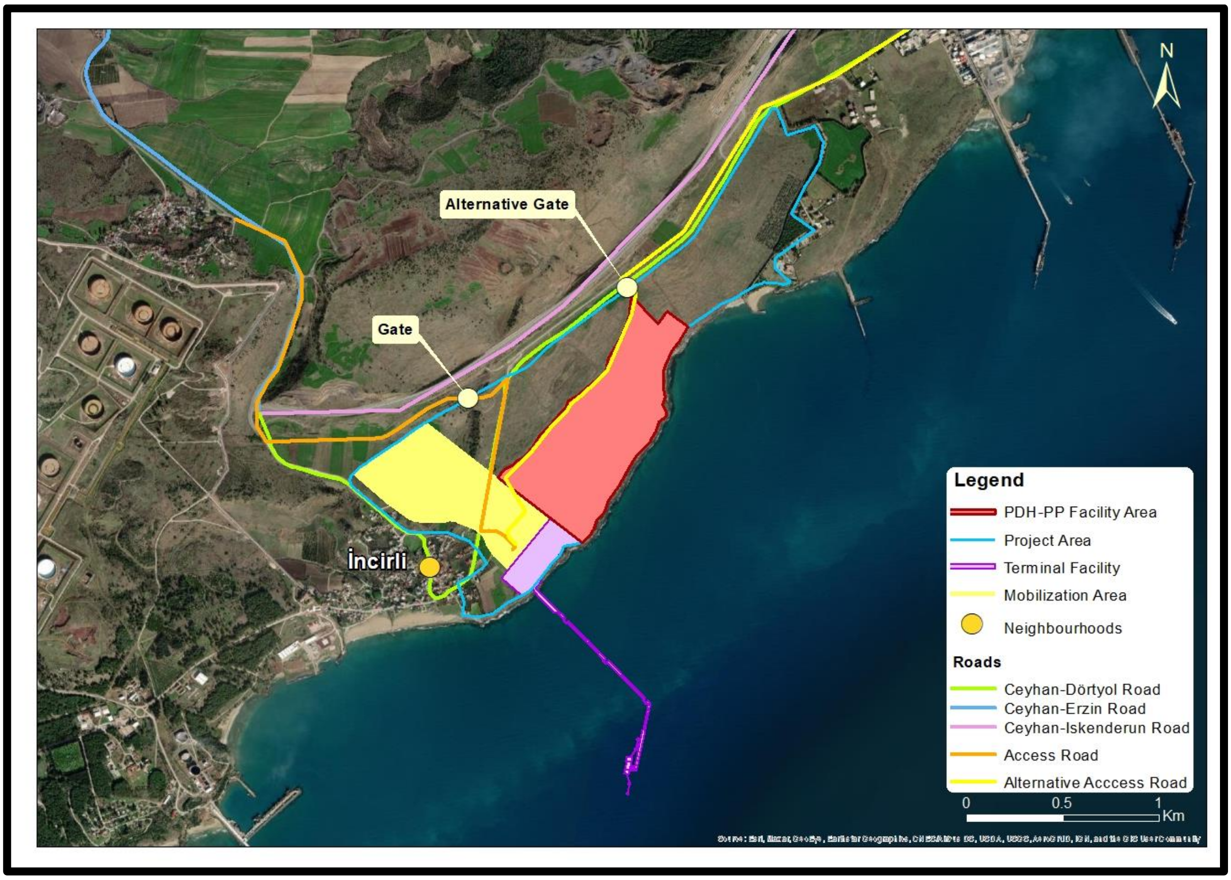

Figure 11-17. Road network near the Project Area, and Project Entrance Gate(Construction)

The locations of the gates to be used during the construction phase of the Project to allow operation personnel to enter to the Project Area are presented in Figure 11-18. Both the main and the alternative gates will not be located in Incirli community.

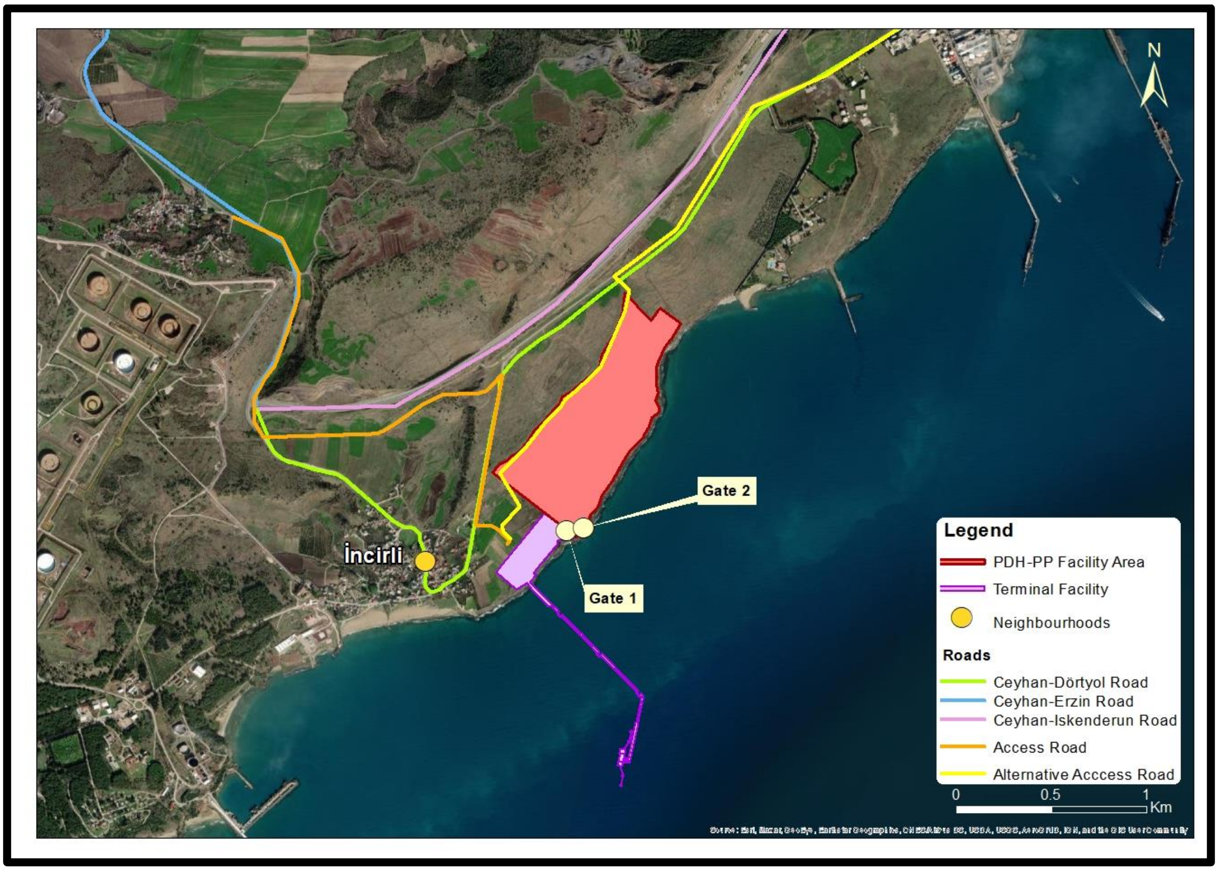

Figure 11-18. Road network near the Project Area, and Project Entrance Gate (operation)

The Project Company shall ensure that detailed layouts showing entrance/exit gates and traffic movements within and around the Project Area will be integrated into Traffic Management Plans to be developed for construction and operation phases of the Project.

As reported by the Project Company, the parking spaces to be used during construction phase of the Project will be defined at a later stage and included in the Construction Traffic Management Plan.

11.1.3 Traffic Management during Operation Phase

Traffic Estimation

An alternative scenario has been defined for the operational phase by the Traffic Expert; the traffic simulation has been conducted based on the assumption that the planned road developments are not finalized and surrounding industrial facilities to be developed in the future are not yet operational. Thus, the simulation is based on the following conditions:

- The road traversing the Project Area (as shown in green in Figure 11-16) is out of the scope of the simulation as it will not be used once the Project activities commence. The access to Project Area will be provided from the road to the west of the Project Area as shown in Figure 11-19, which is currently not used due to its insufficient physical properties;

- The road to the west of the Project Area will be renovated in line with the characteristics defined in the zoning plan;
- Traffic load to be created by the operation of Ceyhan PDH-PP Project is added onto the existing traffic loads of the region (including traffic load created by İncirli, BOTAŞ, Yumurtalık Free Zone and Toros Agri industry as shown in Figure 11-20) .

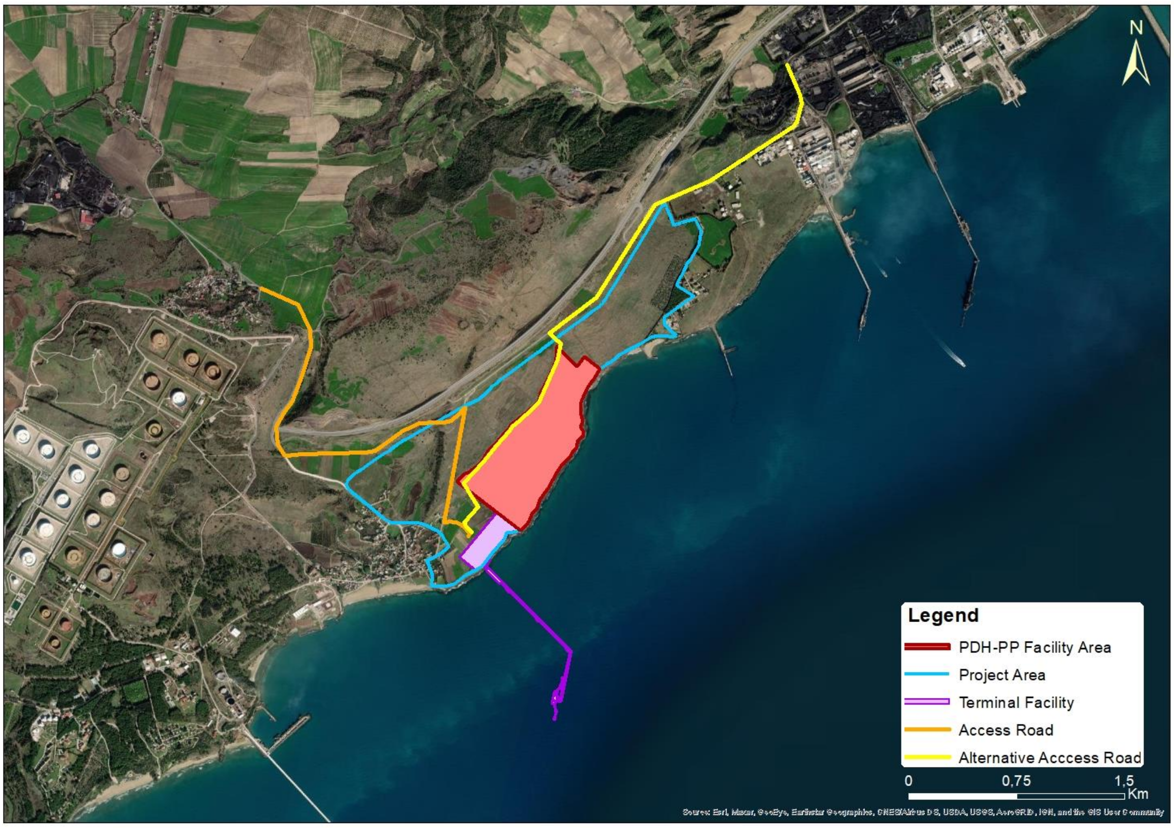

Figure 11-19. Access to the Project site

Total number of workforce to be employed during operation phase of the Project is 321. This number is for the personnel to be employed by the Project Company. The total of 321 personnel will commute to the Project Area by private cars and personnel shuttles. Reportedly, 66% of the personnel are expected to use shuttle buses and the remaining personnel will be using their private vehicles. The traffic load to be generated by the Project and Project' associated facility as well as traffic load to be generated by other facilities in the region (not only all the existing traffic load but also the forecast for the operation phase of the Project) together with the Project activities on the road to the west of the Project Area (as shown in Figure 11-19) are presented in Table 11-4.

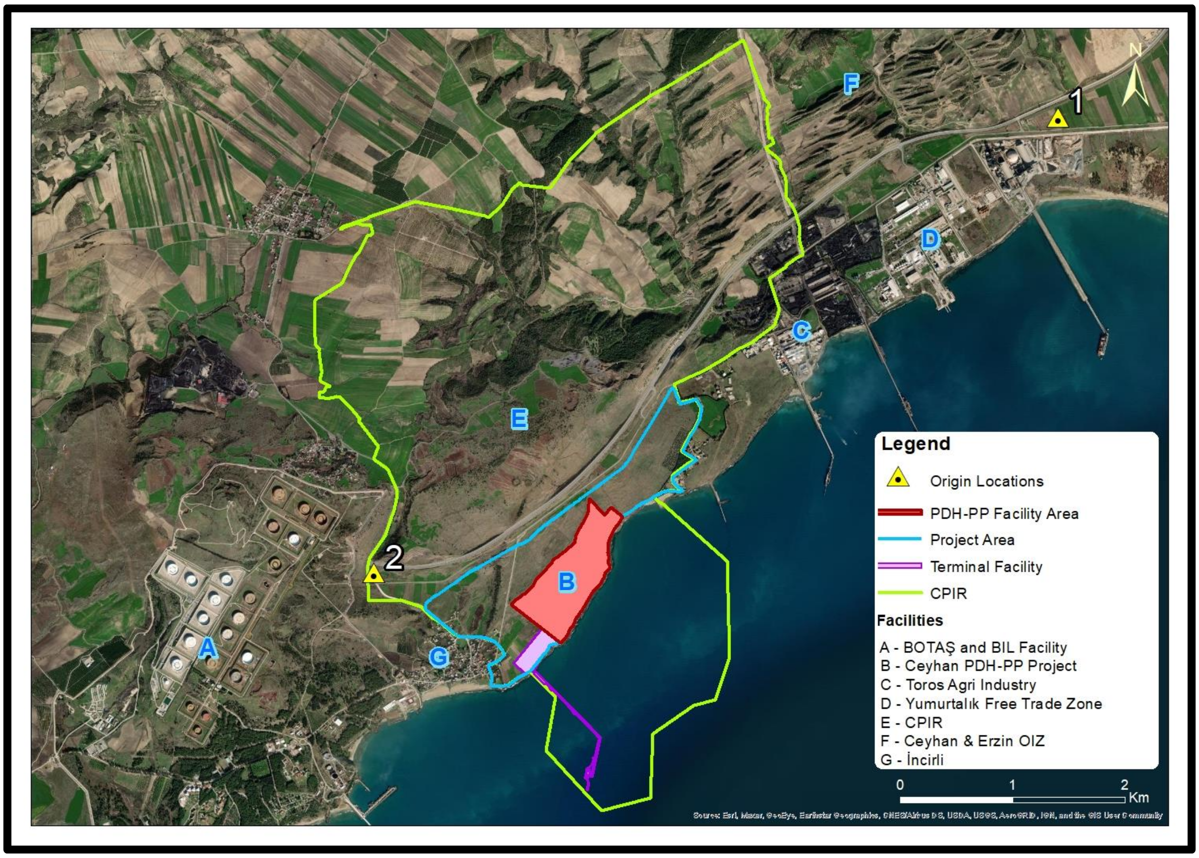

Figure 11-20. Traffic sources around the Project site

Table 11-4. Traffic load increase due to Project and Project Associated Facility (AF) activities in operation phase during Morning Rush Hour (hourly)

Impact of the Facility / Number of Vehicles (Peak hour)	BOTAŞ (A)	Incirli (G)	A+G	Ceyhan PDH-PP Project & AF (B)	A+G+B	% increase after development of the Project
Future forecast						
Heavy vehicle	13	0	13	18	31	**138 %**
Shuttle / Minibus	33	0	33	26	59	**79 %**
Private vehicle	140	25	165	40	205	**24 %**
Traffic load for baseline conditions / Morning						
Heavy vehicle	10	-	13	18	31	**138 %**
Shuttle / Minibus	20	-	20	26	46	**77 %**
Private vehicle	29	9	38	40	78	**95 %**

As a result, the traffic increase in the vicinity of the Project and project associated facilty site will be in the range of 24 to 138 % for future forecast and 95 to 138 % when the current conditions are considered. The access road is planned to be a 15 m wide road with 2 lanes as indicated in the zoning plan. According to the traffic assessment report one lane can sufficiently carry a traffic load of 600 vehicles per hour. In that sense, the capacity of the road is found adequate both for current and future conditions (i.e., A+G+B column in Table 11-4). As reported by the Project Company, the parking spaces are adequately defined in the Project layout for the purposes of the operational activities. Parking allocations as well as traffic flows inside the facility will be defined in the Traffic Management Plan to be developed for the operation phase.

Record keeping will be maintained for different types of waste quantities and the third-party facilities where handling and recycling/disposal of the waste is undertaken – see Chapter 8 Section 8.7.1. The estimations regarding the quantities of different types of waste to be generated during the operation phase of the Project are also presented in the named section. All operational period wastes except Oleflex Wastes are expected to be disposed once at a year. Oleflex Wastes including Cataylyst Dust and fines are planned to be sent to disposal on monthly basis. Considering that Oleflex Wastes will be sent out of the facility once a month and other wastes once a year, the relevant traffic impact caused by waste disposal during the operation stage is considered negligible.

11.4. Marine Section of Associated Facility

A separate Terminal Facility comprising a jetty, a propane storage tank and relevant auxiliary facilities will be used in order to provide raw material for the Project. The Terminal Facility will be constructed by the EPC contractor and operated by a third-party supplier company, which will be formed under Rönesans Holding umbrella and will solely work for the Project. Due to that reason, the Terminal Facility is considered as associated facility in accordance to the IFC PS1.

Operation of the Jetty in the Terminal Facility will be in line with Marpol Convention requirements. Jetty will be equipped with emergency response system including spill response kits and sea water cleaning equipment's. Operation of the Terminal Facility will be carried out by a different operator. Terminal Facility will operate solely for the Project. Maximum two ships a month are expected for raw material transportation. The operator of the Terminal Facility will have to coordinate its activities with relevant authorities and potentially with BOTAŞ Ceyhan terminal as relevant (no specific information was available by the time of the ESIA preparation). Information on responsibilities of different parties for implementation of the Project and associated facilities is provided in Chapter 17: *Environmental and Social Management.*

11.4.1. Baseline Conditions

Çukurova Region on the east Mediterranean coast is advantageous in terms of maritime transportation. Mersin port is one of the largest ports in Turkey. Moreover, BOTAŞ Ceyhan terminal (in Ceyhan district in Adana), which enables shipping of crude oil from Iraq to Azerbaijan, has also a strategic importance for the region by contributing to the regional economy. In addition to Mersin port and BOTAŞ Ceyhan Terminal, Mersin-Taşucu Port and

Toros Ceyhan Terminal are also located in the region. In terms of export and import cargo bulk volumes, Mersin port is ranked in third place among the listed top ten ports in Turkey[12].

The Regulation on Ports (Official Gazette (O.G.) date/number: 31.10.2012/28453) is the main legislation for the management of the ports. The Regulation on Ports:

- defines boundaries and areas of the port authority and anchoring areas;
- identifies the provisions to be followed during navigation, anchoring or mooring, berthing and departure to coastal facilities of vessels or other type of marine vehicles within the administrative boundaries;
- stipulates methods, location and time for loading and evacuation of all kinds of cargo and passengers;
- regulates the notification of vessels and other type of marine vehicles, requirements of pilotage and tugboat; and
- other requirements such as navigation, safety of life and property and environment and security within the administrative boundaries.

The Marine Section of the associated facility lies within the administrative boundaries of BOTAŞ Port Authority. The administrative boundaries of the Port Authorities (including BOTAŞ Port Authority last revision made in O.G. date/number: 24.09.2019/30898) are given in Annex-1 of the Regulation. The administrative boundaries of the BOTAŞ Port Authority as well as boarding points for maritime pilot and anchoring areas are illustrated in Figure 11-21.

[12] Çukurova Regional Plan (2014-2023) prepared by Çukurova Development Agency

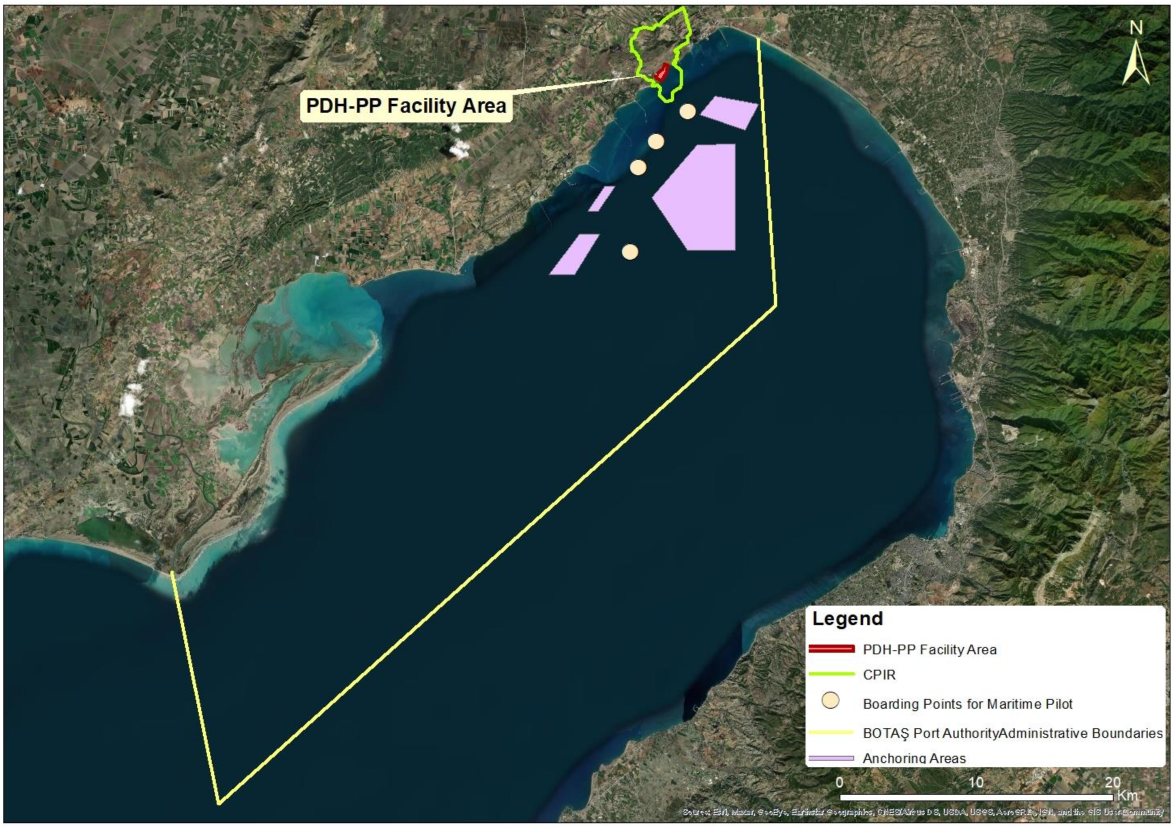

Figure 11-21. The administrative boundaries of BOTAŞ Port Authority, and boarding points for maritime pilot and anchoring areas (indicated with polygons from A-D)

The following definitions are made for anchoring areas in Annex-1 of the Regulation on Ports (O.G. date/number: 31.10.2012/28453);

- Anchoring-A: Anchoring areas for vessels carrying hazardous substances, military vessels operated by nuclear energy and vessels to be kept in quarantine as well as vessels where gas purification is undertaken;
- Anchoring-B: Anchoring areas for military vessels and vessels that do not carry hazardous substances;
- Anchoring-C: Anchoring areas for military vessels and vessels that do not carry hazardous substances;
- Anchoring-D: Anchoring areas for military vessels and vessels that do not carry hazardous substances.

The number of vessels annually visiting the nearest Port Authorities are given in Table 11-5 based on maritime statistics of Ministry of Transportation and Infrastructure. Accordingly, total number of vessels (including both Turkish and foreign flags), that are visiting BOTAŞ Port Authority, are 914 (with 45,480,079 gross tons in total) in 2019. Monthly maritime statistics are also published for each Port Authority; accordingly, total number of vessels visiting BOTAŞ Port Authority are 115 (with 4,023,653 gross tons in total) in January 2020.

Table 11-5. The number of vessels visiting the Port Authorities that are close to the Project Area (2019)

Port Authority	Vessels with Turkish Flag		Vessels with Foreign Flag		Total	
	Number of Vessels	Gross Ton	Number of Vessels	Gross Ton	Number of Vessels	Gross Ton
BOTAŞ Port Authority	125	4,798,862	789	40,681,217	914	45,480,079
Karataş Port Authority	0	0	1	51,821	1	51,821
İskenderun Port Authority	771	5,295,712	3,488	71,541,577	4,259	76,837,289

Meteorological and current conditions of the region are also determining factors during the assessment of the marine traffic and safe navigation of the vessels apart from the existing marine infrastructures/facilities/uses. According to the monitoring data of İskenderun Meteorological Station, the prevailing wind in İskenderun Bay is south-southeast (SSE) and the maximum wind speed is 34.4 m/s. The recommended prevailing wind direction is southeast (SE) and northeast (NE) pursuant to İskenderun Port Authority.

11.4.2. Marine Traffic

Contruction:

Steel piles will be used for the construction of the Jetty (although there is no infomation available on the piling methods). Piling and upper-dec construction will be performed using marine barges. Steel Piles and other constructed modules at onshore will be loaded to the barges and transferred to the piling location.

The Jetty, which is planned as part of the Terminal Facility, is the offshore structure. The Jetty will have a total length of 1.2 km and will consist of the two main parts, including:

- earth filled causeway that provides connection between onshore facilities and jetty; and
- jetty section constructed on piles.

Construction vessels will be generating marine traffic movements during construction phase of the Project. However, type and number of construction vessels to be used during construction phase of the Jetty development have not been determined yet. It is expected that small fishing boats might be affected by the marine traffic. These include fishermen from Incirli and Golovasi. Detailed information on this subject and assessment of relevant impacts are provided in the Chapter 14: *Socioeconomics*.

During the Project construction works, construction material or equipment's will not be directly transferred to the site via marine vessels. Therefore, there will be no temporary or permanent marine structures such as unloading platform, quay or pier.

Operation:

Propane that will be used as raw material in the Project, will be sourced through sea shipment. The Jetty will be composed of two approaching docks (i.e., Jetty #1 and #2). Maximum of two vessels are expected to bring raw material to the Jetty in a month during the operation phase of the Project. According to the information obtained during the stakeholder engagement activities conducted on 10-12nd February 2020, monthly marine traffic of BOTAŞ and BOTAŞ International (BIL) Facilities consists of approximately 30 vessels/tankers. On the other hand, marine traffic movements of İsken Sugözü Thermal Power Plant consist of approximately 20 - 22 vessels/year and the facility makes use of a floating platform to convey the raw materials from the vessels.

It is expected that CPIR Port Project will be operational as of 2025. A projection regarding the number of vessels (together with gross tonnages) visiting CPIR Port is made for the years 2025 and 2047 in the Environmental Impact Assessment (EIA) report prepared for CPIR Port Project. According to the information presented in the EIA report, 1,500,000 tonnes of liquid cargo will be handled and annually 30 vessels are expected to visit the CPIR Port once it becomes operational as of 2025. The Jetty that will be developed as the associated facility of the Project will also be a part of CPIR Port development.

Therefore, the number of vessels that will be visiting the Jetty are included in the projection presented in Table 11-6. The configuration regarding the type, load and number of vessels, that are anticipated within the scope of the CPIR Port Project, are presented in Table 11-6.

Table 11-6. The number of vessels that will be visiting CPIR Port

Years	Bulk-General Cargo		Liquid Cargo Container		Container	
	Load (ton)	Number of Vessels (per annum)	Load (ton)	Number of Vessels (per annum)	Load (TEU)	Number of Vessels (per annum)
2025	-	-	1,500,000	30	-	-
2026	-	-	2,000,000	40	-	-
2027	100,000	3	3,300,000	66	-	-
2028	311,374	8	4,417,860	89	-	-
2029	969,536	25	5,914,389	119	-	-
2030	3,018,880	76	7,917,861	159	-	-
2031	9,400,000	235	10,600,000	212	500,000	63
2032	9,591,995	240	10,866,281	218	537,500	68

Years	Bulk-General Cargo		Liquid Cargo Container		Container	
	Load (ton)	Number of Vessels (per annum)	Load (ton)	Number of Vessels (per annum)	Load (TEU)	Number of Vessels (per annum)
2033	9,787,921	245	11,139,252	223	577,813	73
2034	9,987,830	250	11,419,079	229	621,148	78
2035	10,191,832	255	11,705,937	235	667,735	84
2036	10,400,000	260	12,000,000	240	717,815	90
2037	10,629,633	266	12,678,749	254	753,705	95
2038	10,864,336	272	13,395,890	268	791,391	99
2039	11,104,222	278	14,153,595	284	830,960	104
2040	11,349,404	284	14,954,156	300	872,508	110
2041	11,600,000	290	15,800,000	316	916,134	115
2042	12,064,000	302	16,590,000	332	961,940	121
2043	12,546,560	314	17,419,500	349	1,010,037	127
2044	12,922,957	324	18,116,280	363	1,060,539	133
2045	13,310,646	333	18,840,931	377	1,113,566	140
2046	13,709,965	343	19,594,568	392	1,169,244	147
2047	14,121,264	354	20,378,351	408	1,227,707	154
2048	14,544,902	364	21,193,485	424	1,289,092	162
2049	14,835,800	371	21,829,290	437	1,353,547	170

11.4.3.Manoeuvring Modelling Study

A vessel manoeuvring risk assessment and modelling study was performed for CPIR Port Project by Maritime Faculty, Dokuz Eylül University (DEU). Adana Ceyhan Port Modelling Report dated 10 August 2020 was prepared by DEU to detail details and findings of the modelling study. The Jetty, the associated facility of the Project, is part of the CPIR Port and included in the relevant modelling study for risk assessment.The assessment and the results of the vessel manoeuvring risk modelling study are evaluated in this section of the ESIA Report.

The study was performed in order to identify the manoeuvring risks to arise from the interaction between vessels and coastal structures based on the analytical data obtained from the preliminary findings of this study, through mathematical models in line with the type and tonnages of vessels, which are expected to berth/depart from the Project facility, and neighbouring facilities. For the study “Manoeuvring in bridge simulator” is used by applying prevailing meteorological, oceanographic and topographical conditions in İskenderun Bay and its surroundings. Objects that can affect the surface currents, neighbouring coastal structures as well as marine traffic are modelled for virtual manoeuvring area. The study was performed in three phases: i) 3-D Site Development, ii) Preliminary modelling, iii) Modelling considering the size of the CPIR Port Project site, number of berths, variety of vessels to be served. Simulation studies are preferred to be undertaken in order to provide safe and economically feasible and effective operations. It is essential for the coastal facilities, that are in the design stage or prior to the implementation of their development plan, to undertake simulations (through bridge simulator system-Model Wizard) and manoeuvring experiments (berthing, departure and harbouring) with the defined types and size of vessels in different meteorological conditions and with appropriate tug boat opportunities with the support of authorized maritime pilot.

Methodology

In the modelling study, vessel manoeuvring trials were performed by means of “Ship’s Bridge Simulator System” (model: NTPro 5000) which was developed by Transas Company. Vessel movements during berthing/approaching manoeuvres, back-up operations, hawser assembles/operations and other port operations are determined and supported by numerical and realistic data.

Risks for each berth were numerically determined and assessed through a risk matrix. Pursuant to the Communique Regarding the Assessment of Applications Regarding Development of Coastal Facilities (O.G. date/number: 15.03.2009/27170). A modelling report, that defines and assesses numerical risks associated with the vessel manoeuvring, was prepared at the end of the study. According to the above-mentioned Communique the minimum requirements for the study and results report are as follows:

- It is required to undertake simultaneous simulations of generic area and marine traffic in the surrounding of the CPIR Port and to apply risk assessment in fully equipped bridge simulator systems in the modelling report as a prerequisite. A concrete risk assessment shall be made for the manoeuvring difficulties stemming from marine traffic and shoreline structures based on the findings of the simulation analysis through applying numerical analysis methods;
- The modelling report to be prepared by authorized organizations shall include the following:
    - Information on the port development and portolan charts for the port;
    - Static features of the vessels to be used for manoeuvring (type, tonnage, neural, machine power-speed relation, freeboard, draft survey);
    - Records to monitor mathematical model variables (information on applied rudder angles, heading rate, speed and route, location, machine controls, used tugs and mooring);

- Information related with simultaneous simulations;
- Information related with numerical analysis methods and findings of numerical risk analysis based on simulation implementations;
- Risk assessment modelling based on environment, traffic and findings of risk analysis;
- Risk assessment and findings;
- Minimum distances between the facilities in terms of safe navigation/vessel manoeuvring by taking into account the maximum size of vessels to approach to the facilities, provided that there are other coastal facilities/jetties planned to be developed in the shoreline or there are existing neighbouring facility/facilities.

Well-accepted methodologies by Safety Awareness for Uzmar Maritime Pilot and Tug Boat Services Organization, Safety Awareness for Gemport Maritime Pilot and Tug Boat Services Organization, Risk Assessment for İzmir Port, Safety Awareness for Ditaş Maritime Pilot and Tug Boat Services Organization were followed during the risk assessment of the manoeuvring of vessels. The theory behind the methodology is to perform modelling with all the determined parameters and vessel models by means of bridge simulator system with the support of an authorized maritime pilot. The maritime pilot, together with the manoeuvring team, determined manoeuvres and type of vessel models to be applied before the manoeuvring simulations. Risks were identified and assessed by the maritime pilot and manoeuvring team depending on their professional judgement. As highlighted in the modelling study report, maritime pilots receive theoretical trainings on hazard/threat, likelihood, impact/consequences, risk and risk assessment before undertaking the risk assessment study.

As mentioned above, the prevailing wind direction in İskenderun Bay is south-southeast (SSE) and the maximum wind speed is 34.4 m/s according to the monitoring data of İskenderun Meteorological Station. The recommended prevailing wind direction is southeast (SE) and northeast (NE) pursuant to İskenderun Port Authority. Considering approaching conditions of the vessel to the jetties and port, the prevailing wind direction is assumed as northeast (NE-045°) and southwest (SW-225°) for the CPIR Port area. In the modelling study, the wind speed is limited with 5 Beaufort in all manoeuvres and the wind speed is determined 16 Knot for vessels (300 m) considering the safe manoeuvring. The height of wave is assumed to be 1.5 m H_s. Although the flow/current at the site is generally negligible as reported by İskenderun Port Authority; the current speed is assumed as 210° and 0.1 Knot in the simulation studies. The direction of the approaching to the jetties are assessed considering the prevailing wind direction and meteorological data. It is concluded that Jetty #1 in the Marine Section of Ceyhan PDH-PP Project and Jetty #2 (of CPIR Port Project) are feasible in terms of approaching suitability.

The Jetty neighbours to jetties of BOTAŞ and BIL (to the west) and Toros Agri Industry (to the east). There are two jetties (1,950 m and 2,600 m) belonging to BOTAŞ and BIL which are located approximately 1.3 km and 3.2 km distance to the closest part of the Jetty which is the associated facility of the Project,respectively.

The location of the Jetty and its interaction with the closest BOTAŞ and BIL jetties to the west are shown in Figure 11-22. In Figure 11-22, the space for parallel berthing (i.e., 200 m) for the closest BOTAŞ and BIL Jetty is shown considering the length of vessel (LOA) is 300 m.

Toros Agri Industry has two jetties (Toros Agri Industry West and East Jetties) which serve for import and export run by national and foreign vessels and located approximately 2.0 and 2.8 km distance to the Project Area boundaries, respectively. The distance between the neighbouring closest jetty of Toros Agri Industry and east end of the CPIR Port is 1,060 m. It is stated in the modelling study that the distance between Toros Agri Industry and east end of the CPIR Port is sufficient in terms of safe navigation and manoeuvring of vessels.

In addition to the neighbouring facilities/infrastructures, there is a planned coastal facility in Toros Agri Industry premises (approved with the revised zoning plan) in the close surrounding of the Project site. Information on the planned development in Toros Agri Industry was obtained through Dolfen Consulting Engineering and included in the 3-D simulation study. The distance between the planned coastal facility in Toros Agri Industry premises and the entrance of the CPIR Port breakwater is 740 m.

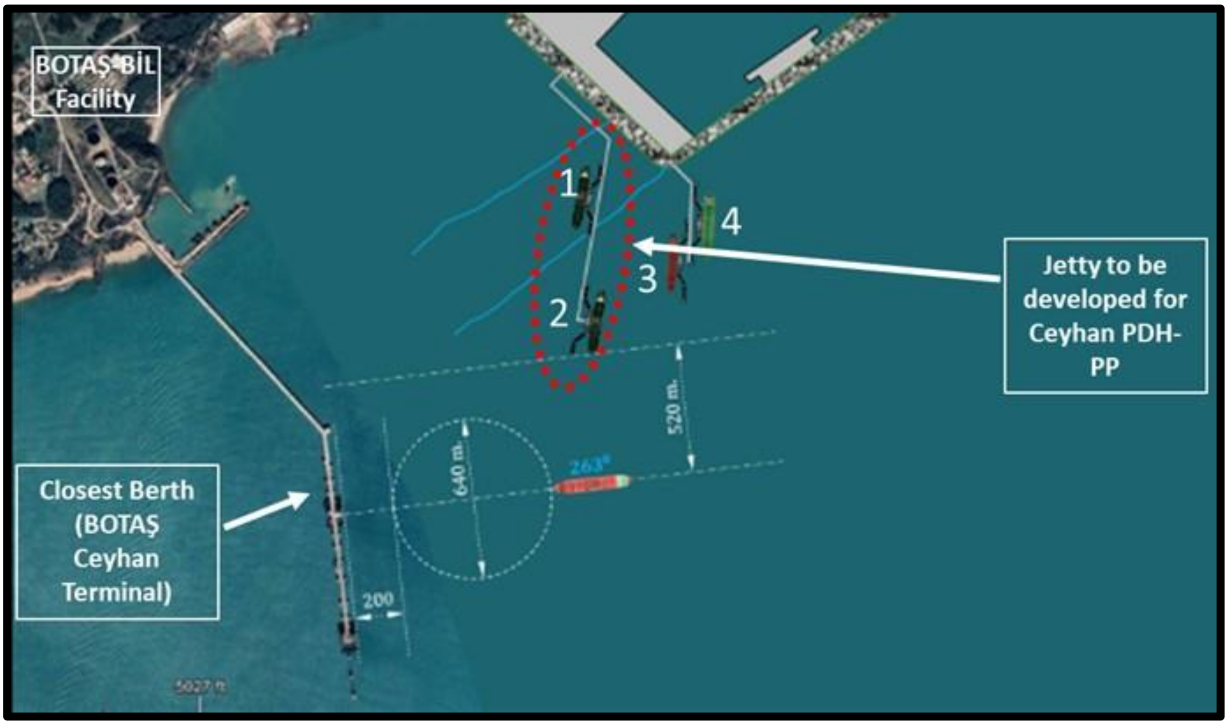

Figure 11-22. Interaction between jetties to be developed for CPIR Port and BOTAŞ and BIL jetty to the west (the jetty to be developed within the scope of Associated Facilities (Jetty #1) is illustrated in red dotted line, other jetties (Jetty #2, 3 and 4) are planned to be established within the scope of CPIR Port Project)

As can be seen from Figure 11-22, in the design of proposed CPIR Port Project Jetty #2 located at the south of the Jetty #1 of Ceyhan PDH-PP Project, a safe clearance (520 m) is provided with the manoeuvring axe of the existing BOTAŞ Ceyhan Berth. This clearance and the current position of the proposed Jetty 2 is found to be safe for manoeuvring. It is also stated in the study that, it is possible to shift Jetty#2 towards the south direction by 220 m with safe manoeuvring conditions.

It is assumed that maximum 60,000 Deadweight tonnage (DWT) tanker vessels (length: 230 m; drafting value: 12 m) will be approaching to the jetty (#1 and #2 as shown in Figure 11-22). The length of vessels at design stage of the jetties were assumed as 260 m. Considering that approaching locations are designed at -17 m depth, relationship between drafting-water depth is found suitable. It is also concluded in the modelling study that the distances (LOA/2+30=160 m) between the approaching points/berths are found adequate (even more than its required distance). Approaching point/berth #1 is found risky in terms of safe manoeuvring of vessels due to the proximity to the shoreline. Therefore, a recommendation is made on the manoeuvring alternatives for approaching point#1 in the modelling study, illustrated in Figure 11-23. Considering this type of manoeuvring alternative, manoeuvring circle is assumed as 1.5 LOA diameter.

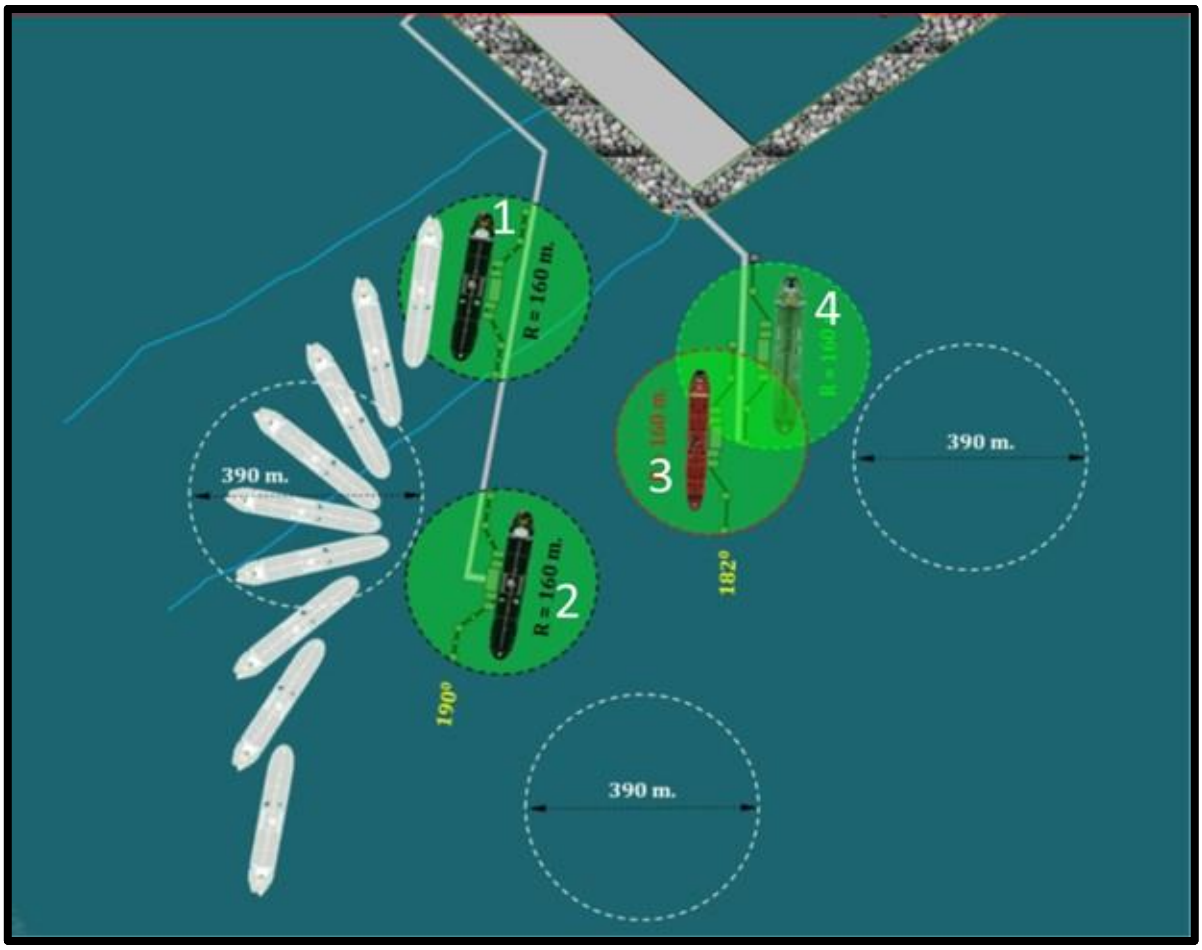

Figure 11-23. Manoeuvring alternatives for approaching point #1

Moreover, within scope of the CPIR Port Project considering other jetties (Jetty #3 and #4) to the east of the Jetty (Jetty #1) it is assumed that maximum 100,00-125,000 DWT LPG tanker vessels (length: 260 m; drafting value: 15-16 m) will be approaching the jetty (#3 and #4 as shown in Figure 11-22). Considering that approaching locations are designed at 22 m depth, the relationship between drafting-water depth is found suitable. It is also concluded in the modelling study that the distances (LOA/2+30=160 m) between the approaching points/berths (#3 and #4) are found adequate. Additionally, the distance between approaching point #2 and #3 is assessed in terms of safe manoeuvring of vessels. Since the distance (between #2 and #3) is more than the size of one vessel, it is concluded in the modelling study that the distance is found sufficient in terms of safe manoeuvring of vessels.

Simulation Scenarios

The comparison of size of designed and modelled vessels taken into consideration during the configuration of the modelled approaching scenarios are presented in Table 11-7.

Table 11-7. Comparison of designed and modelled vessels

Jetty/Berth No.	Designed Vessel			Modelled Vessel	
	Type	Size	Drafting	Vessel Class*	Size (LOA-B-D)
1	Container	400 m	16m	CS32	398m-59m-16m
2	Container	400 m	16m	CS32	398m-59m-16m
3	Container	300m-400m	14m-16m	CS15	304m-40m-14.2m
4	Container	300m-400m	14m-16m	CS15	304m-40m-14.2m
5	Dry/bulk cargo	240m-250m	12m-13m	BC1	182.6m-22.6m-7.5m
6	Dry/bulk cargo	240m-250m	12m-13m	BC1	182.6m-22.6m-7.5m
7	Dry/bulk cargo	240m-250m	12m-13m	BC6	225m-32.2m-7.9m
8	Dry/bulk cargo	240m-250m	12m-13m	BC6	225m-32.2m-7.9m
9	Bulk cargo	290m-300m	16m	BC2	290m-46m-7.5m
Jetty #1	Propane	227m-265m	11.5m-12m	VLCC1	261m-48.3m-7.4m
Jetty #2	LPG	227m-265m	11.5m-12m	VLCC1	261m-48.3m-7.4m
Jetty #3	Chemical tanker	220m-240m	14m	OT2	228m-32.2m-8.7m
Jetty #4	Chemical tanker	250	15m	VLCC1	261m-48.3m-7.4m

*CS: Container ship, BC: Bulk carrier, OT: Oil tanker, VLCC: Very large crude carrier

The simulation study was carried out by using the following type of vessels and approaching manoeuvres were applied for daytime conditions:

- Container ship (CS) 32-Disp 254,575 t with a length of 398 m;
- Very large crude carrier (VLCC) 1 Disp. 159,584 t with a length of 261.3 m;
- Bulk Carrier (BC) 2 Disp. 76,800 t with a length of 290 m; and
- Oil Tanker (OT) 2 Dips. 41,900 t with a length of 228 m.

A total of 21 different manoeuvring trials were applied for CPIR Port Project (including jetties) during daytime conditions in the simulation study based on the following assumptions;

- Southwest (SW) (primary) and north-northeast/northeast (NNE/NE) (secondary) wind directions were applied;
- All vessels approach to the other jetties/berths/port approaching points during approaching/departing manoeuvres in order to represent the existing and potential conditions/affects that may be occurred by the interactions of each other vessels;
- Two tugboats (with 60 tonnes and adjustable power) were applied in the simulations;
- The simulations were carried out under the 15 and 21 Knot wind impact in line with the information notes presented by BOTAŞ Port Authority;
- Since there is no dominant flow/current information; the current is assumed as SW 0.1 Knot (outside of the breakwater);
- Height of wave is assumed as 1.5 m;
- Real depths were applied in the simulations in order to assess the vessel and sea floor interactions;
- Bow thruster and stern thruster were not included in the simulations and it is assessed whether tugboats are sufficient for manoeuvres;
- Simulations start with pilot reference points and ends right after the identification of tension on the fenders at the time of contact which is in the beginning of rope reception. The aim is to identify the most critical moments and prevent the time loss; and
- Approaching manoeuvres are initiated at approximately 1 nautical mile to the CPIR Port (at minimum speed of vessels).

The assumptions and conditions that were considered/applied for Jetties #1, #2, #3 and #4 during the simulation scenarios are provided in Table 11-8 below:

Table 11-8. Data included in the simulation scenarios (selected scenarios considering Jetties #1,2,3 and 4)

Sce.	Flow		Wind		Wave		Type of Vessel	Type of tug	Pier/Night-Day/Manoeuvring
	Severance	Direction	Severance	Direction	Height	Direction			
#1	0.1	210	15	225 (SW)	1.5	225	VLCC1 Disp. 159,584 (LOA:261m)z	2*60 (ASD5)	Jetty #1/Approach
#2	0.1	210	15	225 (SW)	1.5	225	Oil Tanker2 Disp. 41,900t (LOA:228 m)	1*60+1*30 (ASD5)	Jetty #3/Approach
#11	0.1	030	15	030 (NE)	0.5	030	VLCC1 Disp. 159,584 (LOA:261m)	2*60 (ASD5)	Jetty #1/Approach

Sce.	Flow		Wind		Wave		Type of Vessel	Type of tug	Pier/Night-Day/Manoeuvring
	Severance	Direction	Severance	Direction	Height	Direction			
#12	0.1	040	15	000 (N)	0.7	000	VLCC1 Disp. 159,584 (LOA:261.3m)	2*60 (ASD5)	Jetty #2/Approach
#13	0.2	200	15	000 (N)	0.6	000	Oil Tanker2 Disp. 41,900t (LOA:228 m)	2*60 (ASD5)	Jetty #3/Approach
#14	0.3	040	25	225 (SW)	1.5	225	VLCC1 Disp. 159,584 (LOA:261m)	2*60 (ASD5)	Jetty #4/Departure
#20	0.1	210	15	225 (SW)	1.5	225	VLCC 2 Disp. 321260t (LOA:332m)	4*60 (ASD5)	BOTAŞ/Approach
#21	0.1	210	15	225 (SW)	1.5	225	Bulk Carrier 2 Disp.76.800t (LOA: 290m)	2*60 (ASD5)	Toros/Approach

The illustrations of the selected scenarios showing the general movement of the manoeuvres of the vessels are presented in Figure 11-24.

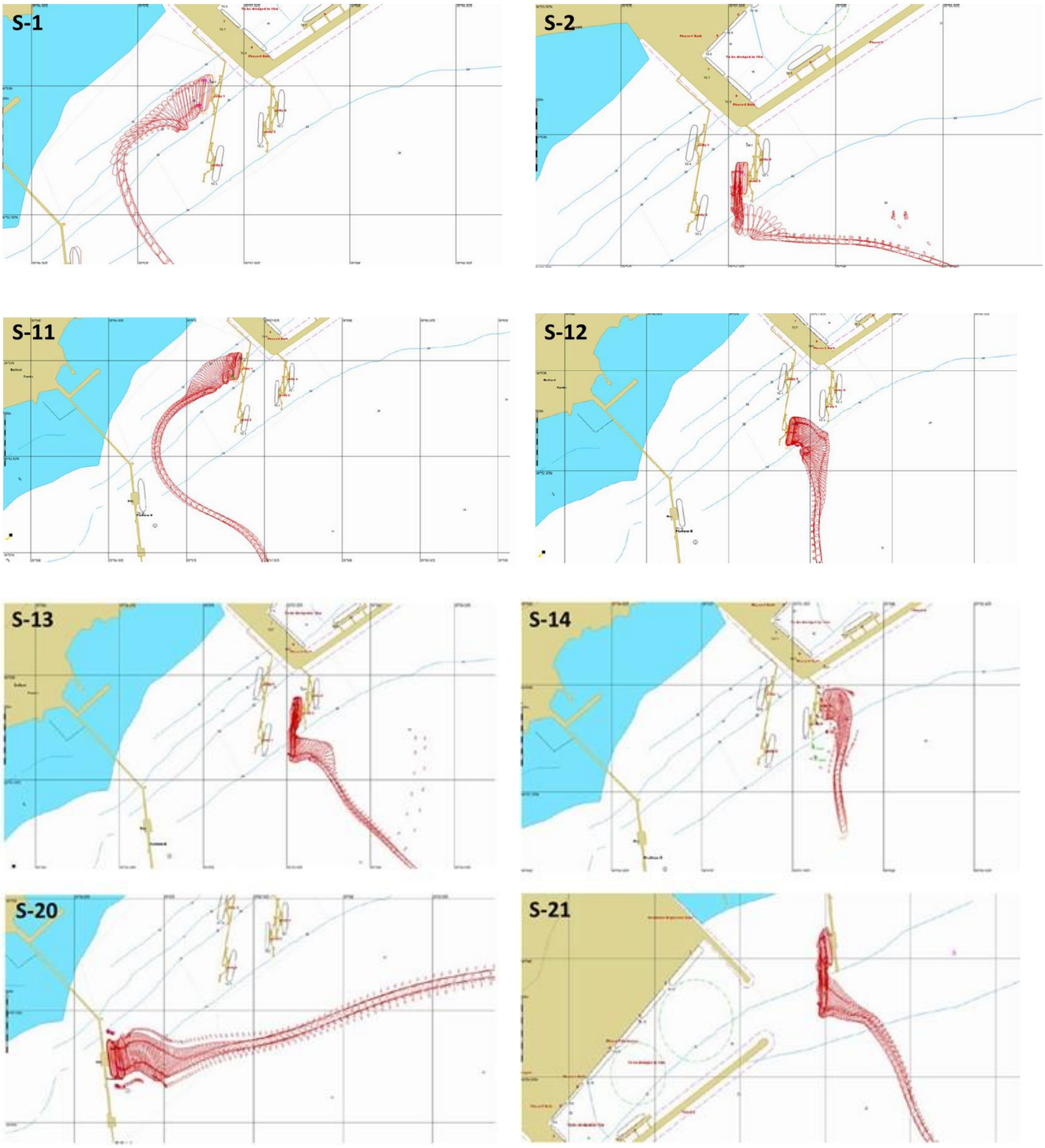

Figure 11-24. Movements of vessels in the selected scenarios

Among the scenarios applied for CPIR Port Project, Scenario #1 is applied for the approaching point/berth #1 at jetty (i.e., the jetty to be developed within the scope of the Ceyhan PDH-PP Project). It is assumed that two tugboats (each with 60 tons bollard pull capacity) supported manoeuvring. It is concluded that there is sufficient distance between the neighbouring facility in terms of safe navigation and manoeuvring.

Findings

As a result of the simulations, risks were identified and assessed based on the risk assessment matrix. The following risks were identified regarding approaching manoeuvres of vessels: i) disruption of manoeuvres in case of a simultaneous manoeuvring of vessels coinciding with the vessels approaching to BOTAŞ Facility; ii) disturbance to manoeuvres that may occur due to damages on the ropes of tugboats caused by strong waves; iii) risks associated with insufficient pulling power of tugboats for the vessels (if LOA>300 m).

Additionally, risks were also identified for departing manoeuvres of vessels which are: i) risks associated with insufficient pulling power of tugboats for the vessels (if LOA>300 m) and ii) risks that may occur during departing the tanker terminals without support in case of an unexpected meteorological condition.

It is reported in the study that the relevant information on the planned developments in the region (i.e., planned coastal facilities by Toros Agri Industry to the east of Project site) has also been taken into consideration during the 3-D simulation study. The manoeuvring locations and safety distances between the berths were assessed by taking into consideration the neighbouring facilities and their components. In terms of manoeuvring safety, it is considered necessary to limit the draft of the ships that will berth to Jetty # 1 to 14 meters, taking into account the contour line of 15 meters. The interaction of the CPIR Port Project and planned development of Toros Agri Industry were studied and it was found that the distance between the two facilities have enough space for vessels' manoeuvring. It was also found that the safety distances between jetties # 2 and 3, and the design in terms of manoeuvring was suitably made considering the neighbouring BOTAŞ-BIL Facilities.

11.5. Impact Assessment

11.5.1. Impacts During Construction

Terrestrial Part

During the construction phase, activities including transport of construction materials to the Project Area and associated facility and travel to/from Project Area by construction workers and other personnel will generate additional traffic load on the existing road network near the Project site. Potential access routes to the Project Area are shown in Figure 11-23.

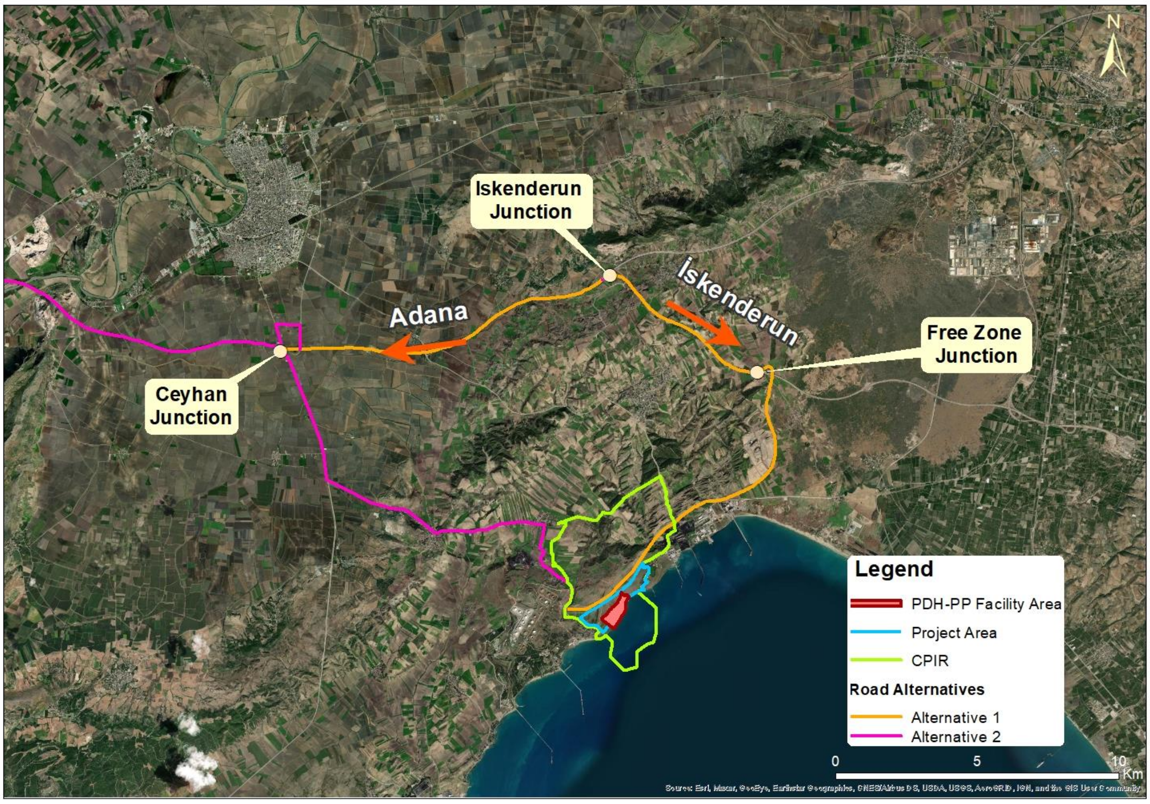

Figure 11-25. Access to the Project & AF site

As given in the Figure 11-25 above, the Project Area is located to the south of the E90 Motorway (i.e., Adana-Şanlıurfa Road) and to the southwest of the E91 Motorway (i.e., Ceyhan-Iskenderun Road). There are two main junctions allowing access to the Project Area which are Ceyhan Junction to the northwest and Free Trade Zone Junction to the northeast of the Project site. It is reported by the Project Company that during construction phase the heavy vehicles and large goods vehicles are expected to use the Ceyhan-Iskenderun Motorway and Free Trade Zone Connection Road to reach to the Project site.

During construction it is assumed that 60 trucks (maximum 6 trucks/hour), 15 trailers (maximum 2 trailers / hour), 4 lorries (maximum 1 lorry/hour) and 100 cars (maximum 40 cars/hour) will be used for the Project and associated facilities. As the worst-case scenario, where it is assumed that trucks, long vehicles, mixers, visitor cars, vehicles with access cards and delivery vehicles for kitchen and canteen will operate at the same time.

The road to the west of the Project Area (i.e., providing access to BOTAŞ and İncirli), is currently poor in terms of its physical properties and lane discipline. This road is of particular importance as it will provide access to the Project Area during construction phase. Therefore, it is important that both its quality and safety should be improved prior to construction phase.Transportation of Heavy Loads

Four major units used in the Project are required special transportation arrangement in order to transfer to the Project Site. These units and their dimensions regarding length (L), height (H), width (W) and Weight are given in Table 11-9. Marine transportation is planned for transfer of these items first to the nearest port with custom. After that these items are planned to be caried to the Project Area with land roads. The Chapter 2: *Project Description* includes discussions of these alternatives. For this purpose, the Project Company performed a special study in order to evaluate land transport options. According to the study, Sanko Port located 10 km southwest of the Project Area is identified as suitable location for unloading of the units. Road distance between Sanko Port and the Project Area is about 28.2 km, and mainly follows single line road between settlements. Heavy Material Handling Routes are shown in Figure 11-26.

Table 11-9. Heavy Items that Require Special Transport Arrangements

Description	Length (m)	Width (m)	Height (m)	Weight (t)
PROPYLENE-PROPANE SPLITTER	113,30	10,5	10,80	1585,4
DEETHANIZER STRIPPER	69,6	7,2	7,3	806,7
LOOP REACTOR	55,0	8,0	2,3	521,0
REACTOR	35,7	9,8	10,3	524,0

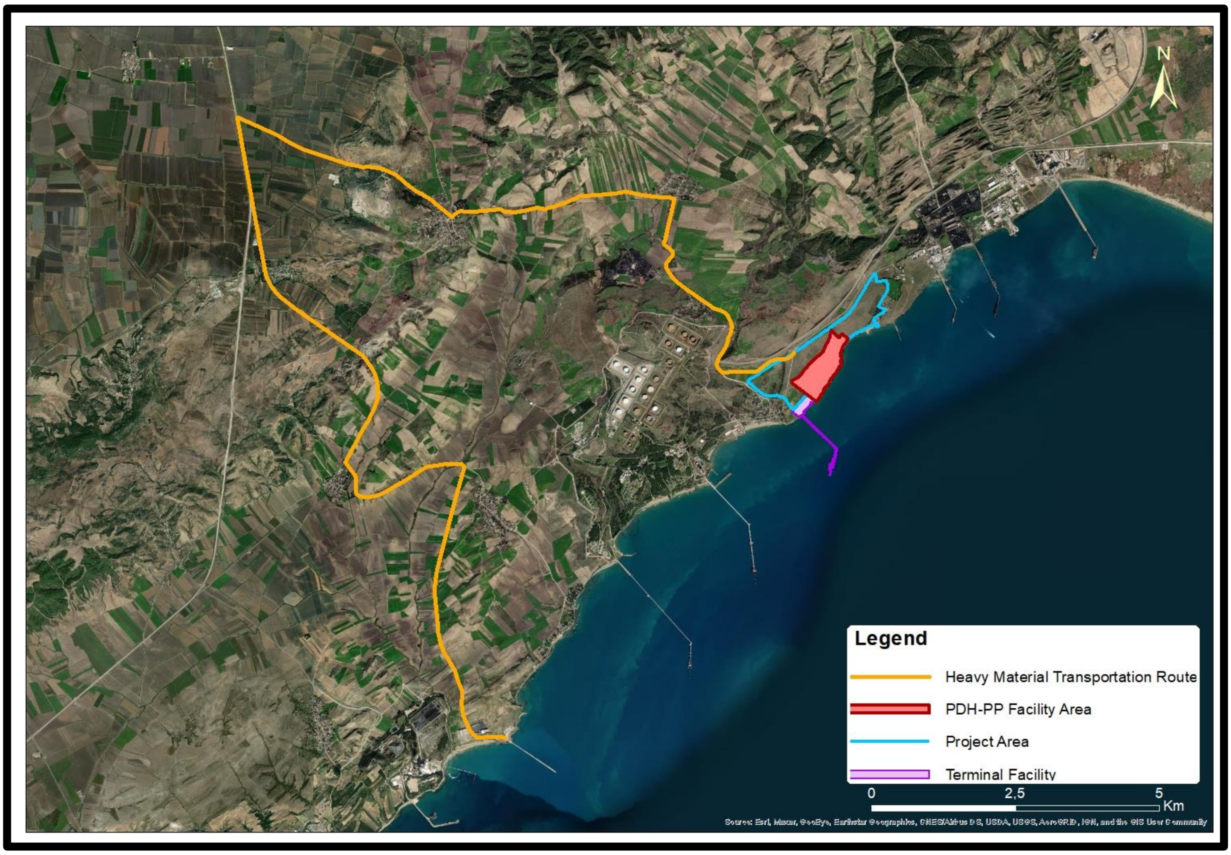

Figure 11-26. Heavy Material Transportation Routes

İskenderun and Sanko Harbours are two potential locations for import of the heavy items required for the construction works. The heavy materials to be transported within the scope of the project are listed below:

Heavy items such as:

- Propylene-Propane Splitter 1,585.4 tones;
- Deethanizer Stripper 806.7 tones;
- Loop Reactor 521.0 tones;
- Reactor 524 tones.

A route survey report regarding transportation heavy items from Sanko Port has been prepared. Total distance of the route is 28.5 km and fallows the single line regional roads. As a result of the study 63 point on the route are defined as locations that require special arrangement and/or repairment. The report concludes that:

- Beach landing option at the Project Area is not considered safe due to shallow bathymetry and wave conditions, which have negative impact on stability of cargo inside the barge. Therefore, transportation of bulk materials by ship was not considered to be a suitable alternative. More information on the Project alternatives is provided in Chapter 2: *Project Description*;
- A jetty is required to anchor the barge and minimum 5m of depth to discharge the units;
- Sanko port is suitable for unloading of the "Propylene-Propane Splitter";
- Sanko Port authority does not recommend unloading of the cargoes from December to April, due to meteorological condition;
- During transportation of the cargos at some locations cable lines (i.e. Electric, Communication and etc) should be shutdown, lift up or dismantled;
- 4 bridges can be passed by flyover bridges;
- Two curve locations are defined as most critical in terms of road transportation and requires repairment and/or construction.

Therefore, an increase in traffic (including heavy traffic) on the road network is expected during construction stage of the Project. This will lead to an increased risk of traffic-related accidents that could lead to injuries or fatalities of other road users and, potentially, pedestrians. Vulnerable groups, such as children, the elderly and disabled people are particularly susceptible to potential traffic-related impacts. It should be noted that in the rural areas children might be left unattended, and local residents may also cross roads not at designated locations. More information on vulnerable groups within the Project Social AoI is provided in *Chapter 14:* Socio-Economics.

Marine Part

The construction of the proposed Jetty have potential risk on marine traffic and impacts considering the other existing/planned developments and associated marine traffic in the region. The impacts will be related to the safe navigation of the vessels (i.e., delays, collision, etc.), marine ecology (accidental spills), safety of life and property (damage to infrastructures) and community health and safety.

During construction phase, construction material or equipment will not be directly transferred to the site via marine vessels. Therefore, temporary or permanent marine structures such as unloading platform, quay or pier will not be constructed. During jetty construction catamaran barges or platforms can be used for piling purpose. Marine traffic originating from the Project is not expected during construction phase. However, the Associated Facility (Terminal Facility) is expected to cause marine traffic during the construction phase. No information on the marine traffic movements during the construction is available. During the construction phase, the passage of fishermen from Golovasi and Incirli will be blocked due to the activities in the sea. Though it is anticipated that the fishermen will continue conducting their activities during the Project construction stage, the construction activities and relevant blockage of the passage may increase the distance/time for the fishermen to reach their fishing areas. If communication with fishermen is not carried out effectively, their nets may be damaged and collisions may occur. The impacts of marine traffic on fishermen are evaluated in the Chapter 15: *Community Health and Safety*.

Impact magnitude for construction phase is given in Table 11-10.

Table 11-10. Construction Phase Impact Magnitude

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Impacts related to Terrestrial Traffic	Negative Direct	Definition	The construction works will be in the Project site, but considering the transportation to the Project site, the impact area is considered regional.	It is planned that the construction phase of the project will take 38 months. The duration of potential impacts is expected to be long.	The traffic resulting from the project will be regulated according to legal standards, but it is likely to lead to tangible changes in environmental and social components.	During the construction period, a density that will cause an increase in traffic is expected.	-	After the finish of the construction works, there will be no traffic related the Project. In addition, the Project Area is close to the national connection roads.
		Score	Regional	Long	High	Frequent	N/A	Short/midterm
		Value	3	4	4	4	-	2
	Impact Magnitude (G+D+I+F (or L)) x R		**30**					
Impacts related to Marine Traffic	Negative Direct	Definition	The construction works will be at the Project Area but the impact area is local as the construction of the port will impact the local fishermen.	The duration of potential impacts is expected to be long.	The traffic resulting from the Jetty will be regulated according to legal standards, but it is likely to lead to tangible changes in environmental and social components	During the construction period, a density that will cause an increase in traffic is expected.	-	After the finish of the construction works, there will be no traffic related the Project. In addition, the Project Area is close to the national connection roads.
		Score	Local	Long	High	Frequent	N/A	Short-/midterm
		Value	2	4	4	4	-	2
	Impact Magnitude (G+D+I+F (or L)) x R		**28**					

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Impacts related to Heavy Material Transporat tion Routes	Negative Direct	Definition	Heavy materials coming to the Project Area will create a regional impact	Heavy materials that will come to the Project Area will come to the site several times and then the effect will cease.	Vehicles that will carry heavy materials are expected to have a high impact on traffic.	Its frequency will be limited to a few times.	-	From the moment the effect ceases, the traffic will return to its original state.
		Score	Regional	Short	High	Infrequent	N/A	Short/Mid-Term
		Value	3	2	4	2	-	2
	Impact Magnitude (G+D+I+F (or L)) x R		**22**					

11.5.2.Impacts During Operation

There will be an additional traffic load with the commencement of the operation phase of the Project on the existing road network. The Traffic Study suggests a total of 84 vehicles including heavy vehicles, shuttle/minibuses and private vehicles will be traveling due to Project activities during the peak hour. As a result, the increase in the traffic load will be in the range of 24 to 138 % for future forecast and 95 to 138 % when the current conditions are considered.

The resulting impact will therefore be in the moderate to high magnitude. The sensitivity of receptors are often high as there are social infrastructure facilities (schools or kindergartens etc.) along the routes. The resulting impact will therefore be of major significance.

Since it is not clear to which regions the product will be shipped during the operational period, there is currently no designated route for such activities. However, it is important to take into consideration that the capacity of the Free Trade Zone Connection Road is found adequate both for current and future conditions with its capacity to carry 600 vehicles per hour (ten vehicles per minutes).

It is assumed that approximately 35,000 personnel will be employed in the region provided that the existing facilities continue their operation and planned developments (as previously mentioned) will become operational. It is assumed in the simulation study that almost half of the total number of employees use public transportation (buses and train). For this reason, any delay in the development of planned road will cause lost time during personnel transfer between collection locations (i.e., train station, bus stop etc.).

Propane that will be used as raw material in the Project, will be sourced through sea shipment. A new Jetty will be established for sea shipment and is the associated facility of this Project.The proposed jetty will be composed of two approaching docks.

The operation of the proposed jetty have also potential risk on marine traffic and impacts considering the other existing/planned developments and associated marine traffic in the region. The impacts will be related to the safe navigation of the vessels (i.e., delays, collision, etc.), marine ecology (accidental spills), safety of life and property (damage to infrastructures) and community health and safety.

In order to identify and assess the potential risks and impacts to be raised during the operation phase of the Project, vessel manoeuvring risk modelling study was performed for “CPIR Port” Project by Maritime Faculty, Dokuz Eylül University (“Adana Ceyhan Port Modelling Report” 10 August 2020). The study indicates that the main potential risks and impacts such as collision of vessels and delays will be related with approaching and departing manoeuvres of the vessels by considering the location and position of the existing and planned neighbouring facilities. In this respect, existing and planned neighbouring facilities[13] are also assessed in the simulation study.

In addition to the risks and impacts mentioned above, there will be impacts related with marine water quality due to uncontrolled/accidental discharge of waste/wastewater to marine environment as a result of machinery and vessel collisions (e.g., in the events of accidents).

Impact magnitude for operation phase is given in Table 11-11.

[13] (information is limited to the information obtained from BOTAŞ Port Authority within the scope of the vessel manoeuvring risk modelling study conducted for CPIR Port Project)

Table 11-11. Operation Phase Impact Magnitude

Potential Impact	Impact Type	Nature of Impacts (Magnitude designations)						
			Geographical Extent (G)	Duration (D)	Intensity (I)	Frequency (F)	Likelihood (L)	Reversibility (R)
Impacts related to Terrestrial Traffic	Negative Direct	Definition	The Project and the Associated Facility will cause traffic in the Project Area and on the highways around the Project site. Therefore, the impact will be regional.	The operational period of the project will last 49 years and the impact is very long.	The traffic resulting from the project will be regulated according to legal standards, but it is likely to lead to tangible changes in environmental and social components	The personnel who will work during the operation period of the project will arrive as 3 shifts per day and the impact is recurrent.	-	After the finish of the operation, there will be no traffic related the Project. In addition, the Project Area is close to the national connection roads.
		Score	Regional	Very long	Medium	Recurrent	N/A	Short/midterm
		Value	3	5	3	3	-	2
	Impact Magnitude (G+D+I+F (or L)) x R		**28**					
Impacts related to Marine Traffic	Negative Direct	Definition	Only the local people who are involved in fishing will be impacted in the ship traffic during the operation period.	During the operation period of the project (49 years), the Jetty will be operated and the impact is very long.	The traffic originating from the Jetty will be regulated according to the legal standards. Considering that 2 ships will arrive per month, the impact is low.	The impact is infrequent considering that there will be 2 ships a month.	-	After the finish of the operation, there will be no traffic related the Project.
		Score	Local	Very Long	Low	Infrequent	N/A	Short/midterm
		Value	2	5	2	2	-	2
	Impact Magnitude (G+D+I+F (or L)) x R		**13**					

Table 11-12 lists Vulnerabilities and Receptor Sensitivity.

Table 11-12. Vulnerabilities and Receptor Sensitivity

Potential Receptor	Sensitivity		
	Sensitivity Score	Description of the Sensitivity	Sensitivity Value
Social Infrastructure facilities (schools or kindergartens etc.)	**High**	During the construction period the access roads will be used by the traffic. There are social infrastructure facilities (schools or kindergartens etc.) along the routes. Main roads will be used during the operation period, however, the sensitivity is considered high considering the social infrastructure.	**5**
Fishermen	**High**	Fishermen are expected to be impacted by sea traffic during the construction and operation period.	**5**
Communities around the Route	**High**	During the transportation of heavy materials, the surrounding communities will be affected by traffic and the measures to be taken (power cut, road closure, tree felling, etc.). Considering that the receptor will be disabled, elderly, children, women and their living standards and conditions will be affected, the sensitivity is high.	**5**

Table 11-13. Impact Significances

Potentail Impact		Impact Magnitude	Sensitivity	Impact Significance		
				Value	Score	Description
Construction Phase	Impacts related to Terrestrial Traffic	30	5	**150**	**High**	During the construction of the Project, an increase in traffic due to vehicles carrying work and load is expected on the roads of the Project site. The magnitude of the effect is high.
	Impacts related to Marine Traffic	28	5	**140**	**Medium**	Marine traffic is not expected to have a high impact during construction stage of the Project. Marine traffic will make it difficult for fishermen to reach the fishing areas.
	Impacts Related to Heavy Material Transporattion Routes	22	5	**110**	**Medium**	Heavy materials to be transported during the construction of the project will increase traffic and risk on the roads of the project site, but the transportation of materials is short-lived and the impact is medium.
O pe	Impacts related to Terrestrial Traffic	28	5	**140**	**Medium**	An increase in land traffic is expected during the operation period of the project. The main source of

Potentail Impact		Impact Magnitude	Sensitivity	Impact Significance		
				Value	Score	Description
						the increase will be employees and the distribution of the final product within the country.
	Impacts related to Marine Traffic	65	5	**65**	**Low**	Marine traffic during the operational period will be limited to a maximum of 2 ships per month. In the case of effective communication with fishermen, the impact will be highly limited.

11.6. Mitigation Measures

Measures to avoid and mitigate potential traffic risks and impacts related to terrestrial and marine traffic for construction and operation stages of the Project and associated facility are provided below. The focus will be made on avoidance of potential risks and impacts; mitigation measures will apply if avoidance is not feasible. The measures discussed in the report will apply to all the Project (sub)contractors. The Project owner and the Project management company will be responsible for controlling implementation of these mitigation measures.

11.6.1. Construction Phase

Terrestrial Traffic

The Company will implement approach on avoidance of impacts as a first priority. If avoidance is not feasible, mitigation measures will apply.

The Company will prepare Construction Traffic Management Plan for construction phase of the Project and implement it in order to minimize the impacts to the extent possible. Necessary consultation with the relevant authorities and stakeholders should be made related to the implementation of the Traffic Management Plan for the construction stage.

Specific to construction phase, the following mitigation measures should be considered:

- Entrance / exit to and from the Project Area will be ranged with visibility splays;
- There will be 1.5 m x 3 m signs placed at every 300 m around the Project Area stating the relevant contact details for any potential grievances to be communicated to the Project;
- All operators of construction vehicles will be given educational seminars on traffic safety;
- Information brochures (which include the relevant contact details for any potential grievances to be communicated to the Project) will be distributed to all the residential buildings and to the Muhtar of the surrounding neighbourhoods;
- Necessary precautions will be taken and the residents will be informed as necessary in Incirli neighbourhood in order to ensure their safety; in particular when the schools are open. The heavy loads and construction materials might be transported via Kurtpınarı location, where Toros Tarım Primary School is located,. The school will also be considered in the Traffic Management Plan, and the relevant measures, including installation of traffic signs and setting speed limits will be outlined accordingly. These precautions will be planned in coordination with relevant public authorities.

As mentioned above, Ceyhan-Dortyol road will be used for the Project. Currently, this road crosses Incirly community (dividing it into two parts) and then crosses the Project Area (the section of Ceyhan-Dortyol road crossing the Project Area is shown in brown in Figure 11-16). This part crossing the Project Area will not be publicly used with the start of the construction activities as it lies within the Project Area boundaries. However, there is another existing road connecting Incirli community with Ceyhan-Dortyol Road traversing in parallel to the north boundary of Project Area (see Figure 11-16). This connection option will be used during the construction phase by Incirli residents. It is anticipated that the section of Ceyhan-Dortyol road crossing Incirli will not be used during the Project construction stage. Alternative road to the gate to the Project Area running in parallel to the north boundary of the Project Area will be used instead.

As it is expected that Ceyhan-Dortyol Road road will potentially be used during constructiıon phase of the Project (section not crossing Incirli community), the primary recommendation is to ensure higher safety on this road regarding traffic flow conditions. Specific to the current condition of the existing road network important remarks can be listed as:

- The cross section of the road should be 15 meters as indicated in the zoning plan;
- The cross section should only allow 2 lanes (two-ways);
- Each lane will have a width of 4.5 meter considering the safety margins;
- Pedestrian walkways are provided (minimum of 3 meters width) at each side of the road;
- Parking is not allowed at any condition on the sides of the road; and
- Vehicle tires should be cleaned at the facility gates.

By the time of the ESIA preparation, there was no information on other potential improvements of road infrastructure with regard to the Project and/or the broader CPIR area. If other access route is to be unitilized for the Project and associated facilities, relevant analysis of the route should be conducted and relevant provisions on improvement of road infrastructure should be made as necessary. Relevant measures to ensure traffic and community safety should be provided as part of the Traffic Management Plan (see below).

At the same time, shuttle service will be provided to the employees in order to reduce the traffic caused by the Project. The accommodation facility to be established within the Project Area will reduce the mobilization of employees, and the number of vehicles arriving at the site will be reduced. Main roads will be used in the Project and no traffic load will be created on the roads connecting to the neighborhoods.

The whole process will be planned through the Traffic Management Plan. Special driving training and traffic training (rules to be followed, sensitivities related to communities, etc.) will be given to all vehicle drivers who will work within the scope of the Project. Communities will be regularly informed on traffic activities. Communication with the communities (especially İncirli) will be maintained by the Project Community Liaison Officer and by such means as local newspapers, radio, brochures, advertisements and announcements to be left at the mukhtar's offices (the means will be determined as appropriate). All contractors and subcontractors involved in the Project will comply with the plan. The Project company is responsible for subcontractors' compliance with this plan.

Mandatory pre-trip examinations of drivers will be conducted (including check for potential signs of alcohol of drug intoxication). The Project will adopt a policy of zero tolerance in relation to alcohol consumption, including immediate termination of employment agreement in case of violation.

Mitigation measures as part of the Traffic Management Plan will be developed in consultation with affected communities and stakeholders, including Incirli community. Consideration of vulnerable groups and relevant risks should be given. The appropriate consultation measures will be provided in the Plan.

In accordance to the Highway Transportanion Law (#4925 dated 10/07/2003), transportation permit is required for transportation of heavy materials. The law also request a road transportation report in addition to the permit. For that reason a heavy material transport report will be preaperad. This plan will also be part of the Construction Traffic Management Plan.The Permit will be obtained from them General Directorate of Highways.

During the transport of heavy materials, communities will be informed at least 1 month before the works in order to provide meaningful timing for potential affected people to make necessary arrangements. Consultation methods with communities will be determined within the scope of the heavy material transport plan to be prepared. A person responsible for the plan will be appointed and the contact number of this person or of the Project CLO will be communicated to the communities (for example, through brochures, advertisements, announcements). Power cuts required during transportation will be made locally.

Communities will be informed about power cuts and transportation routes. School buses organisation will be informed and official institutions will be in contact. Stakeholders may need different communication channels. For this purpose, the stakeholders will be informed through advertisements and brochures in areas frequently used by local people such as mosques, health centers, headman's offices, market places.

There are trees on the route that will prevent the passage. These trees will be pruned. As stated in the route survey report, high voltage electrical power must be cut off at points that do not allow passage. Telephone cables will be cut at points that do not allow passage. Restoration works will start within a maximum of 2 days after the transportation works are completed. All infrastructure services will be restored to ensure that communities do not experience unjust treatment. Automatic reverse alarms will be installed on all heavy vehicles. Tire washing units at the site exits and dumping area will be installed in order to prevent earth and mud contamination of the heavy vehicle transportation routes as per local regulation and Project standards. Only designated drop-off areas will be used for employees’ transportation.

The transport of heavy materials will be carried out by professional transport companies. The transportation process will be under control of related safety protection measures, professional drivers and specialized personnel to accompany drivers. Safety training, speed limit control, GPS location management, regular control, prohibition of tired vehicle use, strict transportation routes, time limits regarding driving hours are recommended for the safety of heavy vehicle drivers and road users. A follow-up mechanism will be established to continuously monitor and inspect the speed control of heavy vehicles, the routes they use, and the transportation routes. Regulations and laws regarding the transportation of materials and cargo by heavy vehicles will be implemented and additional measures will be undertaken. The load limits, maintenance and measurements of the vehicles will be controlled, and environmental and social security measures will be undertaken. All drivers and operators of heavy equipment, including crane operators, and bus drivers are required to undergo drug and alcohol test as part of their medical examination and may be selected at any time for random assessment and testing. All drivers shall be required to undergo a drug and alcohol test if required in the event of a road traffic accident, regardless of fault. All necessary mitigation measures will be included in the heavy material transport plan in more detail. The impacts of transporting heavy loads on public health and safety and mitigation measures for these impacts are included in *Chapter 15: Community Health and Safety*.

Marine Traffic of Associated Facility

- The authority to make official announcements regarding the works to be carried out in the field is the responsibility of the General Directorate of Coastal Safety. In this context, the General Directorate of Coastal Safety will be informed about the works to be carried out at sea and the General Directorate will announce the construction area in the NAVTEX system. Jetty will be equipped with emergency response system including spill response kits and sea water cleaning equipment;
- At the same time, the Project Company CLO will inform local fishermen about the construction works. The marine area will be designated by buoys, and safe passage of boats and ships using the sea route near the coast will be ensured. Barges to be used for construction will also be illuminated, and necessary precautions will be undertaken for night traffic. The barges will be berthed in safe harbors on the coast, especially during bad weather conditions. Piles will also be illuminated, especially at the ends, until the construction of the Jetty is completed;
- Marine Traffic Management Plan should be developed for the SPV responsible for construction & operation of associated facility (no Marine Traffic Management Plan is to be developed for the Project). The Company will request/recommend the SPV development of this plan and will make reasonable effort to ensure this measure is implemented and that the plan will be in line with international standards and ESIA provisions.

The Marine Traffic Management Plan will cover such issues as:

- Determination of navigation routes;
- Measures to ensure competency of crews and to provide relevant training;
- MARPOL compliance of vessels delivering product;
- Proactive regular engagement with marine area users (in particular, with fishermen in Incirli and Gölovası);
- Ensuring availability of grievance mechanism;

- Mitigation measures related to fishermen health and safety are given in *Chaper 15 Communtity Health and Safety*.

11.6.2.Operation Phase

Terrestrial Traffic

Mitigation measures during the operation stage will be similar to those described above for the construction stage. Specific to operation stage, the following mitigation measures will be implemented:

- Development and implementation of the Operation Traffic Management Plan;
- Coordination with relevant affected communities (in particular, Incirli) and authorities with regard to development and implementation of traffic safety measures;
- Provision of shuttle service to employees to reduce traffic load;
- Implementation of grievance mechanism, etc.

Marine Section of Associated Facility

In the modeling study carried out for the associated facility of the project, it was concluded that the berthing points/berths for the designed vessels do not possess unacceptable risks. The following technical mitigation measures were proposed in terms of safe navigation of vessels and marine safety of life and property:

- Meteorological conditions at the Project Area shall be continuously monitored, it will be appropriate to postpone the docking manoeuvres in cases where the Hs (wave height) value exceeds 1.5 meters when the southern seas rise;
- In terms of manoeuvring safety at the tanker terminals, it will be appropriate to define a reference line so that the ships that will berth to Jetty #1 do not fall close to the shore while turning;
- For ships of 300 meters and above, 3 tugboats (each with a pulling force of 60 tons and each direction type) are required;
- Ships on the jetties should be berthed with their prow facing the open sea.

Mitigations

The following general mitigation measures in terms of environmental and social impacts will be undertaken during construction and operation phases of the Project:

- It shall be ensured by the Project Company that the ship propulsion power in port access areas shall be considered during the design stage to provide safe navigation of vessels;
- It will be considered to offer marine safety training to main vessel companies and applying an incentive scheme for companies that can demonstrate good maintenance of their vessels and low accident statistics;
- Avoid unnecessary vessel movements, as possible;
- A grievance mechanism that allows communities to communicate concerns and have them addressed in a timely and effective manner shall be established and implemented;
- A Marine Traffic Management Plan will be prepared and implemented covering operation phase of the Project. The plan will cover such issues as:
    - Determination of navigation routes;
    - Measures to ensure competency of crews and to provide relevant training;
    - MARPOL compliance of vessels delivering product;
    - Proactive regular engagement with marine area users (in particular, with fishermen in Incirli and Gölovası);
    - Ensuring availability of grievance mechanism;
- A detailed Emergency Preparedness and Response Plan, which involves the Marine Part of the Project, shall be prepared before the construction stage, in accordance with the "Act on Guidelines for Response to Emergencies and Compensation of Losses in Case of Pollution of the Marine Environment from Oil and Other Harmful Substances" and its regulations.

11.7. Residual Impacts

Assuming that mitigation measures mentioned above and those mentioned in relevant chapters are implemented, the residual impacts on traffic is estimated to be less significant and the summary of the residual impact significance are shown in Table 11-14 and Table 11-15.

Table 11-14. Construction Phase Residual Impact Significance

Subject	Construction Phase Residual Impact
Terrestrial Traffic	Low
Marine Traffic	Low
Heavy Material Transporattion Routes	Low

Table 11-15. Operation Phase Residual Impact Significance

Subject	Construction Phase Residual Impact
Terrestrial Traffic	Low
Marine Traffic	Negligible

11.8. Summary of Analysis Outcome

The average daily number of vehicles to be used during construction phase of the Project and associated facility are 60 trucks, 15 trailers, 4 lorries and 100 cars. The excavation and filling works will be required to be undertaken for 16 months including Phase-1 Early Site Works. It is concluded in the Traffic Study that the capacity of the transportation network is sufficient to carry traffic load caused by the construction activities of the Project during peak hours. It is reported by the Project Company that the construction activities of the Project and CPIR Port will be parallel. As a result of the assessment made by traffic consultants, the road network around the Project site, which has adequate capacity to carry current traffic load, will also be sufficient for future traffic load to be generated by the Project. With that, it is important to take necessary measures in coordination with public authorities in order to maintain safety of residents of the nearby communities, especially Incirli neighbourhood.

Total number of workforce to be employed during operation phase of the Project is 321. This number is for the personnel to be employed by the Project Company. The personnel will commute to the Project Area by private cars and personnel shuttles; reportedly 66% of the personnel are expected to use shuttle buses where the remaining personnel will be using their private vehicles. The traffic increase in the vicinity of the Project Area will be in the range of 24 to 138 % for future forecast and 95 to 138 % when the current conditions are considered. The access road is planned to be a 15 m wide road with two lanes as indicated in the zoning plan. The traffic consultants state in their assessment report that one lane can sufficiently carry a traffic load of 600 vehicles per hour. In that sense, the capacity of the road is found adequate both for current and future conditions.

A vessel manoeuvring risk modelling study was performed for “CPIR Port” Project by Maritime Faculty, Dokuz Eylül University (“Adana Ceyhan Port Modelling Report” 10 August 2020). The Jetty (associated facility) was evaluated in risk modelling study as a part of the CPIR Port (as Jetty#1) among other jetties of the CPIR Port (jetties #2, 3, and 4). Therefore, the assessment and the results of the vessel manoeuvring risk modelling study have been evaluated in this section of the ESIA Report. The study was performed in order to identify the manoeuvring risks. In this modelling study, vessel manoeuvring trials were performed by means of “Bridge Simulator system”. A total of 21 different manoeuvring trials were applied for CPIR Port Project (including jetties).

The following risks were identified regarding approaching manoeuvres of vessels: i) disruption of manoeuvres in case of a simultaneous manoeuvring of vessels coincide with the vessels approaching to BOTAŞ Facility; ii) disturbance to manoeuvres that may occur due to damages on the ropes of tugboats caused by strong waves; iii) risks associated with insufficient pulling power of tugboats for the vessels (if LOA>300 m). Additionally, risks identified for departing manoeuvres of vessels are: i) risks associated with insufficient pulling power of tugboats for the vessels (if LOA>300 m) and ii) risks that may occur during departing the tanker terminals without support in the case of an unexpected meteorological condition.

It is concluded in the modelling study that the approaching points/berths do not possess unacceptable risks for the designed vessels. Additionally, the existing neighbouring facilities as well as planned developments in the close surrounding of the CPIR Port Project were also included in the assessment. The interaction of the CPIR Port Project and planned development to be proposed by Toros Agri Industry were studied and it was found that the distance between the two facilities have enough space for vessels’ manoeuvring. Additionally, it was also found that the safety distances especially between jetties # 2 and 3, and the design in terms of manoeuvring was suitably arranged considering the neighbouring BOTAŞ-BIL Facilities.

The mitigation measures proposed in the Adana Ceyhan Port Modeling Report prepared by Dokuz Eylul University Maritime Faculty in terms of safe navigation of vessels and safety of life and property at sea will be undertaken by the EPC contractor during the construction of the Associated Facility Project and by the O&M during the operation phase. The design of the marine section of the CPIR Port (including jetties) shall be made in accordance with the findings driven from the simulation study and recommendations that have been already stated in the Adana Ceyhan Port Modelling Report.

Traffic Management Plan of the Project and Marine Traffic Management Plan for construction and operation stages will be developed to ensure potential risks and impacts are mitigated and managed.

CEYHAN PROPANE DEHYDROGENATION - POLYPROPYLENE PRODUCTION PROJECT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT

(CHAPTER-12)

FEBRUARY 2023

ANKARA

CEYHAN PROPANE DEHYDROGENATION - POLYPROPYLENE PRODUCTION PROJECT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT

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ABBREVIATIONS

BERN	Bern Convention
BIL	BOTAŞ International
BOTAŞ	Turkish Petroleum Pipeline Company
BTC	Baku-Tbilisi-Ceyhan Crude Oil Pipeline
Ceyhan PDH-PP Project / Project	Ceyhan Propane Dehydrogenation - Polypropylene Production Facility Project
Ceyhan Petrokimya A.Ş. or Management Company	Ceyhan Petrokimya Endüstri Bölgesi Yönetim A.Ş.
CITES	Convention on International Trade in Endangered Species of Wild Flora and Fauna
CPIR	Ceyhan Petrochemical Industrial Region
CPIR Port	Raw Material Supply, Storage and Port Facility Project
CR	Critically Endangered
DD	Data Deficient
EIA	Environmental Impact Assessment
EN	Endangered
ESIA	Environmental and Social Impact Assessment
EU	European Union
EX	Extinct
EW	Extinct in the Wild
FSC	Forest Stewardship Council
GN	Guidance Note
IBAs	Important Birds Areas
IFC	International Finance Corporation
IUCN	International Union for the Conservation of Nature
KBA	Key Biodiversity Areas
LC	Least Concern
MAK	Central Game Commission
MoAF	Ministry of Agriculture and Forestry
MoEUCC	Ministry of Environment, Urbanization and Climate Change
MoIT	Ministry of Industry and Technology
NE	Not Evaluated
NT	Near Threatened
O.G.	Official Gazette
PDoAF	Provincial Directorate of Agriculture and Forestry
PFS	Protected Fauna Species
PS	Performance Standard
SPFS	Strictly Protected Fauna Species
Terminal Facility	Jetty and Propane Storage Tank
TRDB	Turkish Red Data Book
UN	United Nations
UVS	Underwater Visual Census
VU	Vulnerable

12 TERRESTRIAL AND MARINE ECOLOGY

12.1 Scope

The potential impacts of the Ceyhan Propane Dehydrogenation - Polypropylene Production Facility Project (Ceyhan PDH-PP Project or the Project) on terrestrial and marine ecology and resources of nature conservation interest are presented in this chapter. Baseline information on terrestrial ecology has been collected through four different ecological walkover surveys conducted on 26-27 February 2020, 20-21 May 2020, 28-29 June 2020 and 27-28 November 2021 by flora and fauna experts, while baseline information on marine ecology information has been collected through ecological surveys conducted within the scope of the Environmental Impact Assessment (EIA) study. These ecological surveys were supported by desktop studies.

Data obtained from the ecological surveys were evaluated according to national and international legislation as well as international standards, guidelines and conventions. Turkey is a party to a number of conventions on different aspects of biological diversity as listed below, including Turkish legislation. Although not all of the listed conventions are relevant within the scope of the Project, it is useful to set out the binding framework for any project undertaken in Turkey:

- Environmental Law (Law No: 2872) (Official Gazette (O.G.) date/no: 16.08.1983/18132);
- Law on National Parks (Law No: 2873) (O.G. date/no: 09.08.1983/18132);
- Law on Olive Improvement and Grafting of Wild Species (Law No: 3573) (O.G. date/no: 7.2.1939/4126);
- Law on Terrestrial Hunting (Law No: 4915) (O.G. date/no: 11.07.2003/25165);
- Regulation on Protection of Wetlands (O.G. date/no: 04.04.2014/28962);
- Regulation on Wildlife Protection and Wildlife Development Areas (OG date/no: 08.11.2004/25637);
- Law on Aquaculture (Law No: 1380) (O.G. date/no: 04.04.1971/13799);
- Regulation on Aquaculture (O.G. date/no: 10.3.1995/22223);
- Communique Regarding the Protection of Sea Turtles (2009/10);
- Communique Regarding the Illegal Killing of Wild Animals) (O.G. date/no: 24.05.2002/24764);
- Communique Regarding Biological Monitoring (O.G. date/no: 21.06.2019/30808);
- Paris Convention on the Protection of the World Cultural and Natural Heritage (acceded by Decision of the Council of Ministers dated 23.05.1982 and number 8/4788 published in the O.G. dated/no:14.02.1983/17959);

- Bern Convention (BERN) on Protection of Europe's Wild Life and Living Environment (acceded by the Decision of the Council of Ministers dated 9 January 1984 and published in the O.G. dated/no: 20.02.1984/18318);
- Barcelona Convention on the Protection of the Mediterranean Sea Against Pollution (acceded by the Decision of the Council of Ministers, namely "Agreements Regarding the Protection of Marine Environment and Coastal Regions of Mediterranean", no 2002/4545, published in the O.G. dated/no: 22.8.2002/24854);
- International Convention for the Prevention of Pollution from Ships (MARPOL) (published in the O.G. dated/no: 24.06.1990/20558);
- Convention to Combat Desertification (acceded by the Decision of the Council of Ministers dated 16.04.1998 and published in the O.G. dated/no: 16.05.1998/23344);
- Ramsar Convention on Wetlands of International Importance Especially as Wildfowl Habitat (acceded by the Decision of the Council of Ministers dated 15.03.1994 and published in the O.G. dated/no: 17.05.1994 /21937);
- Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) (acceded by Law no. 4041 and published in O.G. date/no: 20.06.1996/22672);
- United Nations (UN) (Rio) Convention on Biological Diversity (ratified by Law no. 4177 published in O.G. dated/no: 27.12.1996/22860).

In evaluating the threat/protection status of species, CITES, BERN, and Turkish Red Data Book (TRDB), which is based on International Union for Conservation of Nature (IUCN) Red List classifications, are used.

The IUCN standards maintain a List of Threatened Species (the IUCN Red List) which is a widely recognized, global approach for evaluating the conservation status of plant and animal species. The IUCN Red List intends to draw attention to species whose populations are at risk or under threat. The IUCN places a species on the Red List only after studying its population and the reasons for its decline. Some countries pay greater attention to IUCN-listed species than BERN-listed species, since the Red List relies more on research.

Species covered in CITES are listed under three different appendices according to their conservation status. Appendix I covers the species, which are under the threat of extinction. Trade in the specimens of these species is not allowed except in extraordinary circumstances. Appendix II includes species which are not threatened with extinction, but trade in specimens is restricted in order to prevent utilization incompatible with their survival. Appendix III includes species for which other parties of CITES is applied for assistance in controlling trade and which are conserved at least in one country.

The BERN aims at conserving and promoting biodiversity, developing national policies for the conservation of wild flora and fauna and their natural habitats, protection of the wild flora and fauna from the planned development and pollution, developing training for protection practices, promoting and coordinating the research done regarding this subject. It has been signed by 26 member states of the European Council (as well as Turkey) with the aim of conserving the wildlife of Europe. Species that are protected under the BERN are classified according to the following categories:

- Appendix I: Strictly protected flora species;
- Appendix II: Strictly protected fauna species;
- Appendix III: Protected fauna species.

All the nations which are party to the BERN have signed the Convention on Biological Diversity as well. Parties of this convention are responsible for ensuring sustainable use of resources in line with their national development trends and conserving threatened species.

The approach to the assessment of impacts on terrestrial ecology has followed the methodology described in Section 4.5 of *Chapter 4: Scope and Methodology* of the ESIA and Stakeholder Engagement.

12.2 Biodiversity Conservation Assessment

International Finance Corporation (IFC) Performance Standard (PS) 6 “Biodiversity Conservation and Sustainable Management of Living Natural Resources” is considered during the assessment. The PS6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development. The requirements set out in this PS have been guided by the Convention on Biological Diversity, which defines biodiversity as “the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species, and of ecosystems”. IFC Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (1st January 2012 and updated on 27th June 2019) corresponds to the PS6.

In IFC PS6, critical habitat criteria are described as follows and should form the basis of any critical habitat assessment; “Critical habitats are areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes.” Critical habitats are the areas having high biodiversity value that may include at least one or more out of five values specified in IFC PS6.

Projects that are located within internationally and/or nationally recognized areas of high biodiversity value may require a critical habitat assessment. Examples include the following:

- Areas that meet the criteria of the IUCN's Protected Area Categories Ia, Ib and II;
- Key Biodiversity Areas (KBAs), which encompass Important Bird and Biodiversity Areas (IBAs).

12.3 Terrestrial Section

The aim of the studies to determine biological characteristics of an area, and conduct identification of principal habitat types, species represented within the area, key species (e.g., rare or endemic) and the conservation status of identified species, if any, to assess how to manage the area while protecting and conserving biodiversity. Terrestrial flora and fauna studies at the Project site were carried out twice in February 2020, May 2020, June 2020 and November 2021 within the context of the above-given scope.

Adana Province is located in the north eastern corner of the Mediterranean Sea. The province has diverse habitats such as rivers, coastal areas, lakes, and mountains over 2,500 meters. According to the Adana Environmental Status Report (2018), habitat types of Adana province are classified based on CORINE land classifications, vegetation analysis and observations made through the biodiversity site visits conducted for Adana province.

EUNIS habitat types, which are identified for Adana province together with the surface areas and distribution ratios, are presented in this 2018 report. Accordingly, the habitat types are classified as marine habitats (A), littoral sediment (A2), coastal dunes and sandy shores (B1), surface standing waters (C1), rivers (C2), mires, bogs and fens (D), mesic grasslands (E2), alpine and subalpine grasslands (E4), sparsely wooded grasslands (E7), maquis, arborescent matoral and thermo Mediterranean brushes (F5), shrub plantations (FB), broadleaved deciduous woodland (G1), broadleaved evergreen woodland (G2), coniferous woodland (G3), mixed deciduous and coniferous woodland (G4), line of trees, small anthropogenic woodlands, recently felled woodland, early stage woodland and coppice (G5), miscellaneous inland habitats with very sparse or no vegetation (H5), arable land and market gardens (I1), buildings of cities, towns and villages (J1), low density buildings (J2), extractive industrial sites (J3), transport networks and other constructed hard-surfaced areas (J4), waste deposit (J6), habitat complexes (X).

The vast majority of the habitat types of Adana province are I1-agricultural lands (36%), X-habitat complexes (12%), G5-woodland-coppice (11%) and G3-coniferous woodlands (11%). Adana Province is rich in terms of flora species. The ecosystem is mainly divided into two: Aquatic ecosystems (coastal dunes, lakes, rivers) and terrestrial ecosystems (maquis, forest, mountains/alpines). There are also urban ecosystems consisting of residential areas and agricultural ecosystems which have been formed by anthropogenic affects. In terms of floral types and vegetation, forest areas are classified based on the climatic conditions that can be changed depending on the dominant types of trees and altitudes. At lower altitudes, the main vegetation has been almost disturbed. Scrubs are densely populated in some areas. Moreover, Ulmus spp and Alnus glutinosa groves can be seen close to the streams. Quercus ithaburenis can be seen in agricultural areas.

The Adana Environmental Status Report (2018) identified 65 mammal species, 49 reptile species, 337 bird species and 34 inland fish species within the borders of the province. The dominant mammal species (medium to large size) are red fox, wild boar, rabbit and crested porcupine.

The distribution of wildlife in the province with altitude is presented as tortoise (0-10 m), francolin (10-550 m), nightingale (500-1000 m), avian predators/raptors (1000-1500 m), wild goat (1500 m). Sea turtles can be seen in the vicinity of the marine sections and sand dunes (0-10 m) and wetland areas are used by sea turtles for egg-laying and breeding areas and wintering, nesting and propagation areas by bird species.

Adana is located on the main bird migration route in Turkey (i.e. the route is between Europe and Africa, crossing through Turkey). Most of the migratory birds in Turkey use this route crossing Hatay region and use Adana and Osmaniye Provinces to go to/from this region. Migrative birds follow land and do not prefer to fly over water bodies and thus the main migration route is located about 10-20 km east of the Project site. Since the bird migration routes coincide with the borders of Adana province and there are several deltas within the borders of Adana province, the province is rich in terms of the bird population.

Adana is located in an area that creates a bridge providing distribution of the fauna between Africa and Anatolia. For instance, some animals of African origin such as the Egyptian fruit bat (Rousettus aegyptiacus) and Egyptian mongoose (Herpestes ichneumon) have restricted distribution in the Mediterranean area (in Turkey) and are present in coastal sections in Adana. Some other species that live in the Mediterranean climate and have relatively small distribution area in Turkey including in Adana include Chamaeleo chamaeleon (Mediterranean Chameleon), Phoenicolacerta laevis (Lebanon Lizard), Ablepharus budaki (Budak's Snake-eyed Skink), Chalcides ocellatus (Ocellated Skink), Eirenis barani (Baran Dwarf Racer), Eirenis levantinus (Levantine Dwarf Racer), and Eirenis lineomaculatus (Striped Dwarf Snake).

The bird species Pycnonotus xanthopygos (Yellow-Vented Bulbul) has a Mediterranean distribution and are present at the Project site. Additionally, a threatened and restricted-range species Schreiber's Fringe-fingered Lizard (Acanthodactylus schreiberi) lives in a very small area in about 7 km east of the Project site.

The Project site is surrounded by industrial facilities, rural residential areas, scattered vacant lands, forest and forestation areas located in the Ceyhan Petrochemical Industrial Region (CPIR) area, to the south of E90 Motorway (i.e. Adana-Şanlıurfa Road) and Ceyhan İskenderun Motorway Free Trade Zone Connection Road. Two crude oil pipelines belonging to Turkish Petroleum Pipeline Company (BOTAŞ) and Baku-Tbilisi-Ceyhan Crude Oil Pipeline

(BTC) are crossing along the Ceyhan İskenderun Motorway Free Trade Zone Connection Road to the north of the Project site. A river-bed is also present along northeast boundary of the Project site.

Some parts of the Project site include agricultural fields and olive groves; some parts are covered by Mediterranean-type bushes while other parts are covered by small annual plants. The shoreline is rocky in natural pattern. The closest settlement is İncirli locality of Kurtpınarı neighbourhood (approximately 50 m to the west of the Project site). It was observed during the ecological walkover surveys that villagers are using the area for grazing of domestic animals such as cows and sheep (Figure 12-1). Because of agricultural activities (Figure 12-2), grazing activities, existing motorway and human activities in the village next to the Project site, it can be considered that the area is partly under human pressure.

Figure 12-1. A villager with livestock grazing on the Project site and views from the Project site

Figure 12-2. Some agricultural areas in the Project site

12.3.1 Terrestrial Flora

Methodology

The flora inventory of the Project site was developed based on a literature review and ecological walkover surveys carried out on 26th-27th February 2020 and 20th-21st May 2020 by Prof. Dr. Hayri Duman from Biology Department of Gazi University Faculty of Science and 28th -29 th June 2020 and 27th-28th November 2021 by Prof. Dr. Galip Akaydin from Biology Education Department of Hacettepe University Faculty of Education. Initially, a desk-based study was performed to determine sampling stations through satellite images, determine the flora species and vegetation characteristics within the Project site, identify critical flora species and habitats and minimise potential impacts of the Project on these species and habitats.

Since the Project site has a rather small surface area, the entire site was surveyed through the transect method, and no habitat-based sampling was conducted for either survey. The flora list is composed of species whose samples were collected at the site and those that were identified through direct observation without sampling, as they are well-known by the flora expert. Species that could not be identified were taken to a herbarium to conduct a proper identification. The floral characteristics of the Project site were identified in line with the observations made at the Project site during ecological walkover surveys. The main vegetation of the Project site has been identified as degraded maquis, herbaceous vegetation growing on arid Mediterranean soils and dry agricultural areas.

The flora list is categorised as ferns (*Pteridophyta*), open seed plants (*Gymnospermae*) and closed-seeded plants (*Angiospermae*). Families under each group are also listed in phylogenetic order in the Turkish flora. Species are listed in accordance with author names, their Turkish names (if available), phytogeographic regions, endemism, threat categories for endemic and rare species, Bern and CITES annexes, and their relative abundance in their corresponding EUNIS habitats.

The listed characteristics for each identified species are given in Table 12-1. Samples that are collected from the Project site were transformed into herbarium material and species were identified by using “Flora of Turkey and the East Aegean Islands” by Davis, 1965-1988.

While determining the threat status of endemic and rare flora species, the Red Data Book of Turkish Plants (Ekim et al., 2000), prepared in accordance with IUCN 1994 criteria, was re-evaluated based on the 2001 criteria to define populations of species in the area and potential threats. Furthermore, there is an ongoing project at the national level for the determination and identification of endemic and rare flora species of Turkey named “Türkiye Endemik Bitkilerinin Tehlike Sınıflarının Küresel Ölçekte Değerlendirilmesi Projesi”, in which our flora expert is involved as the IUCN SSC Red List Authority Coordinator of Turkey. As this project has not yet been finalised, the evaluation of the threat status of endemic and rare flora species was also based on the expert judgement from the project’s preliminary outcomes.

Overview of Baseline Conditions

The Project is located in the Ceyhan district of Adana province in the south of Turkey along the Mediterranean coast. Given this location, the effect of the Mediterranean climate and its characteristics are observed on the vegetation. The two vegetation types that occur naturally in the region are maquis and dry Mediterranean lands with unpalatable non-vernal herbaceous vegetation. Olive groves and dry agricultural areas are also observed in the Project site.

The shoreline is rocky in its natural pattern. The main agricultural products observed during the ecological site survey are *Olea europaea* L. var. *europaea* (olive), *Triticum vulgare* L. (wheat), *Pisum sativum* L. (pea), *Phaseolus vulgaris* L. (bean) and *Allium cepa* L. (onion). There are no permanent water bodies such as rivers, creeks, lakes, or ponds in the Project site.

Terrestrial Flora Inventory of the Project Site

The Project site mainly consists of natural vegetation. However, some parts of the site have been modified and planted after 2007. In various parts of the land allocated for CPIR (i.e., land for which expropriation has been completed) including within the Project site, scattered olive groves with a total area of 37.89 ha are present. As stated in the official letter obtained from the Provincial Directorate of Agriculture and Forestry (PDoAF) on 08.03.2019 (see. Annex A) regarding permission for non-agricultural use of the site, the relocation of the olive groves to another suitable location in the same land parcel was approved by PDoAF pursuant to the Article 20 of the Law No. 3573. The tree relocation is conducted under the responsibility of Ministry of Agriculture and Forestry (MoAF).

The list of flora species of the Project site is presented in Table 1 of Annex J-I. A total of 256 flora taxa that belong to 56 families were identified through the two ecological walkover surveys. None of the flora taxa are endemic species, but one is a CITES Annex II species: *Cyclamen persicum*. Additionally, *Pancratium maritimum* distribution is also possible in the vicinity of the Project area according to the information available in relevant literature. This species is rare and classified as EN according to the Red Data Book of Turkish Plants. There are three plant species in the study area classified as rare and VU according to the Turkish List. *Cyclamen persicum, Crocus vitellinus* and *Sternbergia pulchella* respectively.

As a result of the additional field studies carried out in June 2020 and November 2021, 189 taxa belonging to 49 families, all belonging to the Angiospermae group, were identified in the project area. Among the plants detected in the study area, there is 1 taxon (*Pacratium maritimum* L.) in the EN category in the rare (Rare) plants group, although it is not endemic. Details of additional field studies is given in Annex-T.

During the field studies carried out within the scope of Biodiversity Action Plan (BAP)-Terrestrial in January 2022, 2 vulnerable species were identified. These are *Sternbergia pulchella* and *Crocus vitellinus*.

Examples of some of the identified flora species at the Project site are presented below in Figure 12-3.

Figure 12-3. Examples of flora species identified at the Project site (a) *Cyclamen persicum* (CITES Annex II); b) *Solanum elaeagnifolium* (invasive species))

Threat Status and Endemism of Flora Species

According to the results of thewalkover surveys, none of the flora taxa are endemic species. Besides, *Pancratium maritimum* distribution is possible in the vicinity of the project area according to the information in the literature. This species is rare and classified as EN according to the Red Data Book of Turkish Plants[1].

[1] Prepared in accordance with the IUCN 1994 criteria and re-evaluated based on the 2001 criteria to define populations of species in the area and potential threats

However, one species *Cyclamen persicum* is a CITES Annex II species, and is also listed as vulnerable (VU) in the Red Data Book of Turkish Plants. All the flora species listed in Table 1 of Annex J except *Pancratium maritimum* and *Cyclamen persicum* are listed as least concern (LC) in the Red Data Book of Turkish Plants.

Cyclamen persicum is only widespread in the Mediterranean coasts of Turkey and it is prohibited to collect and export tubers. There are approximately 250 specimen of *Cyclamen persicum* at the Project site, with their locations shown in Figure 12-4.

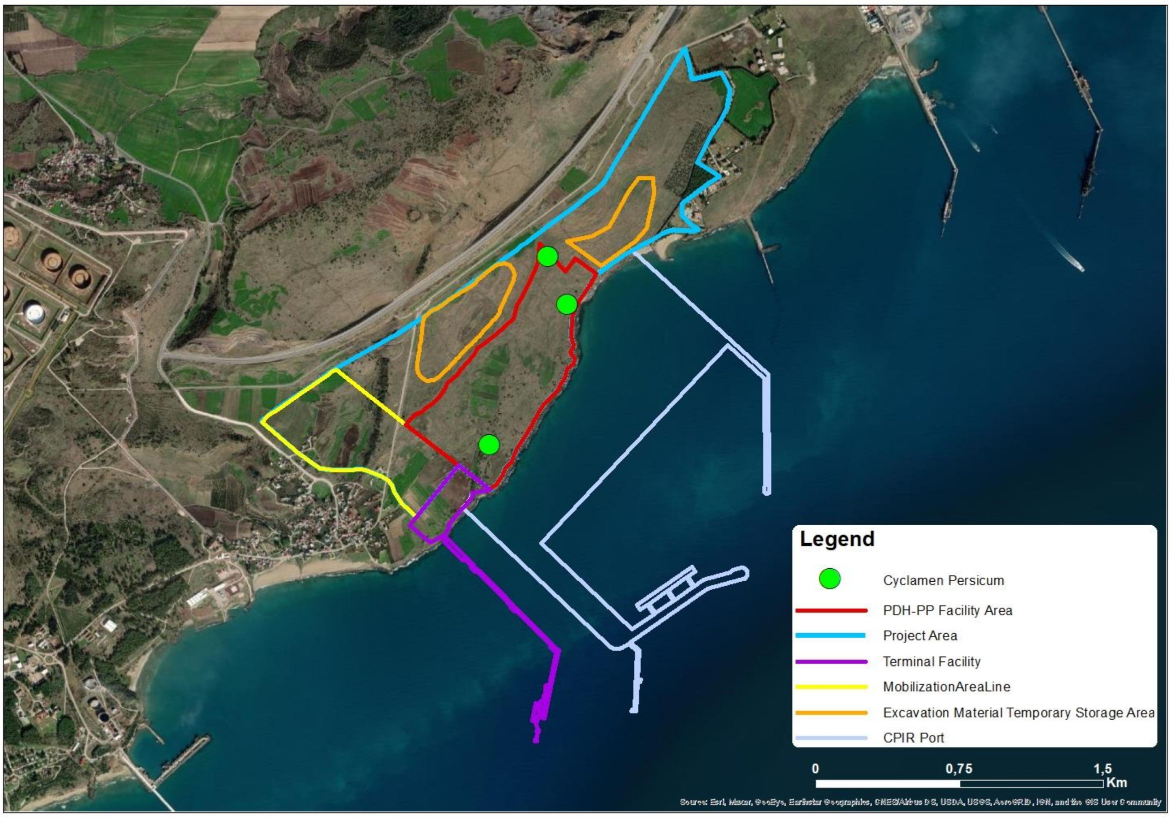

Figure 12-4. Locations where Cyclamen persicum is observed

Solanum elaeagnifolium, on the other hand, is a terrestrial invasive species from the U.S.A. which entered Turkey in the 2000s via imported seeds. It was first identified in Kahramanmaraş in 2007 and spread across agricultural land in Çukurova region, followed by the eastern Mediterranean and Southeastern Anatolia.

None of the floral habitats or species identified at the Project site are endemic species that meet the IFC PS6 thresholds for critical habitats[2], with the exception of *Cyclamen persicum* which is listed as VU in TRDB. A detailed Critical Habitat Assessment is available in Annex K.

[2] Areas of high biodiversity value that may include at least one or more of the five values specified in IFC PS6

Vegetation Characteristics

There are 4 different EUNIS habitat types observed within the Project site, each of which comprise different vegetation types: two natural and two modified habitats (see Habitat Maps in Annex K). Dry Mediterranean Lands with unpalatable non-vernal herbaceous vegetation (EUNIS Code: E1.C) and Maquis (EUNIS Code: F5.2) are the natural habitats, while Evergreen orchards and groves (EUNIS Code: G2.9) and Arable Land with unmixed crops grown by low-intensity agricultural methods (EUNIS Code: I1.3) are the two modified habitats. Plant communities and characteristic of their species distributed within the Project site are as follows:

Dry Mediterranean Lands with unpalatable non-vernal herbaceous vegetation (EUNIS Code: E1.C):

This is the most common vegetation type within the Project site, covering nearly 80% of the site. These habitats usually result from degradation of maquis and over-grazing of garrigue vegetations which eliminate the shrubs. This habitat is composed of species that are poisonous (see Figure 12-5) and are not consumed by animals.

The species composition is similar to that of maquis and garigue. Dominant species of the vegetation are *Urginea maritima, Asphodelus aestivus, Asparagus acutifolius, Themeda triandra, Scolymus maculatus, Sarcopoterium spinosum, Zizyphus lotus, Phlomis longifolia var. longifolia* (indicated with a) in Figure 12-6*), Echinops viscosus subsp. bithynicus* (indicated with b) in Figure 12-6)*, Bupleurum odontite (indicated with c)* in Figure 12-6*), Paliurus spina-christi, Eryngium creticum, Silybum marianum, Hymenocarpus circinatus* and *Olea europaea. Cyclamen persicum,* listed under CITES, is also a species within this habitat type.

Figure 12-5. Dry Mediterranean Lands with unpalatable non-vernal herbaceous vegetation

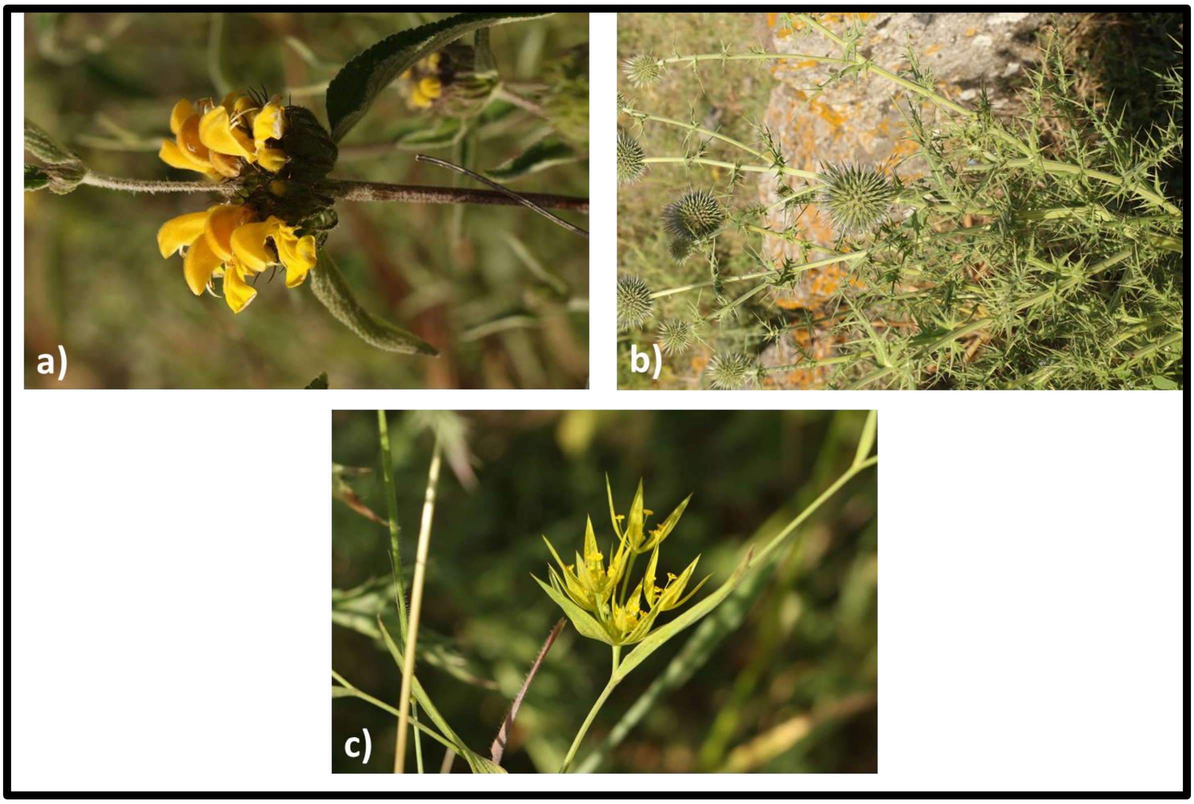

Figure 12-6. Some of the example species a) *Phlomis longifolia* var. *longifolia*; b) *Echinops viscosus* subsp. *bithynicus*; c) *Bupleurum odontites*

Maquis (EUNIS Code: F5.2):

Only small sections of the Project site consist of this habitat. Generally, the maquis habitat has been reduced and deteriorated by grazing activities and agricultural use (see. Figure 12-7). Dominant species of this habitat that are represented by small patches are *Istacia lentiscus, Phillyrea latifolia, Quercus coccifera, Urginea maritima, Fontanesia philliraeoides and Asphodelus aestivus. Cyclamen persicum* listed under CITES is also a species within this habitat.

Figure 12-7. Maquis

Evergreen orchards and groves (EUNIS Code: G2.9):

Olea europaea (olive) is planted in this widespread modified habitat (see Figure 12-8) but were only observed during the 1st ecological walkover survey, since olive groves were recently relocated to another location by MoIT.

Figure 12-8. Evergreen orchards and groves (Olea europaea)

Arable land with unmixed crops grown by low-intensity agricultural methods (EUNIS Code: I1.3):

This habitat type is limited in its extension in the Project site, and is used by local community members to cultivate grains and vegetables. The main products are wheat (*Triticum vulgare*), beans (*Phaseolus vulgaris*), peas (*Pisum sativum*) and onions (*Allium cepa*).

Figure 12-9. Arable land by low-intensity agricultural methods (a:wheat, b:peas and c:beans)

Incirli Beach is located outside the Project boundaries to the west and consist of EUNIS habitat type "B1.4 Coastal stable dune grassland (grey dunes)", which is not present within the Project site. The floral characteristics are perennial herbaceous species and succulent communities with the main species of *Euphorbia paralias, Cakila maritima and Salsola ruthenica*, in addition to *Pancratium maritimum* which is listed as Endangered (EN) in the Red Data Book of Turkish Plants, but classified as LC in the IUCN Red List.

Impacts on Terrestrial Flora

As a result of the walkover surveys undertaken, none of the flora taxa are endemic species. *Pancratium maritimum* distribution is possible in the vicinity of the project area according to relevant literature, which is rare and classified as EN according to the Red Data Book of Turkish Plants.

However, *Cyclamen persicum* is a CITES Annex II species and is also listed as VU in the Red Data Book of Turkish Plants. All the flora species listed in Table 1 of Annex J. *Pancratium maritimum* and *Cyclamen persicum* are listed as LC in the Red Data Book of Turkish Plants. There is also an invasive species from the U.S.A. named *Solanum elaeagnifolium* which entered Turkey in the 2000s.

It can be concluded that the Project site has lost its natural characteristics to a great extent, and therefore impacts of the Project activities on flora and vegetation in the area will be rather limited.

12.3.2 Terrestrial Fauna

Methodology

The terrestrial fauna study has been carried out to outline the most fundamental terrestrial faunal characteristics of the Project site. The fauna list was prepared by combining the fauna species distributed within the sample areas as well as the findings of the ecological walkover surveys. The four ecological walkover surveys were carried out on 26th-27th February 2020 and 20th-21st May 2020 by Prof. Mustafa Sözen from Biology Department at Bülent Ecevit University Faculty of Arts and Science (with a limited particular focus on birds), to represent two different seasons and 28th -29th June 2020 and 27th-28th November 2021 by Prof. Dr. Salih Levent Turan from Biology Education Department of Hacettepe University Faculty of Education.

The ecological walkover surveys were carried out to cover all parts and habitat types within the Project site and its surroundings. Since the area is rather small in size, several transects were walked in Project site and the entire area was surveyed and monitored for fauna. In suitable points the area was also observed for birds by a binocular (Nikon Aculon 16x50) and observed species were photographed by a Sony A7RIV camera body, with a Sony 200-600 mm lens attached to it. Suitable and different parts of the Project site were observed through walking and fauna groups were determined based on direct observations, animal tracks, burrows, animal calls and songs, droppings, and food remains.

Apart from the findings of the ecological walkover survey conducted within the scope of this ESIA process, literature records and previous experiences of the fauna expert were also used to prepare the fauna inventory. The fauna list was prepared by combining the fauna species distributed within the sample areas and the findings of the ecological walkover surveys. An evaluation of the threat status and endemism for each species are presented using criteria from IUCN, BERN, Central Game Commission (MAK 2019-2020) Decrees, CITES and the Habitats Directive.

Baseline Conditions and Faunal Species

As mentioned above (Section 12.3), the Project site is surrounded by industrial facilities, rural residential areas, scattered vacant lands, forest and forestation areas within the CPIR area. Some parts of the Project site include agricultural fields and olive groves, with some areas covered by Mediterranean type bushes and at other parts by small annual plants. Because of agricultural activities, grazing activities, existing motorway and human activities in the village next to Project site, the area is considered to be partly under human pressure.

There are amphibian, reptile, avifauna and mammal species that are likely to be present at the Project site. There is no permanent water body in the Project site and so any amphibian specimen could not be directly observed during the ecological walkover surveys. The Project site is not an important area for amphibians and is not structured in a way to support the reproduction and sheltering of many amphibian species. The area may host a small number of toad species.

The 1st ecological walkover survey was conducted during the winter season with a temperature of approximately 20 ^{o}C. Bird migration had not started yet and few faunal elements were directly observed during this survey. The 2nd walkover survey enabled a more comprehensive assessment of possible avifauna species at the Project site. Since Turkey is located in a temperate climate region of the northern hemisphere, various migratory bird species that spend the winter season in warmer countries of Africa, are present. Moreover, many bird species migrate through Turkey to northern Europe and Russia to breed from the spring to autumn seasons.

The relevant categories used for the terrestrial faunal species and their criteria are listed below (see. Table 12-1).

Table 12-1. Categories used for terrestrial faunal species

Name	Categories and Criteria
BERN	Appendix - II: Strictly Protected Fauna Species (SPFS) Appendix - III: Protected Fauna Species (PFS)
CITES Categories	Appendix-I List includes species that are threatened with extinction and thus international trade in specimens of these species is prohibited, except when the purpose of the import is not commercial. Appendix-II List includes species that are not necessarily now threatened with extinction but that may become so unless trade is closely controlled. Appendix-III List includes species included at the request of a Party that already regulates trade in the species and that needs the cooperation of other countries to prevent unsustainable or illegal exploitation.
European Union (EU) Directive Directive 2009/147/EC	Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the Conservation of Wild Birds: The birds in the scope of EU list are listed as Annex I, Annex II (Part A, Part B); the birds in Annex I are the ones that require strict protection; while the others are listed in Annex II.
IUCN Red List Categories	*Risk Categories* EX (Extinct), EW (Extinct in the Wild) CR (Critically Endangered), EN (Endangered), VU (Vulnerable) *Low Risk Categories* NT (Near Threatened), LC (Least Concern), DD (Data Deficient), NE (Not Evaluated)
2015-2016 Central Game Commission (MAK) Decrees	Appendix-I: List of animals protected by MAK Appendix-II: List of game animals whose hunting is allowed for certain periods for 2019-2020 season
EU Directive 92/43/EC Habitats Directive	Annex I: Natural habitat types of community interest whose conservation requires the designation of special areas of conservation. Annex II: Animal and plant species of community interest whose conservation requires the designation of special areas of conservation Annex III: Criteria for selecting sites eligible for identification as sites of community importance and designation as special areas of conservation Annex IV: Animal and plant species of community interest in need of strict protection Annex V: Animal and plant species of community interest whose taking in the wild and exploitation may be subject to management measures Annex VI: Prohibited methods and means of capture and killing and modes of transport

Amphibians

Amphibians are water-dependent species; though some spend most of their life on land, they have to return to water to breed. There are no permanent water bodies in the Project site so amphibian specimen could not be observed directly during the ecological walkover surveys. The Project site is not an important area for amphibians and is not structured in a way to support the reproduction and sheltering of many amphibian species. The area may host a small number of toad species, among which there are no endemic or endangered species. Probable amphibian species at the Project site are listed in Table 2 of the Annex J-I[3].

As a result of the additional field studies carried out in June 2020 and November 2021, the number of amphibian species identified as potentially occurring in the areas defined as the

[3] Baran, İ., Ilgaz, Y., Kumlutaş, Y. and Olgun, K. 2012. “Amphibians and Reptiles of Turkey- Türkiye Amifbi ve Sürüngenleri”. TÜBİTAK Books Editors, Publication No: 12/2012. Ankara.

activity area and in the habitats adjacent to these areas is only 2. Both of these species were identified during field observations and habitat surveys in wet habitats close to the project site. Details of additional field studies is given in Annex-T

Reptile species

32 reptile species are likely to be present within the Project site[2]. Among these species listed, the Mediterranean Spur-thighed Tortoise (Figure 12-10), starred agama and snake-eyed lizard were directly observed during the ecological walkover surveys, while the European glass lizard was only observed during the 2nd ecological walkover survey. None of the reptile species are endemic; on the other hand, *testudo gracea* from the Testudinidae family is listed in the threatened categories of IUCN as VU. Numerous Roughtail Rock Agama specimen (*Stellagama stellio*) listed in the IUCN as LC were observed in the Project site.

Probable reptile species at the Project site are listed in Table 3 of Annex J-I, which shows that probable reptile species other than *Testudo graeca* are listed in the IUCN as LC.

As a result of the additional field studies, the total number of reptile species that can be seen in the project site and its vicinity is 12. Among these species, 8 Reptile species were identified by our field observations and investigations and included in the relevant list. Apart from this, the remaining 4 reptile species were included in the relevant list according to the literature and survey findings. Details of additional field studies is given in Annex-T

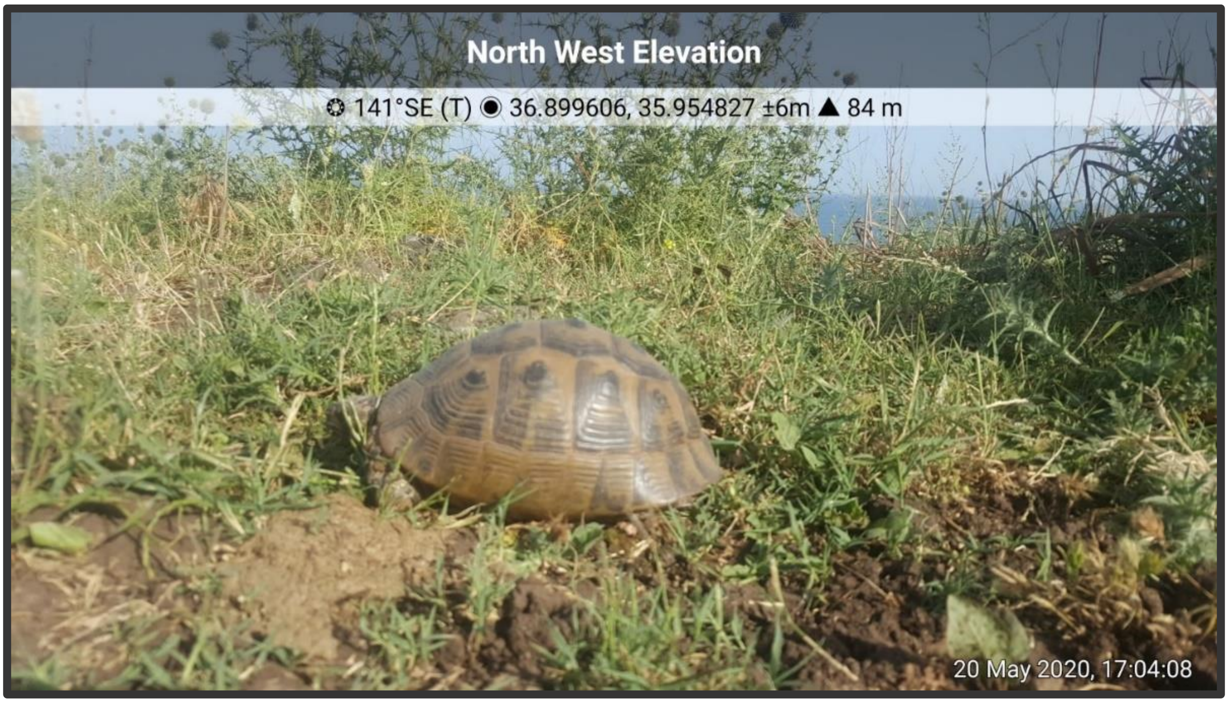

Figure 12-10. Mediterranean Spur-thighed Tortoise observed at Project site

Mammal species

From the literature review and findings of the ecological walkover surveys, it has been determined that there are 42 mammal species likely to be present in the Project site (Krystufek and Wohralik 2001, 2005, 2009[4]; Yiğit et al. 2002, 2006[5]). Three of the species – two bat (i.e., *Myotis capaccinii* and *Rhinolophus mehelyi*) and one Mustelidae (i.e., *Vormela peregusna*) species – are listed as threatened and considered as VU according to the IUCN criteria. Moreover, *Rhinolophus Euryale* and *Miniopterus schreibersii* are listed as NT according to the IUCN criteria. The rest of the listed species are considered to be LC according to the IUCN criteria. The mammal species likely to be present in the Project area are listed in Table 4 of Annex J-I.

As a result of the additional field studies, the number of mammal species determined within the boundaries of the project site and in the areas adjacent to the site is 12. Among these species, 4 mammal species were identified during field studies. The remaining mammal species were added onto the species list after literature checks and surveys with local residents. Details of additional field studies is given in Annex-T.

A number of Palestine blind mole rat (*Nannospalax ehrenbergi* shown in Figure 12-11) burrows were observed within the Project site in addition to a small number of vole (*Microtus* sp.) nests. The listed species are likely to appear in the Project site on an occasional basis.

Bats are one of the key mammal groups listed for the Project site, however there is no possibility for sheltering, nesting and reproduction for bats since no appropriate structures such as old buildings, caves, roofed houses, and old trees with holes in the trunk are available within the Project site. Bats may fly over the Project site for feeding at nighttime, however. Bats are hibernator mammals and are not active in the winter.

In comparison, most other mammal species listed are active throughout the year. The Southern vole (LC according to the IUCN criteria) and Palestine Mole Rat (DD according to the IUCN criteria) were directly observed during both ecological walkover surveys.

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[4] Kryštufek B and Vohralík V (2001) Mammals of Turkey and Cyprus. Introduction, checklist, Insectivora. Znanstveno-raziskovalno središče Republike Slovenije Koper.

Krystufek, B. & Vohralik, V., (2005) Mammals of Turkey and Cyprus. Rodentia I: Scuidae, Dipodidae, Gliridae, Arvicolinae. Zgodovinsko drustvo za juzno Primorsko Znanstveno-raziskovalno sredisce Republike Slovenije Koper. 292 pp.

Kryštufek B and Vohralík V (2009) Mammals of Turkey and Cyprus (Rodentia II: Cricetinae, Muridae, Spalacidae, Calomyscidae, Capromyidae, Hystricidae, Castoridae). Univerza na Primorskem Koper., pp.25.

[5] Yiğit, N. Çolak, E., Ketenoğlu, O., Kurt, L., Sözen, M., Hamzaoğlu, E., Karataş, A., Özkurt. Ş. 2002. Environmental Impact Assessment- Çevresel Etki Değerlendirme "ÇED", 592 sayfa, Kılavuz Paz. Tic. Ltd. Şti. Ankara. ISBN: 975-96176-1-7.

Yiğit, N., Çolak, E., Sözen, M. and Karataş A., 2006. Rodents of Türkiye: Türkiye Kemiricileri. Editor: Demirsoy, A., Meteksan Yayınevi, Ankara. 154 pp.

Figure 12-11. *Nannospalax ehrenbergi* burrows observed at Project site

Birds

The Project site is located between important bird areas and migration routes in the region. Bird migration in Turkey takes place during the periods of March-April-May and August-September-October. Migration times of birds vary, for different species utilising defined time periods (e.g., during autumn migration, White Stork is one of the earliest to commence their migration). Migrative birds who use the Belen strait/pass in Hatay province and proceed through Anatolia to reach Istanbul and Canakkale Strait fly over approximately 10-20 km to the east of the Project site.

The many waterfowls and shore birds dominant in the Yumurtalık lagoons, defined as Ceyhan Delta KBA (located approximately 30 km southwest to the Project site) are not foreseen to be affected by the Project.

Sugözü Akkum KBA, located is approximately 2.5 km west of the Project site with sand dunes, is not a significant area for bird populations, while it is the breeding ground for loggerhead sea turtle (*Caretta caretta*) and green sea turtle (*Chelonia mydas*).

Yılanlıkale Hills KBA is another protected area, located approximately 21 km northwest of the Project site. The steep cliffs in that area create an important breeding ground for *Apus affinis* and *Coracias garrulus*, in addition to being an important breeding ground for ciliated bat (*Myotis emarginatus*). Yılanlıkale Hills also provides a KBA status for *Gomphus,* is a narrow-spreading type of ladybug specific to the Mediterranean biome. It is not anticipated that the Project will have an impact on the abovementioned protected areas.

The protected sites in the vicinity of the Project site is summarised in detail in Section 12.5.

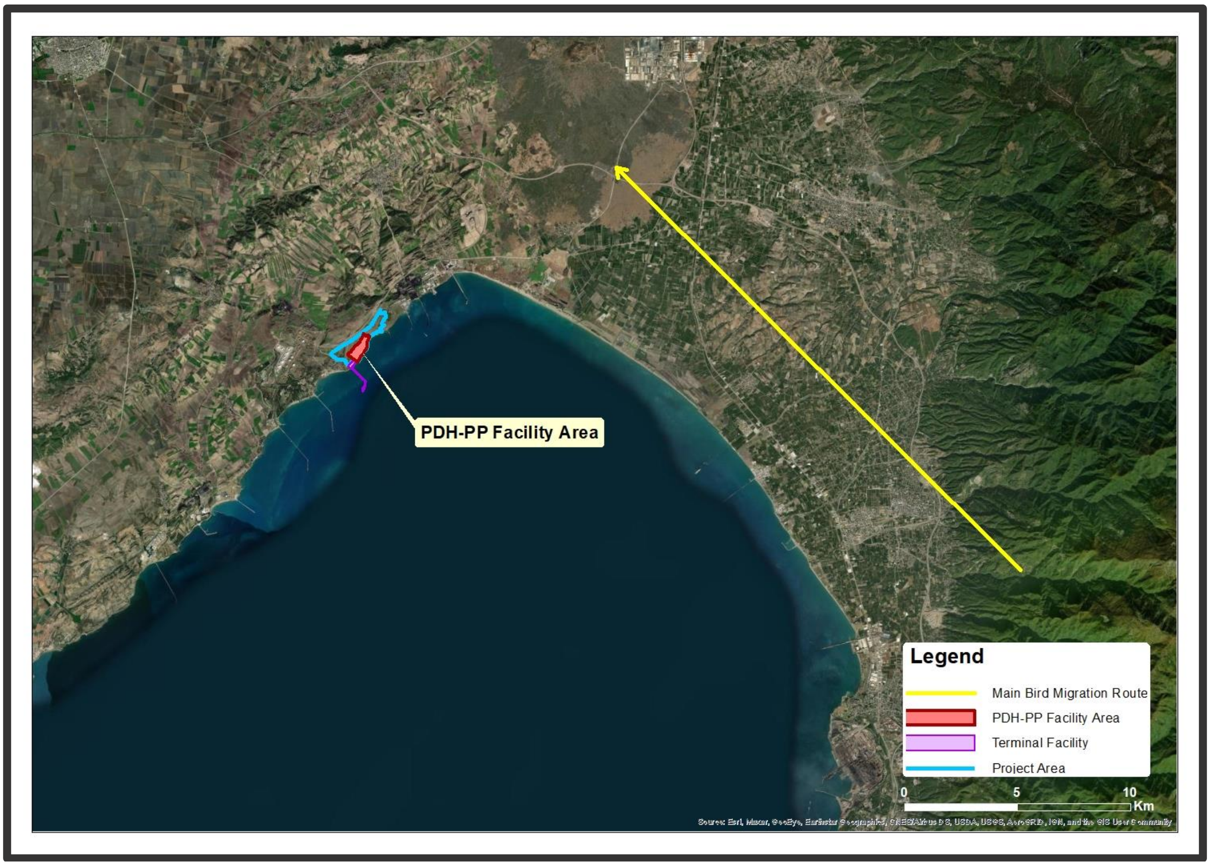

Figure 12-12. Main bird migration routes in the vicinity of the Project site

During the 1st ecological walkover survey, it was observed that a black stork group comprised of 6 (six) individuals was in the process of migrating to the north, flying approximately 3 to 4 km east of the Project site (see. Figure 12-13), amongst observed 22 bird species as listed in Table 12-2.

During the 2nd ecological walkover survey, no migratory bird crossing was observed on the Project site, despite the ongoing migration period. This demonstrates that the Project site is not directly located on the main migrative route of the avifauna species, and is not considered to be a gathering area for migrative birds and shelter or breeding ground for endangered bird species.

There are no continuous or seasonal freshwater sources such as streams, rivers, lakes and ponds in the Project area. Wetland-dependent birds such as ducks and seagulls are only found on the sea-side and coastlines. The shoreline of the Project site extends along the rocky coast and is not considered as a suitable area for the coastal avifauna species. A number of “Crested Larks” were observed during the ecological walkover survey on the terrestrial part.

Based on the information obtained from the literature review and ecological walkover surveys, it was determined that 198 bird species are likely to be present in the Project site[6,7,8]. It is unlikely that all the identified bird species will be present on-site at the same time, but they will instead be observed in the area at different times of the year.

During the ecological walkover surveys, 35 species were directly observed in the Project site including the following 13 which were observed during the second survey: Buzzard, black francolin, rock, turtle and stock doves, swift, bee-eater, house martin, rufous bush robin, northern wheatear, olivaceous warbler, woodchat shrike, and black headed bunting. According to the IUCN criteria, 3 (three) of the identified species (Pochard and Turtle Dove listed as VU and Egyptian Vulture listed as EN) are listed in threatened categories. 9 (nine) of the identified species (Ferruginous Duck, Black Vulture, Pallid Harrier, Red-Footed Falcon, Eurisan Oystercatcher, Lapwing, Knot, Meadow Pipit, Curlew Sandpiper) are listed and considered as NT according to the IUCN criteria.

One Turtle Dove flight was observed during the walkover, while the Pochard and Egyptian Vulture were not spotted. There is a possibility that the Pochard could be observed in the marine section and the Egyptian Vulture could be observed in the region during the migration periods. However, the Project site does not appear to be a breeding, permanent feeding or sheltering area for any of these species. Bird species observed during the ecological walkover surveys are presented in Table 12-2, while the complete list of bird species that are likely to be found in the Project site are given in Table 5 of Annex J-I.

As a result of the additional field studies, the number of bird species that were observed in the first field study (28th -29 th June 2020) within the boundaries of the project site and adjacent to the project site was 48. During the field study carried out by us during the winter period (27th-28th November 2021), 2 more bird species were added to this number. With the addition of these species, the number of bird species that were identified and included in the list during field studies, which was 44 before, increased to 46 and the total number of bird species to 51. Among these species, 5 were added to the list a result of literature review. First species that was observed and added during the winter period fieldwork was Quail *Coturnix coturnix* and the second one was Silver plover *Pluvialis squatarola.* Details of additional field studies is given in Annex-T.

[6] https://ebird.org/

[7] Birds of Turkey (https://www.trakus.org/kods_bird/)

[8] Kirwan, G.M, K.A. Boyla, P. Castell, B. Demirci, M. Özen, H. Welch and T. Marlow. (2008). The birds of Turkey: a study of the distribution, taxonomy and breeding of Turkish birds. Christopher Helm. London.