TÜRKİYE PETROLLERİ ANONİM ORTAKLIĞI

OTC OFFSHORE TECHNOLOGY CENTER

SAKARYA GAS FIELD DEVELOPMENT PROJECT – ENHANCEMENT OF SUBSEA PRODUCTION CAPACITY AND FLOATING PRODUCTION UNIT

Chapter 6.1 Onshore Physical Baseline

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6.0 ENVIRONMENTAL AND SOCIAL BASELINE

This chapter is aimed at providing a description of the environmental (physical and biological) and social context in the Regional Study Area (RSA) and Area of Influence (AoI) of the Project prior to its realization.

Following the directions outlined in the Methodology (Section 5.0), the work presented here include information on all relevant components to provide an understanding of the environmental and social state of the area (e.g., air quality, terrestrial fauna and flora, marine habitats, demography, livelihoods, land use, etc.).

All information reported in this section represent the starting point to the following Impact Assessment (Section 7.0).

The baseline description process has been aligned to the identified project components (Section 3.0) by grouping all the relevant environmental and social elements into two operational areas, namely Offshore and Onshore.

6.1 Onshore Physical Baseline

6.1.1 Meteorology and climatology

Definition	Meteorological characteristics of the AoI is critical in evaluating the dispersion of pollutants (both in the air and other receiving media and structural safety of Project components and the Project environment.
Study area	**RSA:** Area covering the Zonguldak, Amasra, Bartın Meteorological Stations **Rationale:** Provincial level meteorological data is used to evaluate the trends and behavior of components such as wind direction, temperature, precipitation, etc.
	AoI: 5,000 m buffer zone from onshore facility areas **Rationale:** The nearby receptors (i.e., communities), around the Project area, potentially exposed to Project's impacts.
Data sources	**Primary sources**: a) Data from Zonguldak, Amasra, Bartın Meteorological Stations
	Secondary sources: b) Secondary data from scientific papers, grey literature and databases.

This section presents the baseline conditions for local and regional meteorology and climatology.

Meteorological data were obtained from meteorological stations located around the Project Area. The data were recorded in Amasra Meteorological Station between 1970-2023, Bartın Meteorological Station between 1961-2023, Zonguldak Meteorological Station between 1939-2023, Çaycuma Havaalanı Meteorological Station between 2008-2023 and Bartın Güney Mendirek Feneri Meteorological Station between 2013-2023 obtained from Republic of Türkiye Ministry of Environment, Urbanisation and Climate Change, Turkish State Meteorological Service to establish the basic conditions for meteorology and climatology. The locations of meteorological stations are shown in Figure 6-1.

Figure 6-1: Locations of Meteorological Stations around the Project Area

Zonguldak Province is located in the Western Black Sea Region, which has a coast to the Black Sea from the west and north, between 41°-42° latitude North and 31°-32° longitude East. There is no dry season in Zonguldak, which is rainy and warm in all seasons. The most precipitation occurs in autumn and winter seasons. There is no significant temperature difference between seasons and day and night in the province. As you go inland from the sea, the climate gets a little harsher.

The district of Filyos, where the Project is located, shows Black Sea climate conditions like Zonguldak Province. It is rainy in all seasons.

Specific weather parameters and meteorological data, obtained from above-mentioned meteorological stations, are used in this section to explain the meteorology and climatology of both the regional study area (RSA) and the Project Area, including the AoI. These parameters include temperature, precipitation, evaporation, wind, pressure, relative humidity, and others.

A summary of the values for each parameter is reported below and arranged by Meteorological Station and Meteorological Bulletins of each station are provided in Appendix E.

Temperature

Amasra Meteorological Station

Monthly average, absolute minimum and absolute maximum temperatures recorded in Amasra Meteorological Station between the years 1970 and 2023 are presented in Appendix E. According to these values, the average temperature varies between 6.4 °C (January) and 22.5°C (August) and the annual average temperature is 13.9°C. The minimum temperature was recorded in February of 1985 as -8.4°C, and the maximum temperature were recorded in July of 2000 as 38.4°C. The temperature increases from January to August and decreases from August to January. The coldest months are January, February and March while the hottest are June, July and August.

Bartın Meteorological Station

Monthly average, absolute minimum and absolute maximum temperatures recorded in Bartın Meteorological Station between the years 1961 and 2023 are presented in Appendix E. According to these values, the average temperature varies between 4.1 °C (January) and 22.0 °C (July) and the annual average temperature is 12.9 °C. The minimum temperature was recorded in February of 1985 as -18.6°C, and the maximum temperature were recorded in July of 2000 as 42.8°C. The temperature increases from January to July and decreases from July to January. The coldest months are December, January and February while the hottest are June, July and August.

Zonguldak Meteorological Station

Monthly average, absolute minimum and absolute maximum temperatures recorded in Bartın Meteorological Station between the years 1939 and 2023 are presented in Appendix E. According to these values, the average temperature varies between 6.2 °C (January) and 22.0 °C (August) and the annual average temperature is 13.8 °C. The minimum temperature was recorded in February of 1950 as -8.0°C, and the maximum temperature were recorded in June of 1942 as 40.5°C. The temperature increases from January to August and decreases from August to January. The coldest months are January, February and March while the hottest are June, July and August.

Çaycuma Havaalanı Meteorological Station

Monthly average, absolute minimum and absolute maximum temperatures recorded in Çaycuma Havaalanı Meteorological Station between the years 2008 and 2023 are presented in Appendix E. According to these values, the average temperature varies between 5.8 °C (January) and 25.5°C (August) and the annual average temperature is 15.7°C. The minimum temperature was recorded in January of 2010 as -9.7°C, and the maximum temperature were recorded in June of 2010 as 35.5°C. The temperature increases from January to August and decreases from August to January. The coldest months are December, January and February while the hottest are June, July and August.

Bartın Güney Mendirek Feneri Meteorological Station

Monthly average, absolute minimum and absolute maximum temperatures recorded in Bartın Güney Mendirek Feneri Meteorological Station between the years 2013 and 2023 are presented in Appendix E. According to these values, the average temperature varies between 6.8 °C (January) and 23.1°C (August) and the annual average temperature is 14.4°C. The minimum temperature was recorded in January of 2015 as -4.8°C, and the

maximum temperature were recorded in September of 2017 as 34°C. The temperature increases from January to August and decreases from August to January. The coldest months are January, February and March while the hottest are June, July and August.

Precipitation and Evaporation

Amasra Meteorological Station

Distribution, quantity and type of precipitation are significant factors since they affect wet deposition of air pollutants. Average total and monthly maximum precipitation recorded in Amasra Meteorological Station between the years 1970 and 2023 are presented in the tables and figures of Appendix E. As indicated in Table 4 in Appendix E, the average annual precipitation in the area is recorded as 1009.6 mm. The maximum average monthly precipitation measured is in December (124.7 mm), and the minimum average monthly amount of precipitation measured is in May (46.7 mm). The maximum amount of precipitation is observed on 27 August 1970 (95.6 mm).

No data were found on evaporation values for Amasra Meteorological Station.

Bartın Meteorological Station

Average total and monthly maximum precipitation and evaporation recorded in Bartın Meteorological Station between the years 1961 and 2023 are presented in the tables and figures of Appendix E. The average annual precipitation in the area is recorded as 1058.9 mm. The maximum average monthly amount of precipitation is observed in December (131.7 mm) while the minimum average monthly amount of precipitation measured in May (54.4 mm). The maximum amount of precipitation observed is observed is on 27 August 1970 (161.1 mm).

When the evaporation values for Bartın Meteorological Station are examined, the average annual evaporation is recorded as 1487.1 mm. The maximum amount of evaporation is observed in June and September (9.6 mm).

Zonguldak Meteorological Station

Average total and daily maximum precipitation and evaporation recorded in Bartın Meteorological Station between the years 1939 and 2023 are presented in the tables and figures in Appendix E. The average annual precipitation in the area is recorded as 1228.1 mm. The maximum average monthly precipitation is observed in December (154.1 mm) while the minimum average in May (54.5 mm). The maximum amount of precipitation is observed on 1 August 1955 (431.5 mm).

When the evaporation values for Zonguldak Meteorological Station are examined, the average annual evaporation is recorded as 1487.1 mm. The maximum amount of evaporation is observed in July (13.8 mm).

Çaycuma Havaalanı Meteorological Station

No data were found on precipitation and evaporation values for Çaycuma Havaalanı Meteorological Station.

Bartın Güney Mendirek Feneri Meteorological Station

No data were found on precipitation and evaporation values for Bartın Güney Mendirek Feneri Meteorological Station.

Wind Distribution

Amasra Meteorological Station

Winds recorded in Amasra Meteorological Station between the years 1970 and 2023 are presented in Appendix E, according to directions. The prevailing wind direction is SSE followed by ENE, and S. Wind rose diagrams for annual and seasonal distributions are presented in Figure 6-2.

Bartın Meteorological Station

Winds recorded in Bartın Meteorological Station between the years 1961 and 2023 are presented in Appendix E, according to directions. The prevailing wind direction is N followed by NE, and NNE. Wind rose diagrams for annual and seasonal distributions are presented in Figure 6-3.

Zonguldak Meteorological Station

Winds recorded in Zonguldak Meteorological Station between the years 1939 and 2023 are presented in Appendix E, according to directions. The prevailing wind direction is SE followed by ESE, and NW. Wind rose diagrams for annual and seasonal distributions are presented in Figure 6-4.

Çaycuma Havaalanı Meteorological Station

Winds recorded in Çaycuma Havaalanı Meteorological Station between the years 2008 and 2023 are presented in Appendix E, according to directions. The prevailing wind direction is S followed by NNW, and SSE. Wind rose diagrams for annual and seasonal distributions are presented in Figure 6-5.

Bartın Güney Mendirek Feneri Meteorological Station

Winds recorded in Bartın Günay Mendirek Feneri Meteorological Station between the years 2013 and 2023 are presented in Appendix E, according to directions. The prevailing wind direction is ESE followed by SE, and NE. Wind rose diagrams for annual and seasonal distributions are presented in Figure 6-6.

The annual total number of winds and directions are given in Table 6-1 and graphically represented in.

Table 6-1: Total Number of Annual Wind Blowing of all Meteorological Stations According to Directions

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
Amasra	10397	13858	30585	52127	25928	26606	26438	61294	39235	15716	15716	29547	26055	17974	12340	10329
Bartın	55488	35363	39939	29518	26057	18610	15990	14348	19159	27303	27303	23576	31017	27359	33649	24359
Zonguldak	47721	32545	19669	13182	19650	75819	123020	55203	42080	17615	17615	27966	35346	41294	68980	51014
Çaycuma Havaalanı	10099	2732	1401	1160	5569	2300	3751	6577	10271	1915	1915	1610	2337	1488	3375	8189
Bartın Güney Mendirek Feneri	1406	2965	6991	2223	4488	11599	8614	3082	902	2930	2930	2110	1629	973	877	860

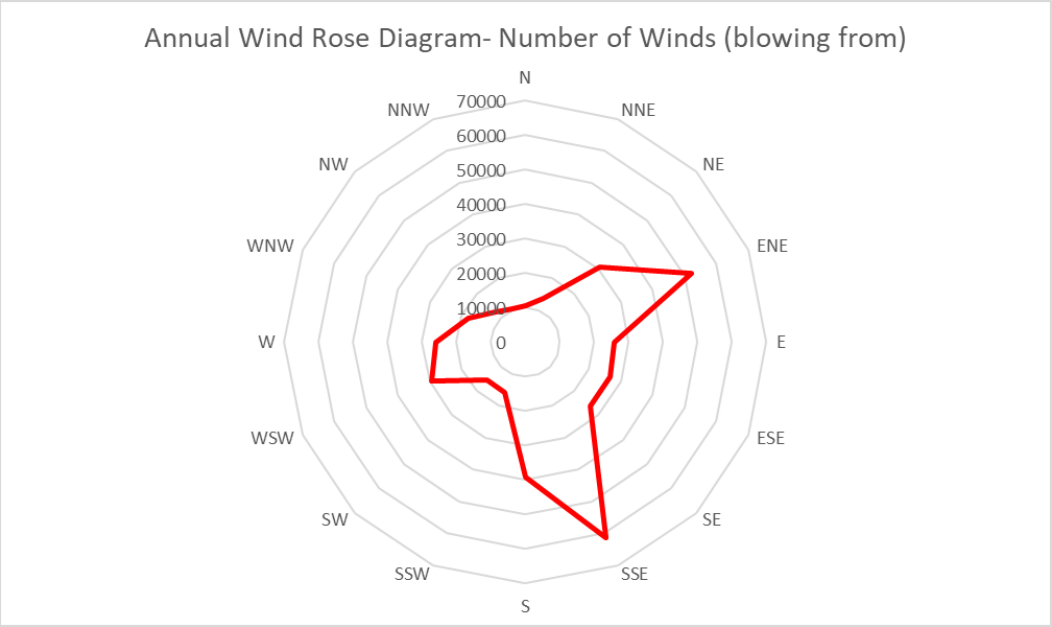


Figure 6-2: Wind Rose Diagram for Amasra Meteorological Station (According to Annual Total Number of Wind Blowing)

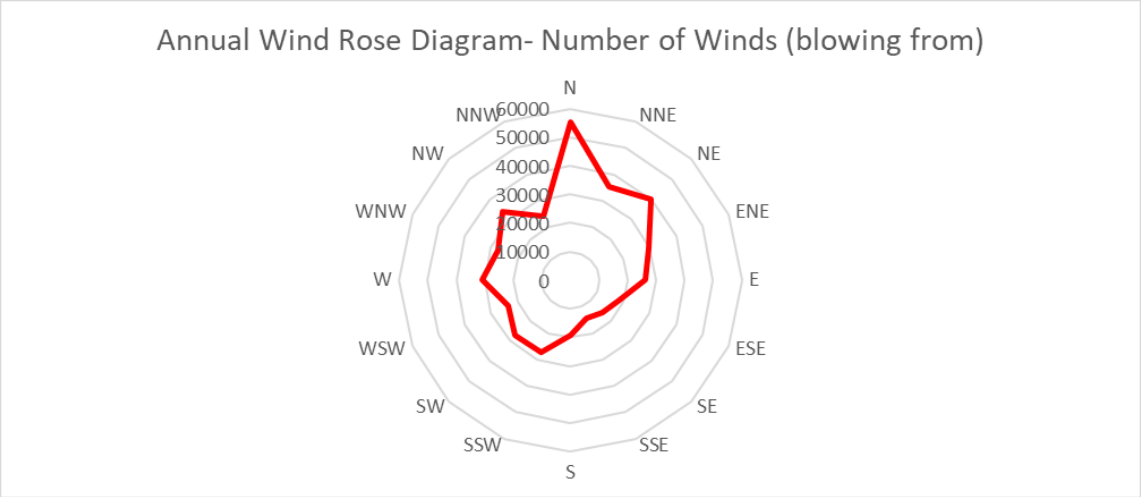


Figure 6-3: Wind Rose Diagram for Bartın Meteorological Station (According to Annual Total Number of Wind Blowing)

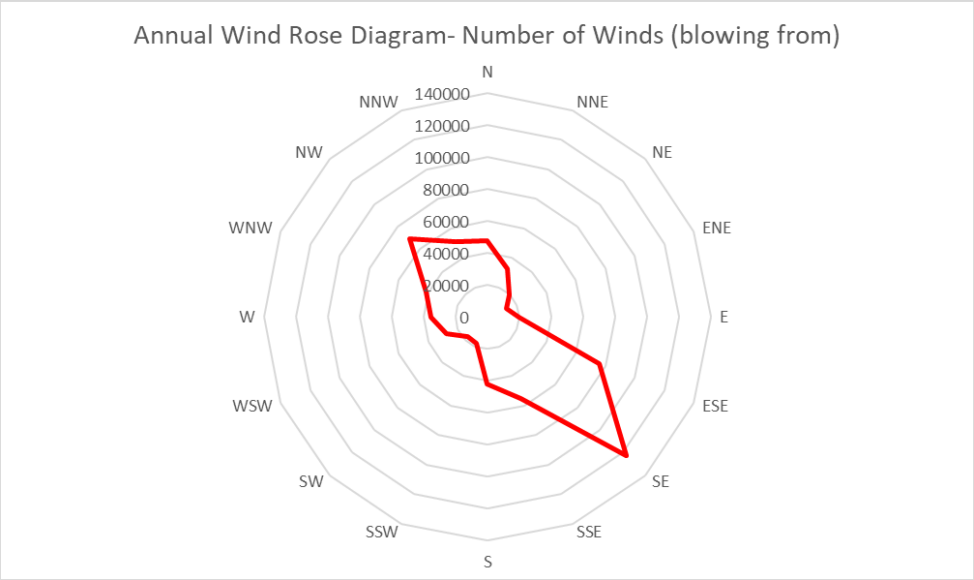


Figure 6-4: Wind Rose Diagram for Zonguldak Meteorological Station (According to Annual Total Number of Wind Blowing)

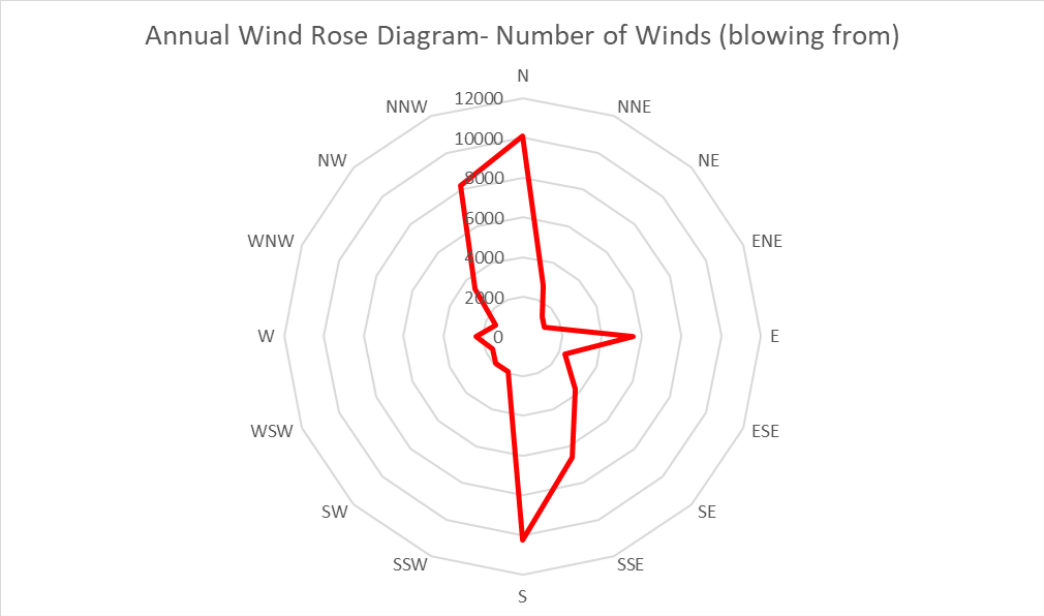


Figure 6-5: Wind Rose Diagram for Çaycuma Havaalanı Meteorological Station (According to Annual Total Number of Wind Blowing)

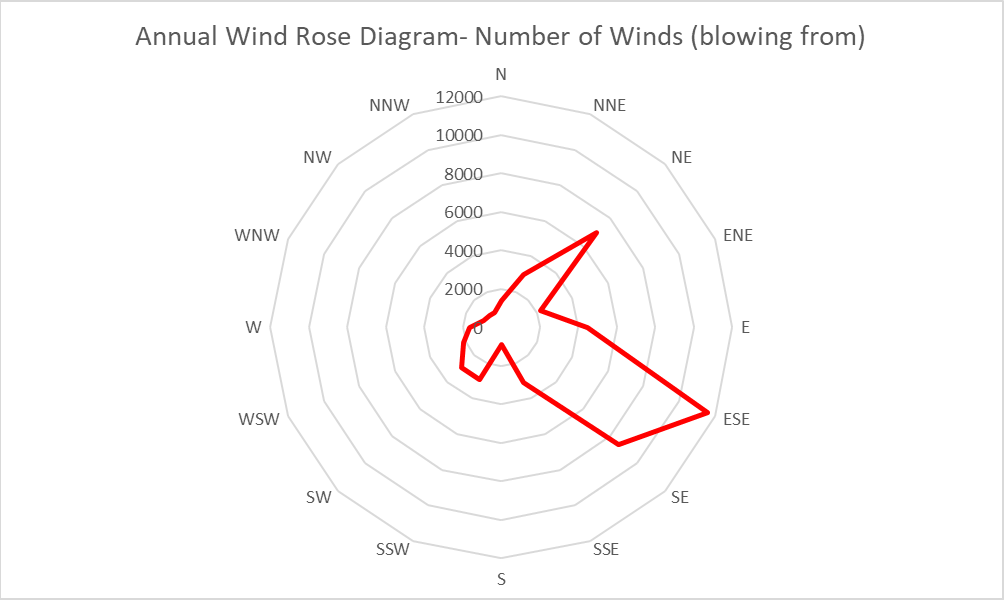


Figure 6-6: Wind Rose Diagram for Bartın Güney Mendirek Feneri Airport Meteorological Station (According to Annual Total Number of Wind Blowing)

Relative Humidity

Amasra Meteorological Station

Average, average maximum and average minimum relative humidity values recorded at Amasra Meteorological Station between 1970 and 2023 are presented in Appendix E. According to the available information, annual average relative humidity is 72.7%. The annual average minimum relative humidity was observed to be 68.9% and average maximum 76.5%. The monthly distribution of average relative humidity is shown in Appendix E.

Bartın Meteorological Station

Average, average maximum and average minimum relative humidity values recorded at Bartın Meteorological Station between 1961 and 2023 are presented in Appendix E. According to the available information, annual average relative humidity is 79.4%. The annual average minimum relative humidity was observed to be 75.1% and average maximum 84%. The monthly distribution of average relative humidity is shown in Appendix E.

Zonguldak Meteorological Station

Average, average maximum and average minimum relative humidity values recorded at Zonguldak Meteorological Station between 1939 and 2023 are presented in Appendix E. According to the available information, annual average relative humidity is 72.3%. The annual average minimum relative humidity was observed to be 69.4% and average maximum 74.5%. The monthly distribution of average relative humidity is shown in Appendix E.

Çaycuma Havaalanı Meteorological Station

Average, average maximum and average minimum relative humidity values recorded at Çaycuma Havaalanı Meteorological Station between 2008 and 2023 are presented in Appendix E. According to the available

information, annual average relative humidity is 71.6%. The annual average minimum relative humidity was observed to be 66.6% and average maximum 78.5%. The monthly distribution of average relative humidity is shown in Appendix E.

Bartın Güney Mendirek Feneri Meteorological Station

Average, average maximum and average minimum relative humidity values recorded at Bartın Güney Mendirek Feneri Meteorological Station between 2013 and 2023 are presented in Appendix E. According to the available information, annual average relative humidity is 83%. The annual average minimum relative humidity was observed to be 79.2% and average maximum 87.8%. The monthly distribution of average relative humidity is shown in Appendix E.

Local Pressure

Amasra Meteorological Station

Monthly average, absolute maximum and absolute minimum pressure recorded in Amasra Meteorological Station between the years 1970 and 2023 are presented in Appendix E. Annual average pressure recorded at Amasra Meteorological Station is 1007.4 hPa. The absolute maximum pressure was observed in January (1032.1 hPa), and the absolute minimum pressure was observed in April (978.2 hPa).

Bartın Meteorological Station

Monthly average, absolute maximum and absolute minimum pressure recorded in Bartın Meteorological Station between the years 1961 and 2023 are presented in Appendix E. Annual average pressure recorded at Bartın Meteorological Station is 1012.8 hPa. The absolute maximum pressure was observed in February (1047.7 hPa), and the absolute minimum pressure was observed in November (977.9 hPa).

Zonguldak Meteorological Station

Monthly average, absolute maximum and absolute minimum pressure recorded in Zonguldak Meteorological Station between the years 1939 and 2023 are presented in Appendix E. Annual average pressure recorded at Zonguldak Meteorological Station is 1000.2 hPa. The absolute maximum pressure was observed in February (1034.1 hPa), and the absolute minimum pressure was observed in November (965.4 hPa).

Çaycuma Havaalanı Meteorological Station

Monthly average, absolute maximum and absolute minimum pressure recorded in Çaycuma Havaalanı Meteorological Station between the years 2008 and 2023 are presented in Appendix E. Annual average pressure recorded at Çaycuma Havaalanı Meteorological Station is 1000.2 hPa. The absolute maximum pressure was observed in January (1037.9 hPa), and the absolute minimum pressure was observed in November (984.1hPa).

Bartın Güney Mendirek Feneri Meteorological Station

Monthly average, absolute maximum and absolute minimum pressure recorded in Bartın Güney Mendirek Feneri Airport Meteorological Station between the years 2013 and 2023 are presented in Appendix E. Annual average pressure recorded at Çaycuma Havaalanı Meteorological Station is 1013.6 hPa. The absolute

maximum pressure was observed in December (1038 hPa), and the absolute minimum pressure was observed in November (982.5 hPa).

Other parameters

General annual statistics for weather parameters such as snow, fog, hail, frost, thunderstorms across all meteorological stations are presented in Table 6-2.

Table 6-2: Annual Average Values for Various Meteorological Parameters Across All Meteorological Stations

	Avg. Number of Snow Days	Avg. Number of Snow Cover Days	Avg. Number of Foggy Days	Avg. Number of Hail Days	Avg. Number of Frosty Days	Avg. Number of Thunder Stormy Days	Abs. Max. Snow Depth (cm)
Amasra	8.3	5.75	8.87	1.27	2.79	1.32	51
Bartın	12.61	17.55	35.38	1.94	17.8	6.22	109
Zonguldak	14.95	12.49	12.89	4.29	3.07	7.38	105
Çaycuma Havaalanı	3.26	-	15.23	-	-	8.54	-
Bartın Güney Mendirek Feneri	-	-	-	-	-	-	-

Detailed statistics for weather parameters such as snow, fog, hail, frost, thunderstorms for each meteorological station can be found in Appendix E.

6.1.2 Air Quality

Definition	Ambient air quality is a broader term used to describe the level of air pollution in outdoor environments. WHO defines ambient air pollution as potentially harmful pollutants emitted by industries, households, vehicles, etc. Construction and decommissioning activities may generate emission of fugitive dust caused by a combination of on-site excavation and movement of earth materials, contact of construction machinery with bare soil, and exposure of bare soil and soil piles to wind. Exhaust gas emissions such as nitrogen oxides, carbon monoxide, hydrocarbon, particulate matter, and sulphur dioxide will occur due to the construction equipment and vessels that will be operated during the onshore land preparation / construction activities and offshore activities. The main sources of air emissions resulting from operations of pre-existing facilities include: combustion emissions from power and heat generation (gas engines and boilers), ground flaring and fugitive emissions (gas/fuel oil leaks). Principal pollutants from these sources include nitrogen oxides, sulphur oxides, carbon monoxide, and particulates. Additional pollutants include hydrogen sulphide; volatile organic compounds, methane and ethane. During the operation phase of the Project, the only emissions in onshore part of the Project would be the fugitive emissions of volatile organic compounds originated from the connection equipment on the pipeline (flanges, valves, etc.).
Study area	**RSA:** Zonguldak Province **Rationale:** Provincial level air quality data from the national air quality Monitoring Locations is available for determination of air quality baseline.
	AoI: 5,000 m buffer zone **Rationale:** The nearby receptors (i.e. communities), around the Project area, potentially exposed to pollutant emissions.
Data sources	**Primary sources**: Field works and air quality measurements conducted between 2022 and 2024 in the scope of ESIA studies.
	Secondary sources: Data from Filyos Port/Industrial Zone Connections Project ESIA Report Data from Air Quality Monitoring Locations in Zonguldak Province Secondary data from scientific papers, grey literature and databases.

Methodological Approach

Regional Context (RSA) - Air Quality Monitoring Stations

Information about the air quality in the RSA is provided from the National Air Quality Monitoring Locations in Zonguldak Province. The air quality data at these stations are published at the website[1] of the Continuous Monitoring Center (CMC) of Republic of Türkiye Ministry of Environment, Urbanisation and Climate Change (MoEUCC) and data between August 2023 and August 2024 is summarized for (SO_2), nitrogen oxides (NOx), nitrogen dioxide (NO_2), ozone (O_3), PM_{10} and $PM_{2.5}$ parameters.

According to the CMC website, there are 8 air quality Monitoring Locations in Zonguldak Province. Locations of the stations are presented in Figure 6-7. Name and locations of the stations are presented in this figure and listed below.

1. Karadeniz Ereğli Station
2. Kozlu Station
3. Zonguldak Station
4. Kilimli Station
5. Çatalağzı Cumayanı Station
6. Çatalağzı Kuzyaka Station
7. Muslu Tepeköy Station
8. Çaycuma Station

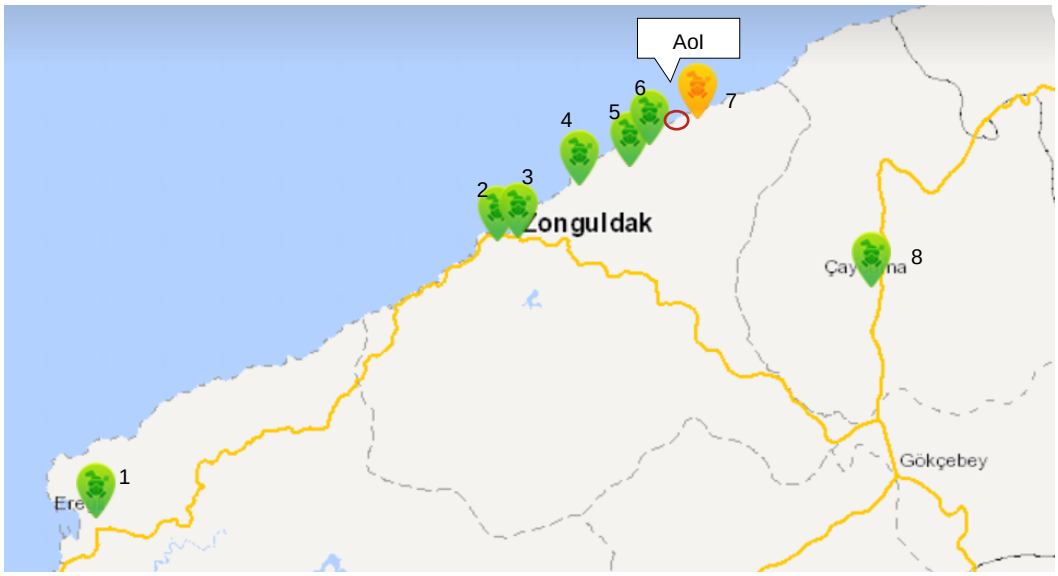


Figure 6-7: Air Quality Monitoring Locations in Zonguldak Province

The nearest air quality monitoring station to the Project area is Muslu Tepeköy Station and the distance between the station and the Project area is approximately 10 km.

While selecting the data period of these air quality monitoring stations, operational period of the SGFD Phase-1 is taken into consideration.

Air Quality Measurements Conducted in the AoI of the Project

[1] https://sim.csb.gov.tr/

Air quality monitoring study was conducted by Çınar between January 17th, 2022, and September 17th, 2022, and by FEBAS between April 26th, 2023 and February 4th, 2024 within the scope of the Phase-1 of the SGFD. Since Phase 2 of the SGFD, which is the subject of this ESIA, will be constructed within the SGFD area, and the air quality monitoring locations are deemed representative of the air quality within the Project's AoI, the air quality monitoring results are presented in this section. The baseline AoI of the Phase-2 of the SGFD includes operational activities of the Phase-1 SGFD. including vessel traffic. Therefore, the air quality monitoring results, which reflect the operational impacts of Phase 1 since its commencement in April 2023, are presented and assessed in this Report.

During the air quality monitoring study in the AoI, ambient SO_2, NO_2, H_2S, O_3, VOC, PM_{10}, $PM_{2.5}$, concentrations were monitored at 12 sensitive receptors (residential areas) around the Project area. Coordinates of monitoring locations are provided in Table 6-3 and map showing these air quality measurement locations is presented in Figure 6-8.

Within the scope of Phase 2, Sulfur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Hydrogen Sulfide (H_2S), Ozone (O_3), and Volatile Organic Compounds (VOCs) parameters were continuously monitored at 12 locations using the passive sampling method for 28-30 days on a monthly basis. Additionally, at these 12 locations, PM_{10} and $PM_{2.5}$ parameters in ambient air were measured and monitored through active sampling over 24-hour periods throughout one month.

Dates of the above-mentioned monitoring campaigns are listed below.

1. April 20th, 2023 - April 21st, 2023
2. September 7th, 2023 - October 7th, 2023
3. October 7th, 2023 - November 6th, 2023
4. November 6th, 2023 - December 6th, 2023
5. December 6th, 2023 - January 5th, 2024
6. January 5th, 2024 - February 4th, 2024

Monitoring for SO_2, NO_2, and H_2S was conducted from April 20, 2023, to February 4, 2024; VOC and O_3 measurements took place between October 7, 2023, and February 4, 2024; while PM_{10} and $PM_{2.5}$ were monitored from April 20, 2023, to October 7, 2023.

Table 6-3: Locations and Coordinates of the Air Quality Monitoring Locations

Monitoring Location ID	Location Name	Coordinates (UTM/WGS) (36T)	
		East	North
HK-1	Aşağıihsaniye Village	424155	4600940
HK-2	Yeşilyayla Village	425744	4601871
HK-3	Gökçeler Village	421717	4601068

Monitoring Location ID	Location Name	Coordinates (UTM/WGS) (36T)	
		East	North
HK-4	Sefercik Village	419996	4602522
HK-5	Sazköy Village	423029	4602850
HK-6	Sazköy Village	422449	4603370
HK-7	Derecikören Village	423394	4600118
HK-8	Filyos Municipality	419395	4601886
HK-9	Gökçeler Village	421883	4600727
HK-10	Aşağıihsaniye Village	423367	4601334
HK-11	Filyos Municipality	419615	4599735
HK-12	Derecikören Village	423072	4599243

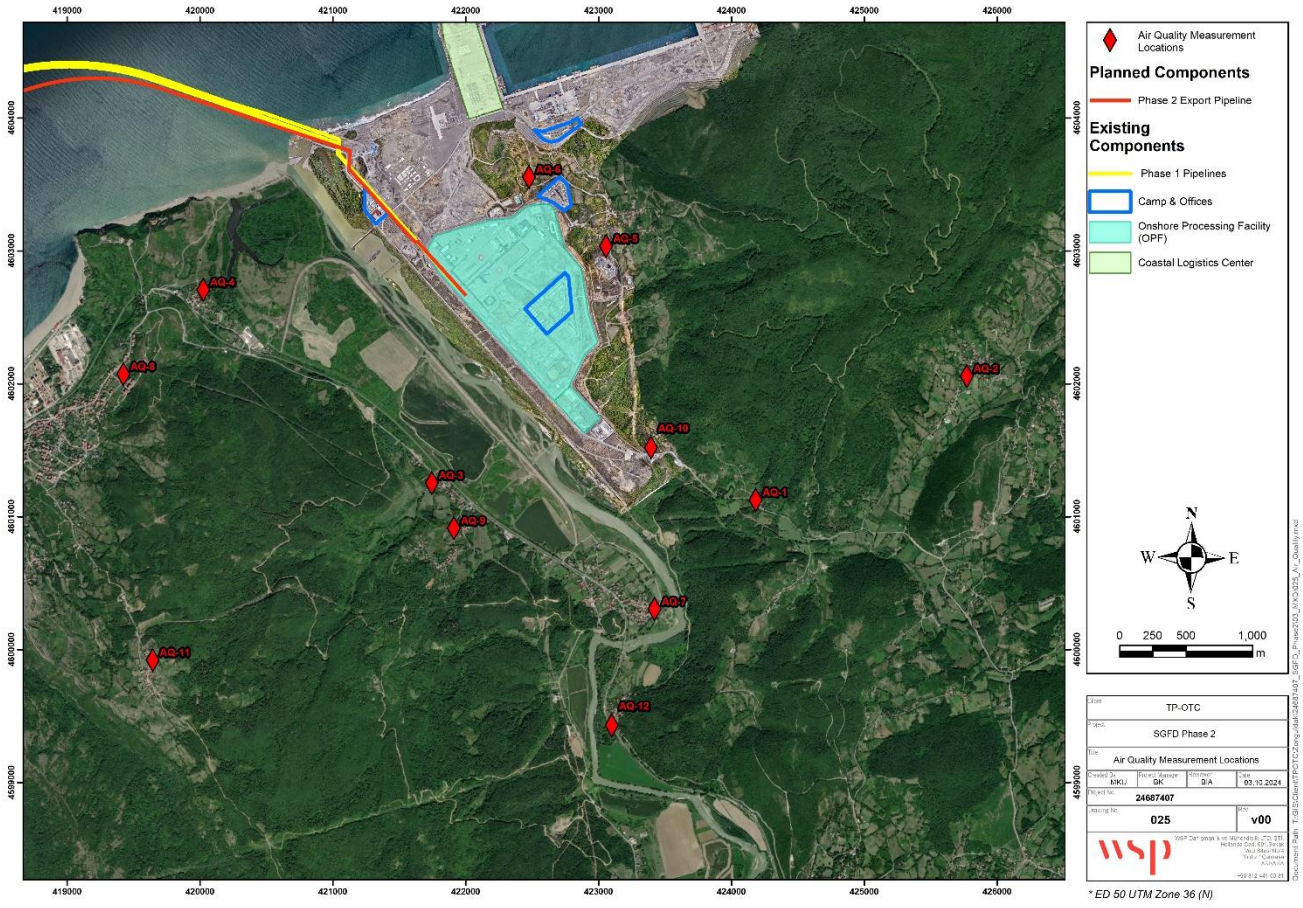


Figure 6-8: Baseline Air Quality Measurement Locations

Air sampling methodologies are provided from the laboratory (FEBAS, 2023) and summarized below.

- SO_2, NO_2, H_2S, O_3, VOC are measured with passive sampling. Passive sampling tubes are installed at the desired measurement points at a height of approximately 1.5 - 4 meters at the measuring points (Figure 6-9). Each tube is color-coded based on the parameter it samples. The tubes are fixed using specially designed suspension brackets, ensuring they are positioned 5 cm away from the wall. During the measurement and sampling period, the tubes are exposed to ambient air, allowing the sampling of the pollutant parameter for which they are specifically produced. The process is documented in the sampling forms.

Figure 6-9: Sample Photos from the Passive Diffusion Monitoring Studies

- PM_{10} and $PM_{2.5}$ measurements are conducted according to the TS EN 12341 standard. Using this method, the analysis of dust in the $PM_{2.5}$ and PM_{10} fraction of ambient air is performed by sampling the air with an ambient air sampling device (Figure 6-10). Dust is collected on a filter by drawing air from the environment through the filter using a pump and nozzle. The filters are then transported to the laboratory for gravimetric analysis. The amount of dust present in the PM_{10} fraction and $PM_{2.5}$ fraction is calculated by correlating the amount of dust found with the volume of air sampled. The detection limit specified for the method is 1 µg/m³.

Figure 6-10: PM Monitoring Device

Baseline Air Quality

Regional Context (RSA)

Air quality monitoring data collected from each monitoring station in Zonguldak Province is provided Table 6-4. While selecting the data period, operational period of the SGFD Phase-1 is taken into consideration.

According to the literature searches, air pollution is an important problem in Zonguldak Province. According to the study of Greenpeace (Ağaçayak, 2021), the most important sources of air pollution in Zonguldak are coal-fired power plants. Air emissions of thermal power plants in Zonguldak generates the pollutants, including particulate matter and NO_x, exceeding the limit values for most of the year. Kemal Ulusoy's study (Ulusoy, 2024) from Niğde Ömer Halisdemir University states that economy of Zonguldak depends on coal and coal dependent industries, which creates industrial air pollution problem. Air quality of Zonguldak Province is poor due to the city's nearby coal mines and the main source of air pollution is the hard coal mines.

Table 6-4: 2023-2024 August Air Quality Monitoring Data Collected from the Air Quality Monitoring Locations in Zonguldak Province

Air Quality Monitoring Station	Distance to the Project Area (~km)	Parameters										
		SO_2		NO_2		O_3			PM_{10}		$PM_{2.5}$	
		Annual Av. Conc. ($\mu g/m^3$)	Project Standard ($\mu g/m^3$)	Annual Av. Conc. ($\mu g/m^3$)	Project Standard ($\mu g/m^3$)	Maximum Hourly Conc. In an annual period ($\mu g/m^3$)	Annual Av. of Hourly Conc. ($\mu g/m^3$)	Project Standard ($\mu g/m^3$)	Annual Avg. Conc. ($\mu g/m^3$)	Project Standard ($\mu g/m^3$)	Annual Avg. Conc. ($\mu g/m^3$)	Project Standard ($\mu g/m^3$)
Zonguldak - Çatalağzı Cumayanı Station	17	15.62	**20**	23.55	**40**	**177.54**	31.43	**100**	46.51	**20**	28.45	**10**
Zonguldak - Çatalağzı Kuzyaka Station	15	11.84		7.23			34.4		51.66		29	
Zonguldak – Çaycuma Station	15	4.43		21.29			-		33.18		6.93	
Zonguldak - Karadeniz Ereğli Station	60	5.42		-			38.43		46.36			
Zonguldak – Kilimli Station	20	8.2		37.29			-		40.47		10.71	
Zonguldak – Kozlu Station	27	4.1		14.83			-		50.18		14.56	
Zonguldak - Muslu Tepeköy Station	10	13.36		14.81			63.62		42.93		17.17	
Zonguldak Station	26	7.7		67.23			-		31.63		12.93	

Notes:1: Project Standards are given in Appendix C of the ESIA.
2: Red colored concentration values are above the relevant Project standard.

Local Context (AoI)

Air quality data provided from the monitoring studies in the AoI of the Project is provided in Table 6-5, Table 6-6 and Table 6-7 below.

According to the monitoring results which were conducted between the periods mentioned above within the AoI of the Project, the measured particulate matter concentrations are below the Project Standard except the PM_{10} concentration at HK-10 in April 2023. Measured O_3, NO_2, H_2S, VOC concentrations are below the Project Standard.

When compared with national air quality measurement stations data, SO_2 concentrations at the AoI is slightly higher. The reasons for the higher concentrations may be that the domestic heating in the rural area is dependent on coal and wood rather than natural gas and the ongoing construction works in the region. Compared to the baseline measurements in Phase 1 ESIA, there are similar SO_2 values in the area even before the SGFD operation.

Table 6-5: PM_{10} and $PM_{2.5}$ Monitoring Results of the Monitoring Study Conducted within the Scope of This ESIA Report

Monitoring Location ID	Coordinates (UTM/WGS) (36T)		Date	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)
	Latitude	Longitude			
HK-01	424155	4600940	20.04.2023-21.04.2023	16.95	10.05
			07.09.2023-09.09.2023	19.35	7.88
HK-02	425744	4601871	20.04.2023-21.04.2024	29.68	9.95
			07.09.2023-09.09.2024	16.69	5.66
HK-03	421717	4601068	20.04.2023-21.04.2025	28.21	11.58
			07.09.2023-09.09.2025	15.23	5.05
HK-04	419996	4602522	20.04.2023-21.04.2026	18.36	5.41
			07.09.2023-09.09.2026	19.02	8.06
HK-05	423029	4602850	20.04.2023-21.04.2027	42.41	11.22
			07.09.2023-09.09.2027	17.33	11.97
HK-06	422449	4603370	20.04.2023-21.04.2028	26.66	10.96
			07.09.2023-09.09.2028	16.98	4.66
HK-07	423394	4600118	20.04.2023-21.04.2029	30.11	11.02
			07.09.2023-09.09.2029	34.23	16.00
HK-08	419395	4601886	20.04.2023-21.04.2030	34.33	12.11
			07.09.2023-09.09.2030	26.78	10.99
HK-09	421883	4600727	20.04.2023-21.04.2031	32.17	12.01

Monitoring Location ID	Coordinates (UTM/WGS) (36T)		Date	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)
	Latitude	Longitude			
			07.09.2023-09.09.2031	39.00	13.65
HK-10	423367	4601334	20.04.2023-21.04.2032	53.41	11.54
			07.09.2023-09.09.2032	20.22	11.86
HK-11	419615	4599735	20.04.2023-21.04.2033	11.18	4.46
			07.09.2023-09.09.2033	16.47	7.83
HK-12	423072	4599243	20.04.2023-21.04.2034	30.08	10.38
			07.09.2023-09.09.2034	40.65	15.11
Project standard				50.00	25.00

Table 6-6: SO_2, NO_2 and H_2S, Monitoring Results of the Monitoring Study Conducted within the Scope of This ESIA Report

Monitoring Location	Coordinates (UTM/WGS) (36T)		Avg/Min/Max of the Monitoring Period	H_2S (µg/m³)	SO_2 (µg/m³)	NO_2 (µg/m³)
	Latitude	Longitude				
HK-01	424155	4600940	avg	<0.65	16.81	5.53
			min	<0.5	1.07	0.41
			max	<0.68	21.71[1]	7.04
HK-02	425744	4601871	avg	<0.65	13.43	4.70
			min	<0.5	1.03	0.32
			max	<0.68	17.30	6.37
HK-03	421717	4601068	avg	<0.65	7.82	3.94
			min	<0.5	1.03	0.32
			max	<0.68	10.17	6.37
HK-04	419996	4602522	avg	<0.65	13.16	2.95
			min	<0.5	14.55	2.30
			max	<0.68	17.30	6.51
HK-05	423029	4602850	avg	<0.65	6.73	2.77
			min	<0.5	0.77	0.35
			max	<0.68	9.68	4.41
HK-06	422449	4603370	avg	<0.65	19.87	9.79

Monitoring Location	Coordinates (UTM/WGS) (36T)		Avg/Min/Max of the Monitoring Period	H_2S (µg/m³)	SO_2 (µg/m³)	NO_2 (µg/m³)
	Latitude	Longitude				
			min	<0.5	1.05	0.35
			max	<0.68	24.41[2]	13.61
HK-07	423394	4600118	avg	<0.65	16.99	6.54
			min	<0.5	0.94	0.27
			max	<0.68	23.07[3]	8.95
HK-08	419395	4601886	avg	<0.65	9.53	3.42
			min	<0.5	0.86	0.30
			max	<0.68	13.32	6.33
HK-09	421883	4600727	avg	<0.65	11.91	4.65
			min	<0.5	0.91	0.39
			max	<0.68	22.67[4]	6.05
HK-10	423367	4601334	avg	<0.65	19.19	2.41
			min	<0.5	0.73	0.45
			max	<0.68	39.40[5]	4.06
HK-11	419615	4599735	avg	<0.65	28.86[6]	3.93
			min	<0.5	0.78	0.44
			max	<0.68	35.07[7]	7.59
HK-12	423072	4599243	avg	<0.65	11.71	6.28
			min	<0.5	11.62	5.95
			max	<0.68	17.06	9.81
Project Standard (µg/m³)				20	20	40

Notes:1: Project Standards are given in Appendix C of the ESIA.

2: Red coloured concentration values are above the relevant Project standard.

[1]*During the measurement interval, the limit value was exceeded 2 times out of 6 measurement values at HK-1 station.*

[2]*During the measurement interval, the limit value was exceeded 5 times out of 6 measurement values at HK-6 station.*

[3]*During the measurement interval, the limit value was exceeded 3 times out of 6 measurement values at HK-7 station.*

[4]*During the measurement interval, the limit value was exceeded 4 times out of 6 measurement values at HK-10 station.*

[5]*During the measurement interval, the limit value was exceeded 5 times out of 6 measurement values at HK-11 station.*

Table 6-7: O_3 and TOC Monitoring Results of the Monitoring Study Conducted within the Scope of This ESIA Report

Monitoring Location	Coordinates (UTM/WGS) (36T)		Avg/Min/Max of the Monitoring Period	O_3 (µg/m³)	TOC (µg/m³)
	Latitude	Longitude			
HK-01	424155	4600940	avg	29.65	<2.05
			min	27.74	<2.05
			max	33.24	<2.05
HK-02	425744	4601871	avg	35.44	<2.05
			min	33.11	<2.05
			max	37.12	<2.05
HK-03	421717	4601068	avg	32.63	<2.05
			min	31.53	<2.05
			max	34.11	<2.05
HK-04	419996	4602522	avg	29.32	<2.05
			min	29.32	<2.05
			max	29.32	<2.05
HK-05	423029	4602850	avg	30.95	<2.05
			min	30.98	<2.05
			max	30.98	<2.05
HK-06	422449	4603370	avg	33.61	<2.05
			min	33.61	<2.05
			max	33.61	<2.05
HK-07	423394	4600118	avg	53.76	<2.05
			min	49.95	<2.05
			max	58.25	<2.05
HK-08	419395	4601886	avg	39.07	<2.05
			min	37.78	<2.05
			max	40.17	<2.05
HK-09	421883	4600727	avg	24.86	<2.05
			min	23.63	<2.05
			max	26.01	<2.05

Monitoring Location	Coordinates (UTM/WGS) (36T)		Avg/Min/Max of the Monitoring Period	O_3 (µg/m³)	TOC (µg/m³)
	Latitude	Longitude			
HK-10	423367	4601334	avg	41.75	<2.05
			min	39.17	<2.05
			max	45.62	<2.05
HK-11	419615	4599735	avg	27.29	<2.05
			min	25.02	<2.05
			max	30.11	<2.05
HK-12	423072	4599243	avg	65.25	<2.05
			min	58.89	<2.05
			max	69.91	<2.05
Project Standard (µg/m³)				100	280(hourly average)

Notes:1: Project Standards are given in Appendix C of the ESIA.

2: Red colored concentration values are above the relevant Project standard.

Sensitivity Assessment

After analyzing the baseline data, the sensitivity of the air quality component is given below.

Sensitivity features	Supported by	Sensitivity value
High NO_2, PM_{10} and $PM_{2.5}$ concentrations in the RSA High PM_{10}, SO_2 concentrations in the AoI Close presence of communities, vulnerable targets and sensitive ecological receptors potentially exposed to air emissions Other projects (planning stage) around the Project area.	Primary and secondary data	Medium-high

6.1.3 Noise and Vibration

Definition	Background noise/vibration or ambient noise/vibration is the sound level of environmental noise/vibration such as water waves, traffic noise, trains and airplanes, alarms, bioacoustics noise from animals, and electrical noise from equipment. During construction and decommissioning activities, noise and vibration may be caused by the operation of construction equipment for earth moving and excavation, concrete mixers, cranes, offshore vessels and the transportation of equipment, materials and people. During operations, the main sources of noise and vibration pollution will be produced by pre-existing facilities including flaring and rotating equipment i.e. flares, pumps, compressors, generators, and heaters. During the operation phase of the Project, since the processed gas will be transported via offshore pipeline to the pre-existing facility (i.e. SGFD Phase-1) for connection to the BOTAŞ network, no additional noise and vibration is expected other than the existing noise caused by SGFD Phase-1 operation.
Study area	**RSA:** Zonguldak Province **Rationale:** Noise and vibration related issues are controlled and managed by the Provincial Directorate of Environment, Urbanization and Climate Change.
	AoI: 1,000 m buffer zone **Rationale:** The nearby receptors (i.e. communities) around the Project area may be affected from potential noise and vibration impacts.
Data sources	**Primary sources** c) Field work and noise and vibration monitoring studies conducted in 2022 and 2023-2024.

Methodological approach

Noise and vibration data collected in AoI is the only available data for this component since there is not any provincial level (or RSA level) noise and vibration information. Details about the methodology used for the noise data collection study are provided below.

Local Context (LSA) - Noise and Vibration Measurements Conducted in the AoI of the Project

Noise and vibration monitoring study within the scope of the operation of the Phase-1 of the SGFD has been conducted at 15 locations since August 2022. The noise monitoring study was conducted within the time intervals described in the Turkish legislation and IFC General EHS Guideline for Noise for 48 hours. Since Phase 2 of the SGFD, which is the subject of this ESIA, will be constructed within the SGFD area, and the monitoring locations are deemed representative of the baseline within the Project's AoI, the monitoring results are presented in this section. The baseline AoI of the Phase-2 of the SGFD includes operational activities of the Phase-1 SGFD including vessel traffic. Therefore, the monitoring results, which reflect the operational impacts of Phase 1 since its commencement in April 2023, are presented and assessed in this Report.

Coordinates of the monitoring locations are provided in Table 6-8. Map showing the monitoring locations and the Project are presented in Figure 6-11.

Table 6-8: Locations and Coordinates of the Noise Monitoring Locations

Monitoring Locations	Coordinates (UTM/WGS) (36T)	
	Latitude	Longitude
Noise-1	424123	4600948
Noise-2	423850	4601284
Noise-3	420075	4602534
Noise-4	419916	4602378
Noise-5	421928	4600858
Noise-6	421706	4601102
Noise-7	422942	4600563
Activity-1	423013	4602818
Activity-2	422996	4603116
Activity-3	422437	4603343
Activity-4	420493	4602057
Activity-5	423224	4602340
Traffic-1	425289	4600706
Traffic-2	423355	4601333
Traffic-3	420797	4602714

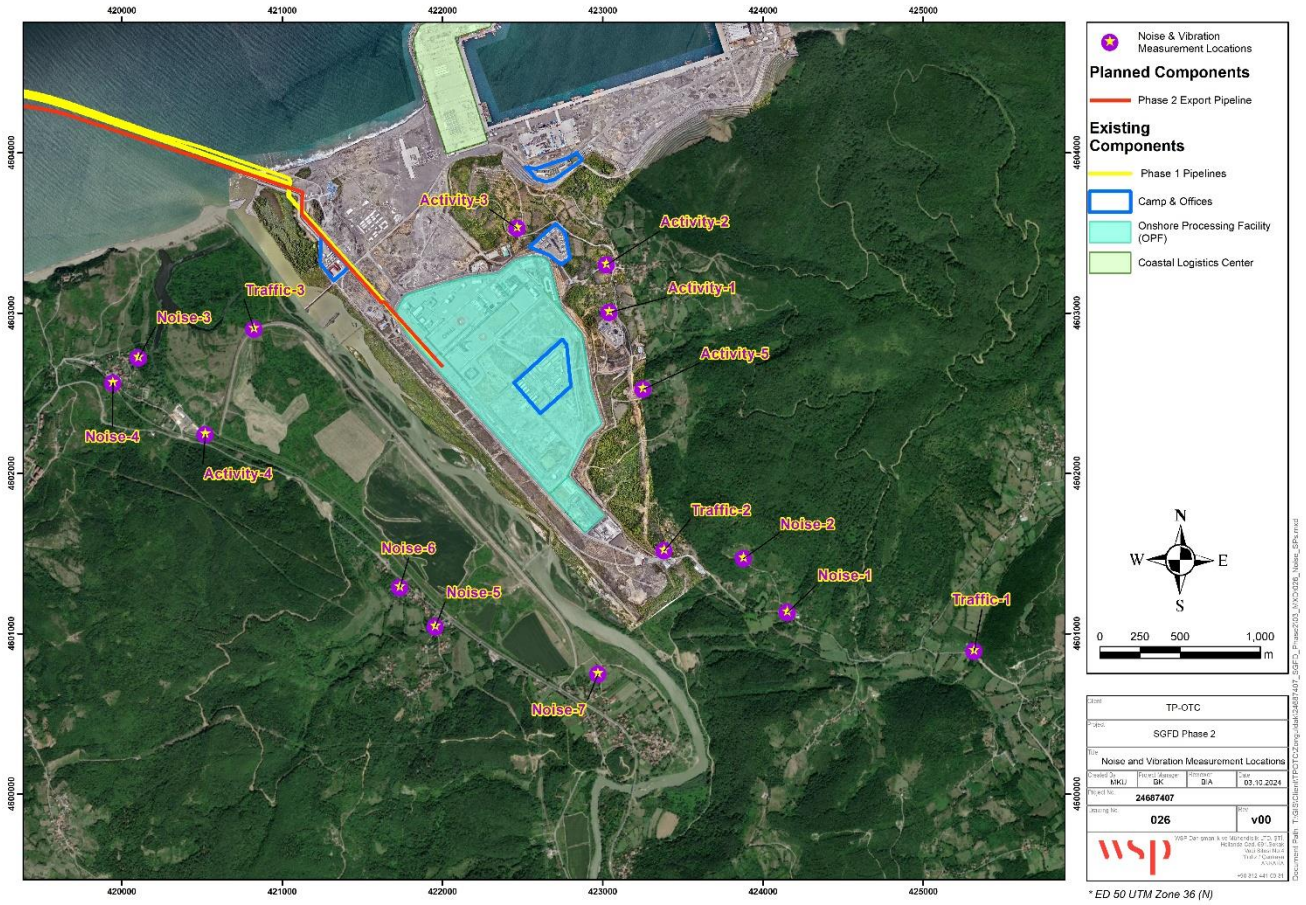


Figure 6-11: Background Noise Measurement Locations

Methodology of noise monitoring studies are provided from the laboratory (FEBAS, 2023) and summarized below.

Environmental noise monitoring studies are conducted according to TS ISO 1996-1 and TS ISO 1996-2 standards.

d) TS ISO 1996-1: Acoustic - Definition, Measurement and Evaluation of Environmental Noise -Part 1: Basic Dimensions and Evaluation Procedures

e) TS ISO 1996-2: Acoustics - Definition, Measurement and Evaluation of Environmental Noise - Part 2: Determination of Sound Pressure Levels

Measurements are conducted at a height of at least 1.5 m from the ground and at a distance of at least 2 m from the reflective surface. Equivalence continuous noise pressure level (L_{Aeq}) value is provided in accordance with the IFC (day and night) and Turkish legislation (day, evening and night) time intervals. The measurement duration at each point is a total of 48 hours, including both weekdays and weekends, with 15-minute intervals.

Devices used to measure sound pressure levels, including microphones, cables, guards, recording devices and other equipment (Figure 6-12), meet the requirements for Class 1 equipment according to IEC 61672 standard. A guard is always be used during outdoor measurements in order to prevent the device from physical impacts (wind, rain, dust etc.).

Figure 6-12: Sound and Level Meters (FEBAS, 2023)

Prior to Phase 1 of the Project, baseline vibration measurements could not be performed due to ongoing ground reinforcement works within the scope of the industrial zone construction. Therefore, the measurements were conducted during the holidays in the construction period when the construction activities of the Project were stopped.

Baseline Noise and Vibration

Local context (AoI)

Noise measurement data provided from the monitoring study in the AoI is provided in Table 6-5. Some of the measurements are above the Project Standard. High noise measurement results were specifically at Traffic 1, 2 and 3 monitoring locations and could be due to a result of traffic in the region.

In addition, the vibration levels measured at the monitoring points are given in Table 6-9

Table 6-9: Noise Monitoring Results According to the Monitoring Study Conducted within the Scope of this ESIA Report

Monitoring Locations	Coordinates (UTM/WGS) (36T)		Avg/Min/Max of the Monitoring Period	Regulation on Control of Environmental Noise (dBA)			IFC (dBA)	
	Latitude	Longitude		Day (07:00-19:00)	Evening (19:00-23:00)	Night (23:00-07:00)	Day (07:00-22:00)	Night (22:00-07:00)
Noise-1	424123	4600948	Avg	47.4	47.2	44.6	47.5	44.6
			Min	46.5	46.4	44.1	46.7	44.1
			Max	47.9	48.1	45.0	48.2	45.0
Noise-2	423850	4601284	Avg	39.0	36.8	36.4	38.6	36.5
			Min	37.7	36.2	35.7	37.5	35.7
			Max	40.4	37.6	37.3	39.8	37.3
Noise-3	420075	4602534	Avg	50.2	45.9	43.0	49.5	43.0
			Min	48.6	44.1	41.5	48.0	41.6
			Max	51.7	47.5	44.6	51.1	44.5
Noise-4	419916	4602378	Avg	52.4	52.2	44.0	52.8	44.1
			Min	50.8	49.4	42.9	51.4	43.0
			Max	54.0	54.5	45.3	54.4	45.0
Noise-5	421928	4600858	Avg	53.3	53.8	43.9	54.0	44.0
			Min	51.8	51.6	42.4	52.5	42.5
			Max	54.5	55.8	44.8	54.9	44.9

Monitoring Locations	Coordinates (UTM/WGS) (36T)		Avg/Min/Max of the Monitoring Period	Regulation on Control of Environmental Noise (dBA)			IFC (dBA)	
	Latitude	Longitude		Day (07:00-19:00)	Evening (19:00-23:00)	Night (23:00-07:00)	Day (07:00-22:00)	Night (22:00-07:00)
Noise-6	421706	4601102	Avg	53.0	53.1	43.2	53.6	43.2
			Min	51.4	51.6	41.7	52.3	41.7
			Max	54.4	54.7	44.5	54.9	44.7
Noise-7	422942	4600563	Avg	52.2	46.3	38.8	51.2	39.3
			Min	50.4	44.8	37.4	49.4	37.8
			Max	53.7	48.0	40.1	52.5	40.9
Activity-1	423013	4602818	Avg	50.9	43.1	37.1	50.6	41.2
			Min	39.2	0.0	0.0	42.4	33.0
			Max	62.8	55.1	47.1	54.9	44.9
Activity-2	422996	4603116	Avg	50.7	48.2	43.5	50.3	43.8
			Min	49.7	46.6	42.8	49.3	43.2
			Max	51.8	50.4	44.1	51.6	44.4
Activity-3	422437	4603343	Avg	48.2	46.5	43.9	47.9	44.0
			Min	47.6	45.3	43.4	47.3	43.5
			Max	48.9	48.5	44.4	48.8	44.6
Activity-4	420493	4602057	Avg	51.4	49.1	43.9	51.0	44.3

Monitoring Locations	Coordinates (UTM/WGS) (36T)		Avg/Min/Max of the Monitoring Period	Regulation on Control of Environmental Noise (dBA)			IFC (dBA)	
	Latitude	Longitude		Day (07:00-19:00)	Evening (19:00-23:00)	Night (23:00-07:00)	Day (07:00-22:00)	Night (22:00-07:00)
			Min	50.2	48.2	43.4	50.0	43.7
			Max	52.9	50.4	44.8	52.5	44.7
Activity-5	423224	4602340	Avg	45.6	44.7	39.9	45.5	40.0
			Min	44.1	43.3	38.8	44.0	38.8
			Max	47.0	46.7	41.3	47.2	41.6
Traffic-1	425289	4600706	Avg	54.1	54.2	43.9	54.7	44.0
			Min	53.3	52.2	43.1	54.1	43.3
			Max	55.1	55.4	45.1	55.2[1]	44.8
Traffic-2	423355	4601333	Avg	53.9	54.7	44.4	54.5	44.6
			Min	53.1	53.2	43.2	53.9	43.6
			Max	54.5	57.0	45.6	55.2[2]	45.5
Traffic-3	420797	4602714	Avg	51.1	49.4	43.9	50.9	44.2
			Min	49.7	48.1	43.1	49.4	43.6
			Max	52.3	50.2	47.0	51.7	47.2[3]
Project Standard				65	60	55	55	45

Notes:1: Project Standards are given in Appendix C of the ESIA.

2: Red coloured concentration values are above the relevant Project standard.

[1] During the measurement interval, the limit value was exceeded 2 times out of 6 measurement values at Traffic-1 monitoring location.

[2]During the measurement interval, the limit value was exceeded in 1 out of the 6 measurement values at Traffic-2 monitoring location.

[3]During the measurement interval, the limit value was exceeded 2 times out of 6 measurement values at Traffic-3 monitoring location.

Table 6-10: Vibration Monitoring Results According to the Monitoring Study Conducted within the Scope of this ESIA Report

Monitoring Locations	Coordinates (UTM/WGS) (36T)		Min/Max of the Monitoring Period	Vibration (mm/s)		
	Latitude	Longitude		X direction	Y direction	Z direction
Noise-1	424123	4600948	min	0.044	0.066	0.041
			max	0.471	0.934	1015
Noise-2	423850	4601284	min	0.1	0.114	0.104
			max	0.792	1740	0.679
Noise-3	420075	4602534	min	0.048	0.112	0.05
			max	0.882	0.598	0.583
Noise-4	419916	4602378	min	0.056	0.054	0.054
			max	0.845	0.494	0.911
Noise-5	421928	4600858	min	0.086	0.193	0.145
			max	0.942	1656	0.722
Noise-6	421706	4601102	min	0.048	0.108	0.046
			max	1.366	0.354	0.581
Noise-7	422942	4600563	min	0.052	0.041	0.046

Monitoring Locations	Coordinates (UTM/WGS) (36T)		Min/Max of the Monitoring Period	Vibration (mm/s)		
	Latitude	Longitude		X direction	Y direction	Z direction
			max	0.586	3013	2971
Activity-1	423013	4602818	min	0.156	0.212	0.232
			max	0.942	1.498	1.407
Activity-2	422996	4603116	min	0.108	0.227	0.108
			max	0.249	2.844	0.921
Activity-3	422437	4603343	min	0.044	0.066	0.046
			max	0.811	0.976	0.757
Activity-4	420493	4602057	min	0.157	0.128	0.112
			max	0.867	4.285	3.819
Activity-5	423224	4602340	min	0.076	0.123	0.133
			max	0.883	1.172	1.907
Traffic-1	425289	4600706	min	0.044	0.062	0.05
			max	0.957	0.764	0.694
Traffic-2	423355	4601333	min	0.037	0.158	0.136
			max	0.629	0.811	1.698
Traffic-3	420797	4602714	min	0.043	0.219	0.091
			max	0.571	0.519	0.736

Monitoring Locations	Coordinates (UTM/WGS) (36T)		Min/Max of the Monitoring Period	Vibration (mm/s)		
	Latitude	Longitude		X direction	Y direction	Z direction
Project Standard				5	5	5

Notes:1: Project Standards are given in Appendix C of the ESIA.

2: Red coloured concentration values are above the relevant Project standard.

Sensitivity Assessment

After analyzing the baseline data, the sensitivity assessment of noise and vibration component is given below.

Sensitivity features	Supported by	Sensitivity value
Medium-high noise levels in the AoI Close presence of communities, vulnerable targets and sensitive ecological receptors potentially exposed to noise and vibration emissions	Primary and secondary data	▪ Medium-High

6.1.4 Geology and Geomorphology

Definition	In order to provide the necessary data for designing works under maximum safety conditions during construction and production, prior to development of the Phase 1 of the SGFD, geological and Geotechnical Studies were conducted to determine the geomorphological, geological and geotechnical conditions in and around the SGFD. A summary of these geological studies is compiled in the following sections.
Study areas	**RSA:** Provincial borders of Zonguldak and Bartın. **Rationale:** Provincial borders of Zonguldak and Bartın has been determined as RSA, Since the regional geology at the SGFD location is related to the provinces of Bartın and Zonguldak.
	AoI: SGFD Footprint. **Rationale:** Within the scope of the Project, since the areas where the Project units are located are likely to be affected by the geological structure, the areas where the Project units are located were selected as AoI.
Data sources	**Primary sources**: Primary data from field work conducted by Toker Drilling Co. in 2021 and 2022.
	Secondary sources: Secondary data from Phase-1 ESIA, various surveys for the Project, scientific papers, geological literature and databases.

Methodological approach

Information presented in this report regarding the regional geological setting of the TP-OTC Sakarya Gas Field is sourced from geological and geotechnical investigations carried out in the area.

The reports that have been review are:

- Filyos (Zonguldak) Industrial Zone Basis of the Master Plan Geological – Geotechnical Survey Report, Geoteknik Mühendislik, May 2016.
- TP-OTC Filyos Natural Gas Processing Plant Stage 2-3-4 Soil and Foundation Investigations Geotechnical Evaluation Report, TOKER Drilling and Construction Engineering Consulting Co., April 2021.
- Sakarya Gas Field Submarine Production Facilities, Submarine Transport Lines and Gas Processing Facility Integrated Project EIA Report, Armada Danışmanlık, September 8, 2021
- Sakarya Gas Field Development Project Probabilistic Seismic Hazard Assessment, DenAR, December 2021.
- Probabilistic Seismic Hazard Assessment Design Ground Motions for TP-OTC FİLYOS Natural Gas Processing Facility Site, Prof. Dr. Zeynep Gülerce-Middle East Technical University, April 2021.
- Geology of the Black Sea coal basin (Zonguldak, Bartın), MTA, 2019.
- Hydrographic and Oceanographic Survey Report, DenAR, May 2021.

- Sakarya Gas Field Development Project Phase 1 Environmental and Social Impact Assessment (Phase 1 ESIA, 2022).
- TP-OTC Filyos Natural Gas Processing Plant, Geotechnical Evaluation Report, April 2021.

6.1.4.1 Geology and Stratigraphy

The Project site is in proximity to the cities of Zonguldak, Çaycuma, and the village of Sazköy. The Middle Ordovician-Lower Devonian aged Ereğli formation forms the Regional Area. It is overlain by the Middle Devonian-Lower Carboniferous Yılanlı formation, the Upper Visian-Upper Namurian aged Alacaağzı formation, and the Westphalian aged Karadon formation. The Permo-Triassic terrestrial Çakra formation and the Triassic Çakraboz formations are transitive with each other. These formations overlie the older units with angular unconformity. Malm-Apsian aged İnaltı formation, Lower Cretaceous aged Ulus formation, Lower Cretaceous aged Kilimli formation, Upper Cretaceous Yemişliçay formation, Upper Campanian-Lower Eocene aged Akveren formation, Lower-Middle Eocene aged Yığılca formation and Lower-Middle Miocene aged Çaycuma formation unconformably overlies the terrestrial clastics. Quaternary aged current deposits unconformably overlie older units.

- **Ereğli Formation (Ode)**

The formation forms a sequence of 250-300m of thickness and it was named by Serdar and Demir (1983). The formation consists of shale-sandstone, shale-limestone and shale-sandstone alternations from bottom to top.

- **Yılanlı Formation (DCy)**

The formation consists of limestone, dolomitic limestone and dolomite and it was named by Saner (1979-1980). The formation starts with shale, siltstone-limestone alternation at the bottom, it continues with limestone, dolomitic limestone and dolomite.

- **Alacaağzı Formation (Ca)**

The formation consists of coal-veined shale, mudstone and sandstone, and it was named by Ralli (1933). The lower part of the formation contains fossils. The thickness of the formation is about 500 m.

- **Karadon Formation (Cka)**

Consisting of conglomerate, sandstone, claystone and diatomite, the formation was named by Ralli (1933). The formation contains yellowish grey coloured conglomerate, sandstone, claystone, shale, diatomite (Dil ve Konyalı, 1978) and refractory clay (Kerey, 1984; Yergök ve diğ., 1987). The formation contains coal veins, and its thickness is around 200 m.

- **Çakraz Formation (PEç)**

Red coloured terrestrial mudstone, shale, sandstone, and conglomerate are named as Çakraz Sandstone. (Akyol et al. 1974) The formation, which consists of dark red, green-red alternating shale, mudstone and sandstone, also includes conglomerates. Cross-bedded sandstones are observed. The thickness of this formation is approximately 600-700 m.

- **İnaltı Formation (JKi)**

İnaltı formation consists of white, beige and grey coloured carbonates. The bottom section consists of sandstone, sandy limestone, dolomitic limestone and dolomite. The middle and upper sections consist entirely of carbonates. The thickness of the formation is approximately 400-500 m.

- **Ulus Formation (Ku)**

The formation, which consists of alternating turbiditic sandstone and shale, was named by Akyol et al (1974). The formation consists of alternating greyish-green, grey and black, medium-bedded turbiditic sandstone and shale. The formation contains volcanic blocks. The formation is represented by slope and sub-slope basin sediments. The thickness of the formation is about 200 m.

- **Kilimli Formation (Kk)**

The formation, which consists of shale, marl, sandstone, and sandy-clay limestone alternation, was named by Saner et al (1981). The formation consists of alternating greyish green, thin-medium bedded shale, marl, and yellowish grey coloured thin-medium bedded sandstone. The thickness of the formation is about 250-300 m.

- **Yemişliçay Formation (Ky)**

This Upper-Cretaceous aged formation consists of volcanic sandstone, siltstone, claystone, shale and pyroclastic rocks and pelagic - semipelagic limestones (Ketin & Gümüş, 1963). The formation generally consists of brown, thin-medium bedded volcanogenic sandstone, greyish green, thin-medium bedded shale, sandstone-siltstone alternation, tuff, tuffite in the lower parts; beige and red-pink colored thin-medium bedded pelagic-semi-pelagic clayey limestones in the middle parts; brown and dark grey colored agglomerates in the upper parts (Turkish Petroleum Corporation, 2021). (Turkish Petroleum Corporation, 2021).

- **Akveren Formation (KTa)**

This Upper Cretaceous-Paleocene aged formation consists of sandy carbonates at the bottom, clayey limestones, reef limestones, mudstones, marls, turbidites and volcanic units at the top (Ketin & Gümüş, 1963). The formation, which starts with sandstone and clastic limestone, continues upwards as claystone-siltstone alternation, mostly clayey limestone-marl. In places, sediments developed by turbidite flows are observed. The unit generally transitions from clastic to semi-pelagic and turbiditic deposits over the Yemislicay formation. Caycuma formation overlies the Akveren formation conformably (TPAO, 2021).

- **Yığılca Formation (Tey)**

The formation which consists of andesite, basalt, tuff, agglomerate and volcanogenic sandstone was named Yığılca formation by Kaya et al (1986). The formation contains agglomerate and tuff in dark grey, brownish grey, red- and green-coloured units. In addition, Nummulites fossils are found in the thin marl between these units. The formation thickness is about 100-150 m.

- **Çaycuma Formation (Teç)**

This Eocene aged formation consists of alternations of volcanic intercalated sandstone, siltstone, claystone and shale. The lower and middle parts of the formation consist of grayish green, thin-medium bedded shale, carbonate shale and rarely green and purple colored limestones. Tuffite intercalations are observed towards the upper parts of the formation. At the top, there are limestone interlayer shales with abundant fossils (Nummulites) (TPAO, 2021).

- **Quaternary (Qal)**

These are gravel, sand, clay, silt and mud deposits in stream beds, on flat areas developed on old depressions. These sediments unconformably cover the older units.

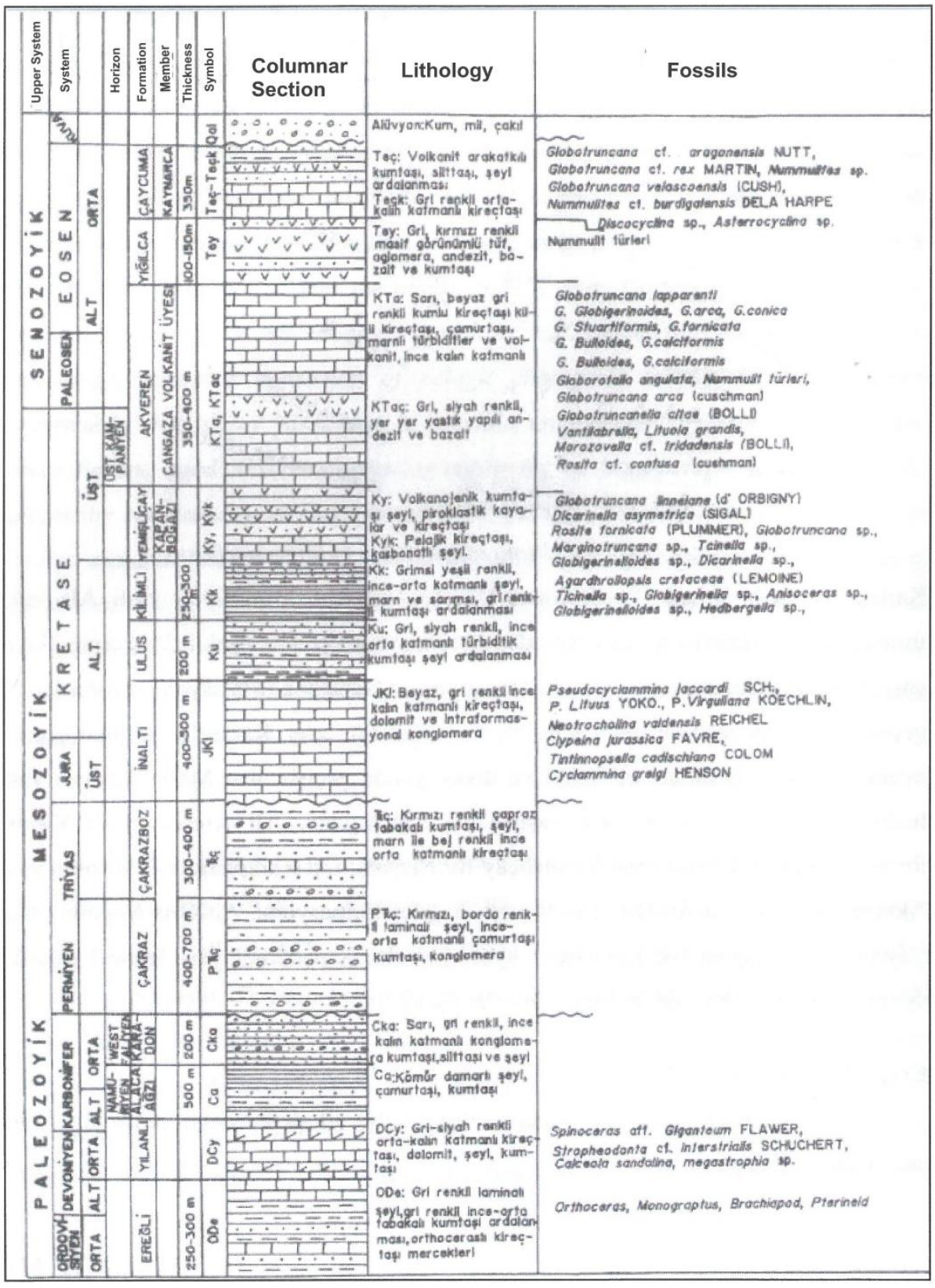


Figure 6-13: Regional Stratigraphy (Akbaş et al., 2002)

ERA	SUB-ERA	PERIOD	EPOCH	FORMATION	SYMBOL	LITHOLOGY	DESCRIPTION
CENOZOIC	QUATERNARY			ALLUVIUM	Qal		Pebble, sand, silt, clay
	TERTIARY		EOCENE	CAYCUMA	Teç		Volcanic intercalated sandstone, siltstone, claystone and shale.
			PALEOCENE	AKVEREN	KTa		Sandy carbonates, clayey limestones, reef limestones, mudstones, marls, turbidites and volcanic units
MESOZOIC	CRETACEOUS	UPPER CRETACEOUS		YEMISLICAY	Ky		Volcanic sandstone, siltstone, claystone, shale and pyroclastic rocks and pelagic - semipelagic limestones

Figure 6-14: Stratigraphy of the AoI (TOKER, 2021)

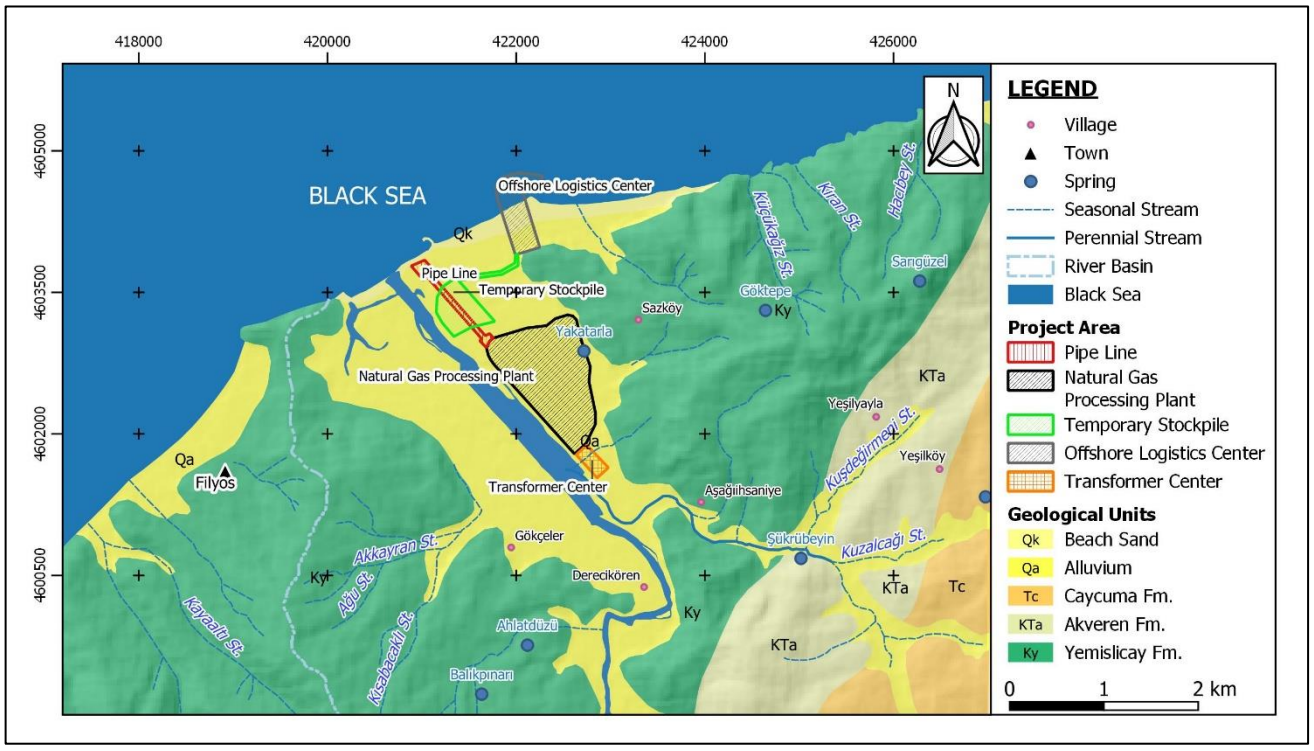


Figure 6-15: Geological map of RSA & AoI and its surroundings (TOKER, 2021)

6.1.4.2 Structural Geology

Türkiye, along its geological history, formed through the development of oceans, convergence-divergence-collision of continents, and tectonic movements in many different characteristics. Long and continuous thrust faults in the Western Black Sea region are faults in the E-W or NE-SW direction. These faults have occurred due to N-S or NW-SE directional stresses. There is not much information on the deformations that occurred as a result of the pre-Alpine movements. The North Anatolian Fault is located approximately 80 km South of the Aol. It is a seismically active, important tectonic structure that starts from Karlıova in the East and extends to the Saros Gulf in the West. It extends the country in an E-W direction, forming a belt with a length of about 1200 km and a width varying between 100 m and 10 km. It is a right-lateral strike-slip fault that provides the movement between the Black Sea plate and the Anatolian plate. (Saroglu et al, 1987).

Türkiye is located in the Alpine orogenic zone and a region with high earthquake activity. 42% of the country's acreage is in 1st-grade seismic belt. The Istanbul Zone, which covers Zonguldak and its surrounding provinces, was influenced by the orogenic movements that occurred in Neogene. In the region, a compressive regime with a N-S direction dominates the post-collision until the Late Miocene (Pontian).

From the Late Miocene, a NW-SE compressive regime started and this regime continued until the Late Pliocene. In the Late Pliocene period, this compression was replaced by a compression in the N-S direction and an expansion in the N-S direction was observed in the region throughout the Middle Miocene. Tectonic map of the North-Eastern Mediterranean region presented by Genç and Yilmaz (2000) is given in Figure 6-16

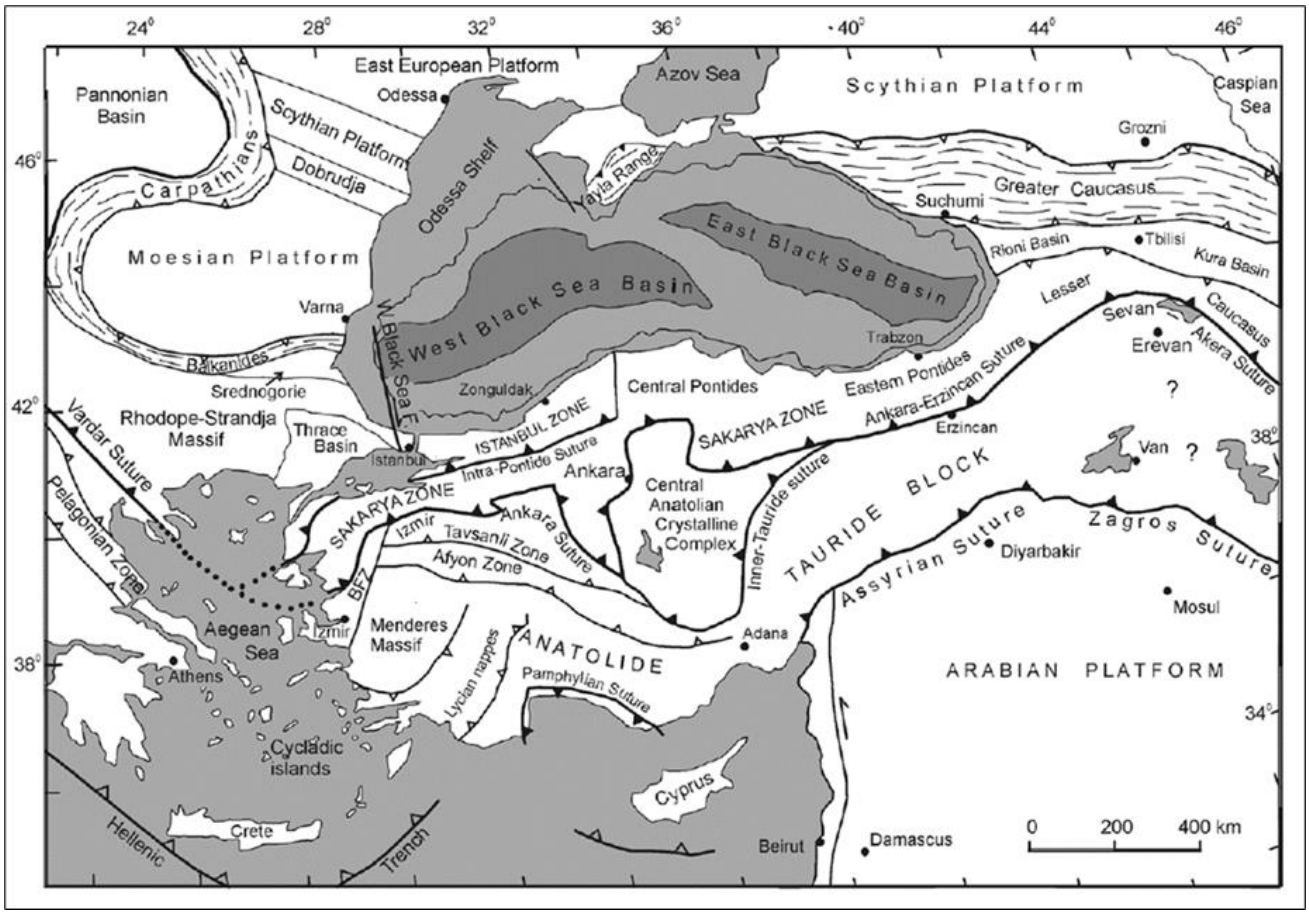


Figure 6-16: Tectonic Map of the north-eastern Mediterranean region showing the major sutures and continental blocks (Genç and Yilmaz. 2000)

For the AoI, Pre-Malm tectonic activity increased in the region and the Ereğli, Yılanlı, Alacaağzı, Karadon and Çakraz formations were uplifted and formed an erosion area. Malm-Early Apsian is a period of tectonic relief. During this period, the positive areas became a shelf-platform (Inalti sedimentation) with vertical subsidence and became a slope deep sea in the Apsian-Albian period (during the Malm-Early Albian period, the basin was transformed into a basin suitable for the deposition of the Ulus Formation). Pre-Santonian (possibly Thioconian) is the period of increased tectonic activity in the region. The Inalti Formation, which was uplifted in the basin due to compression, gave material to the Yemişliçay Formation by shearing to the north. The Campanian-Maastrichtian is the period of increased tectonic activity. During this period, volcanic activity increased and the Çakraz, Inalti, Kilimli and Ulus formations were brought to the surface by horizontal compressional movements. The Maastrichtian is the period of tectonic stability. During this period, pelagic-semipelagic limestones of the Akveren Formation were deposited in transition with volcanites (TP-OTC Filyos Soil and Foundation Investigation Data Report, 2021).

6.1.4.3 Geohazard and Seismicity

There are no faults passing through the AoI. The closest fault to the AoI is the Devrek Fault, which is 45 km away. The active fault map is given below (Figure 6-17). AoI is about 80 km away from one of the most active fault systems in the world, the North Anatolian Fault Zone. North Anatolian Fault Zone extends along Northern Türkiye for more than 1500 kilometers and was ruptured progressively by eight large and destructive earthquakes (Mw>6.7) in the last century. Large magnitude earthquakes that had occurred between years 1939

and 1967 had broken approximately 900 kilometers of a uniform Eastern trace, whereas the Kocaeli and Düzce Earthquakes in 1999 ruptured a total fault range of approximately 200 kilometers on the West. The seismic sources in the surrounding area that would contribute to the design of the TP-OTC Filyos site can be separated into two distinct groups: the seismic sources on the land and the seismic sources off-shore. The seismic sources on the land include different segments of the North Anatolian Fault Zone. the Hendek and Çilimli Faults (Holocene) on the North of the North Anatolian Fault Zone around Sakarya /Düzce and the Quaternary Yığılca, Devrek and Karabük Faults which are the thrust faults formed as a result of continuous N-S shortening during the late Eocene to late Miocene. The off-shore region to the North of the site has a rather complex tectonic structure: considerable seismic activity and faulting due to the convergence between the Arabian and Eurasian plates which gave way to the uplift of the Eastern Anatolia.

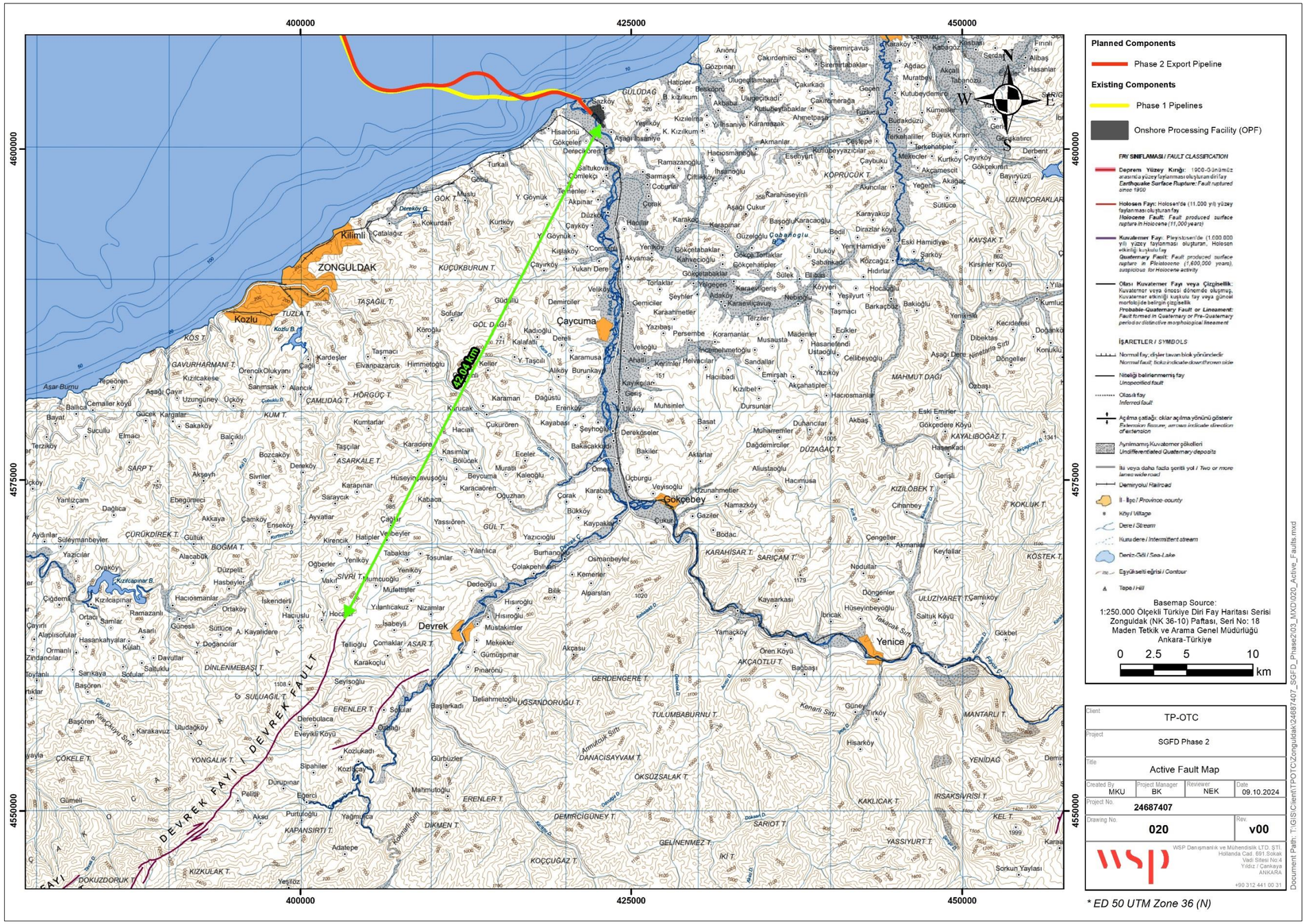


Figure 6-17: Active Fault Map

In the last century, nine big surface ruptures occurred along the North Anatolian Fault Zone in a westward migrating fashion of the earthquake epicenters starting from 1939 Erzincan earthquake in the east and 1942 Niksar – Erbaa, 1943 Tosya, 1944 Bolu – Gerede, 1951 Kurşunlu, 1957 Abant, 1967 Mudurnu Valley (Barka. 1992) and the 1999 İzmit and Düzce Earthquakes (Akyüz et al. 2002) sequentially Westwards. During these 9 major events, 1100 km long surface faulting between Erzincan and the Sea of Marmara was observed (Barka et al. 2002). The closest segments of North Anatolian Fault Zone to the Aol are the rupture zones of 1957 Abant, 1967 Mudurnu Valley, 1999 Düzce. 1944 Bolu-Gerede and 1943 Tosya Earthquakes.

The first Earthquake Zoning Map of Türkiye was prepared by the Ministry of Public Works and Settlement in 1996. This Map was revised in 2018. In the revised map, unlike the previous version, the maximum ground acceleration values are shown instead of earthquake zones and the concept of “earthquake zone” is eliminated. The earthquake hazard map of the Zonguldak Province according to the Map of Türkiye Earthquake Hazard Map is provided below.

According to the big earthquake statistics in the past years, the probability of an earthquake with a magnitude of 7.0 in and around Zonguldak to occur in 49 years is 51% (Figure 6-18). The return period of the earthquake is 68 years. According to the Earthquake Research Department, the risk of a damaging earthquake in the region every 18-20 years is very high.

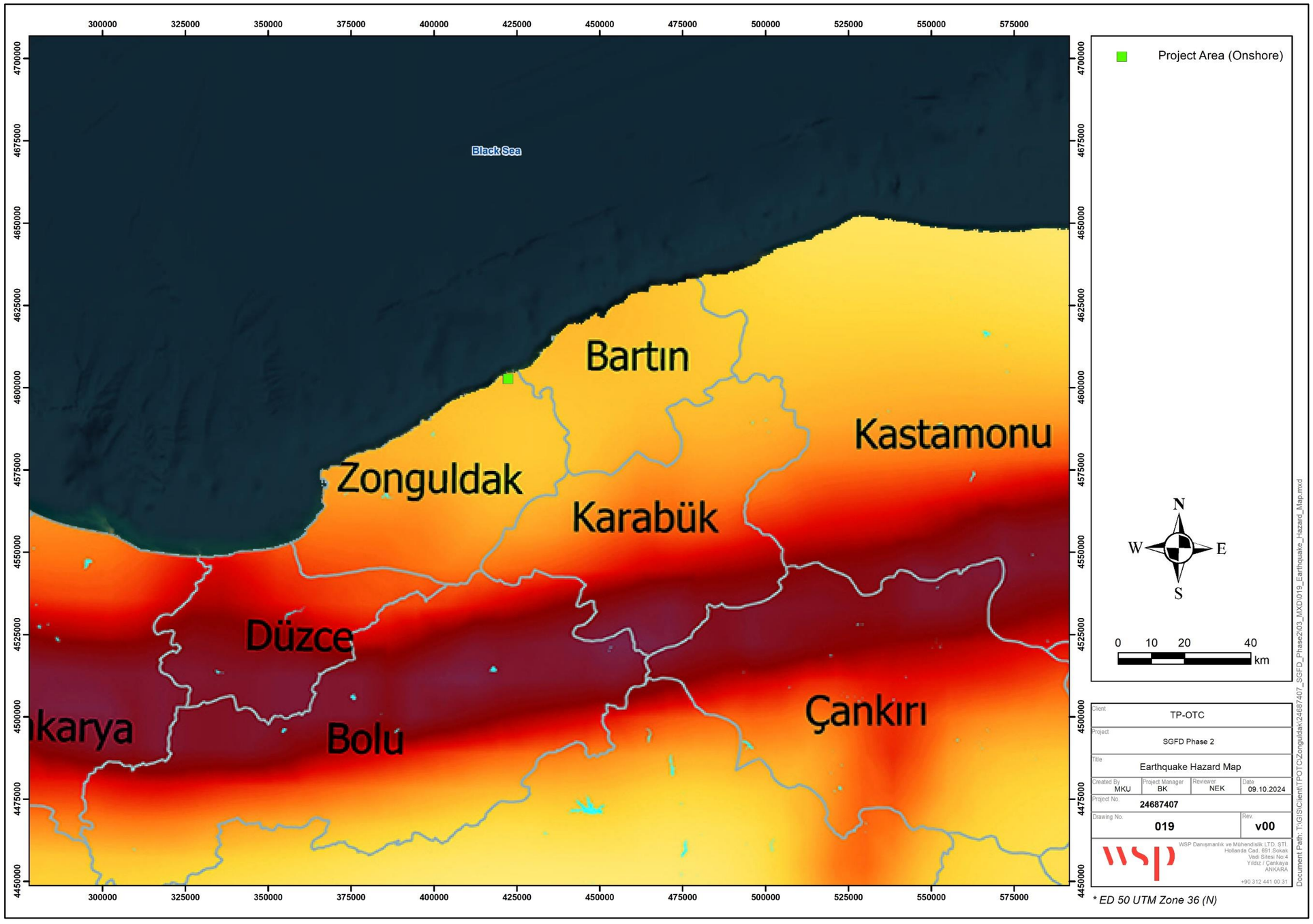


Figure 6-18: The Earthquake Hazard Map of RSA and Surroundings

6.1.4.4 Geotechnical Studies

Comprehensive geotechnical surveys were undertaken in 2021 and 2022 within the Project boundaries by TOKER Drilling and Construction Engineering Consulting Co. These surveys include geological/geotechnical investigations, including boreholes, in-situ and laboratory test results conducted in the scope of Stage 2-3-4 of TP-OTC Filyos Natural Gas Processing Plant Project. The region of the investigation was given in (Section of the Geological Investigation Areas (Investigation points from 2021 geotechnical survey).

On the basis of these studies, 67 boreholes with 2771 m total depth were drilled in the Aol between 02.02.2021 – 18.03.2021. In addition, 20 test pits were dug to investigate the geological conditions and to determine the suitability of excavated material for use in filling works. During drillings, samples were taken from soil and in-situ tests were performed. Standard penetration tests were performed, both disturbed (SPT, DS) and undisturbed (UD) samples were collected in accordance with the technical specifications in order to determine strength, stiffness and density of the soil. Borehole drillings at rock formations were performed by continuous coring method.

Liquefaction Analysis have been performed by using laboratory test results and soil profiles encountered in 45 different boreholes where sand/silty sand and non-plastic silt layers were observed. Among these regions, Region A has a relatively small number of soil layers with liquefaction potential whereas Region B and Region C contains considerable amount of soil layers with liquefaction potential.

The objective of these studies was to develop a settlement model for the site and a corresponding geotechnical design. The results of these studies will be evaluated in the impact assessment phase of this ESIA.

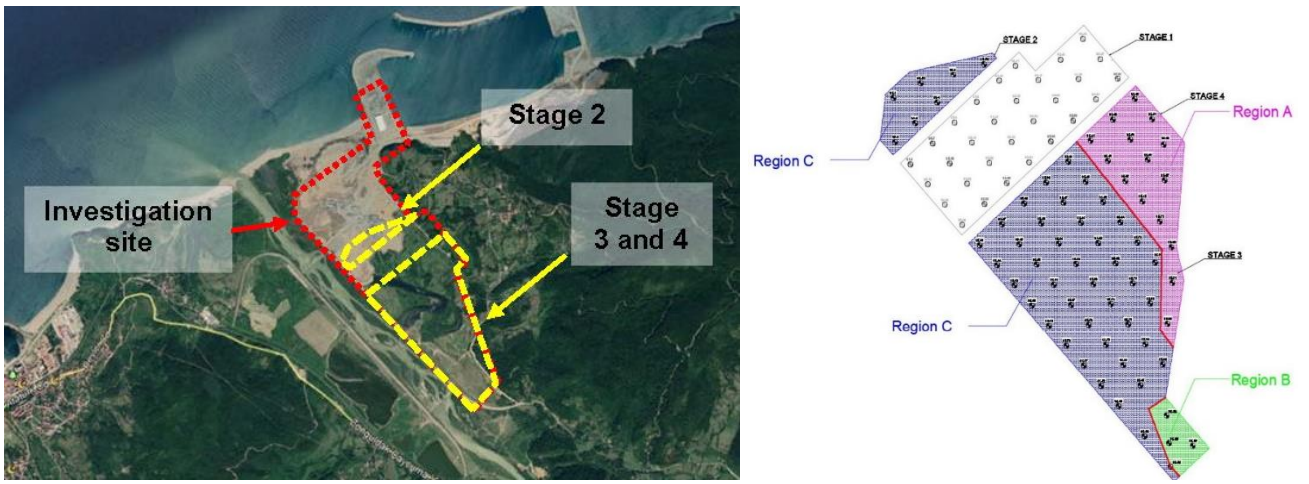


Figure 6-19: Section of the Geological Investigation Areas (Investigation points from 2021 geotechnical survey)

Based on this documentation, the site lithostratigraphy is considered to be as follows (from stratigraphic top to bottom).

The general soil profile at the Aol consists of Fill, Alluvium (Silty Clay/Clayey Silt, Sand/Silty Sand), Residual Claystone, Claystone/ Siltstone/ Argillaceous Limestone and Claystone/Siltstone/ Sandstone.

- **Fill**
  - Fill material with a thickness of 1.2-10.2 m is observed at the top of the soil profile.

- It is brown-grey-green coloured and generally in the form of coarse-grained blocky material. Fill layer also locally includes clay/topsoil. The blocks that form the fill layer are angular.

- **Alluvium**
  - According to the drilling works carried out by TOKER, the alluvium starts as sandy-gravelous above. After this sandy-gravelous level with an average thickness of 5 m, a clay-silt level with a thickness of 30-40 m is observed. Sand bands up to 10 m thick can be observed in places at this level. Afterward, a sandy level with a thickness of 10-20 m is drilled before the end of the alluvium.

- **Residual Clay/Claystone**
  - This layer is mainly green, brownish green, brown and locally pinkish brown-reddish brown colored, generally in the form of hard Clay/Gravelly Clay. Residual Claystone contains little amount of sand. The gravels within this layer are fine-medium-grained and angular-subangular.

- **Claystone / Siltstone / Argillaceous Limestone**
  - This layer is mainly brown, light brown colored and generally very weak – weak in strength. It is intensely fractured – crushed and generally moderately-highly weathered.

- **Claystone/Siltstone/ Sandstone**
  - The bedrock Claystone/Siltstone/Sandstone layer is mainly grey colored, generally moderately - closely-intensely fractured, crushed, and very weak-weak-medium-strong in strength and slightly - moderately weathered. Discontinuities in this layer are dipping at 0-5˚ and filled with locally calcite and clay.

6.1.5 Soil and subsoil

Definition	Soil is a mixture of organic matter, minerals, gases, liquids, and organisms that together support life. In this section, the characteristics of the existing soil layer at the project location, such as its properties, purposes of use, and contamination status are examined.
Study areas	**RSA:** SGFD Area **Rationale:** Since the impact of the Project on the soil layer will be limited from the activities from 2 components in an already disturbed area, the entire SGFD area has been determined as the RSA.
	AoI: Project Units (landfall area, pipeline from the landfall to the BOTAS tie-in point). **Rationale:** Since the impact of the Project on the soil layer will be limited in the Phase 2 footprint, this area from landfall to the BOTAS tie-in point has been identified as the AoI
Data sources	**Primary sources**: According to the baseline study data from soil sampling field work conducted by TP-OTC in May 2021 and January-March 2022 for Phase 1 ESIA.
	Secondary sources: Secondary data from various surveys for the Project, scientific papers, literature review and databases.

Methodological approach

The SGFD already as a Pollution Prevention Plan and Soil Management and Erosion Control Plan for prevention and management of any activity that would impact soils.

Soil baseline characteristics such as land use profile and land use capability were assessed using literature review during Phase 1 ESIA.

The reports that have been reviewed are:

- Preliminary Baseline Study Data from Soil Sampling Field Work, TP-OTC, May 2021 and January-March 2022.
- Sakarya Gas Field Submarine Production Facilities, Submarine Transport Lines and Gas Processing Facility Integrated Project EIA Report, Armada Danışmanlık, 08.09.2021

No impacts on soil or soil sampling campaigns have taken place since the commissioning of the Phase 1. As such, no impacts on the Phase 1 soil baseline have incurred. The soil baseline of SGFD is summarized in this chapter.

Regional context (RSA)

Since the AoI falls into the RSA and is limited to Phase 2 and SGFD, the studies are presented under the section of local context.

Local context (Aol)

Soil Characteristics and Land Use Capability Classification

The soil properties within Aol are evaluated by enquiring the land use and soil properties map of the former General Directorate of Rural Services through GIS as presented in Figure 6-20.

The total land use area in the Zonguldak province is 318,489.27 hectares. 3.357% of this area is urban settlement areas, 5.226% rural settlements (including villages), 29.595% agricultural areas, 61.088% wooded areas, 0.145% central business areas and 0.413% industrial areas. Also, Erosion distributions of the soil mapping unit of the Zonguldak province are given in Table 6-11. There are moderate and severe erosion problems in 83.8% of the Zonguldak province.

Table 6-11: Erosion Distribution in Zonguldak Province

Erosion	Area (ha)	Area (%)
1 (none)	12768,5	4
2 (Slight)	28126,9	8,9
3 (Medium)	252863	79,9
4 (hard)	12352,1	3,9
non-evaluation areas	10413,9	3,3

One major soil group was identified in the Aol. The largest soil group is “alluvial soil” that is observed at the processing facility, transformer station and onshore pipeline. These soils are young soils that are formed on the transported and stored materials by streams rarely belonging to A-C horizons. Mineral compositions depend on the lithological composition of the river basin and the periods of transportation and accumulation during the soil development in geological periods and have a heterogeneous structure. In alluvial areas, the upper soil imperceptibly penetrates to the lower soil. In areas with fine texture and high ground water, the vertical permeability rate is low, the surface is moist and rich in organic matter. As the rough textured soils are well drained, the surface dries quickly. Vegetation on soils depends on the current climate. They are productive soils suitable for the cultivation of all kinds of plants that can adapt to their climate. Alluvial soils are classified according to their structures, regions, or their evolution. In alluvial areas, the upper soil imperceptibly penetrates to the lower soil. In areas with fine texture and high ground water, the vertical permeability rate is low, the surface is moist and rich in organic matter. A mild reduction event take place in the subsoil. The rough floors are well-drained, so the surface layers dry quickly. Vegetation on soils depends on the current climate. They are productive soils suitable for the cultivation of all kinds of plants that can adapt to their climate.

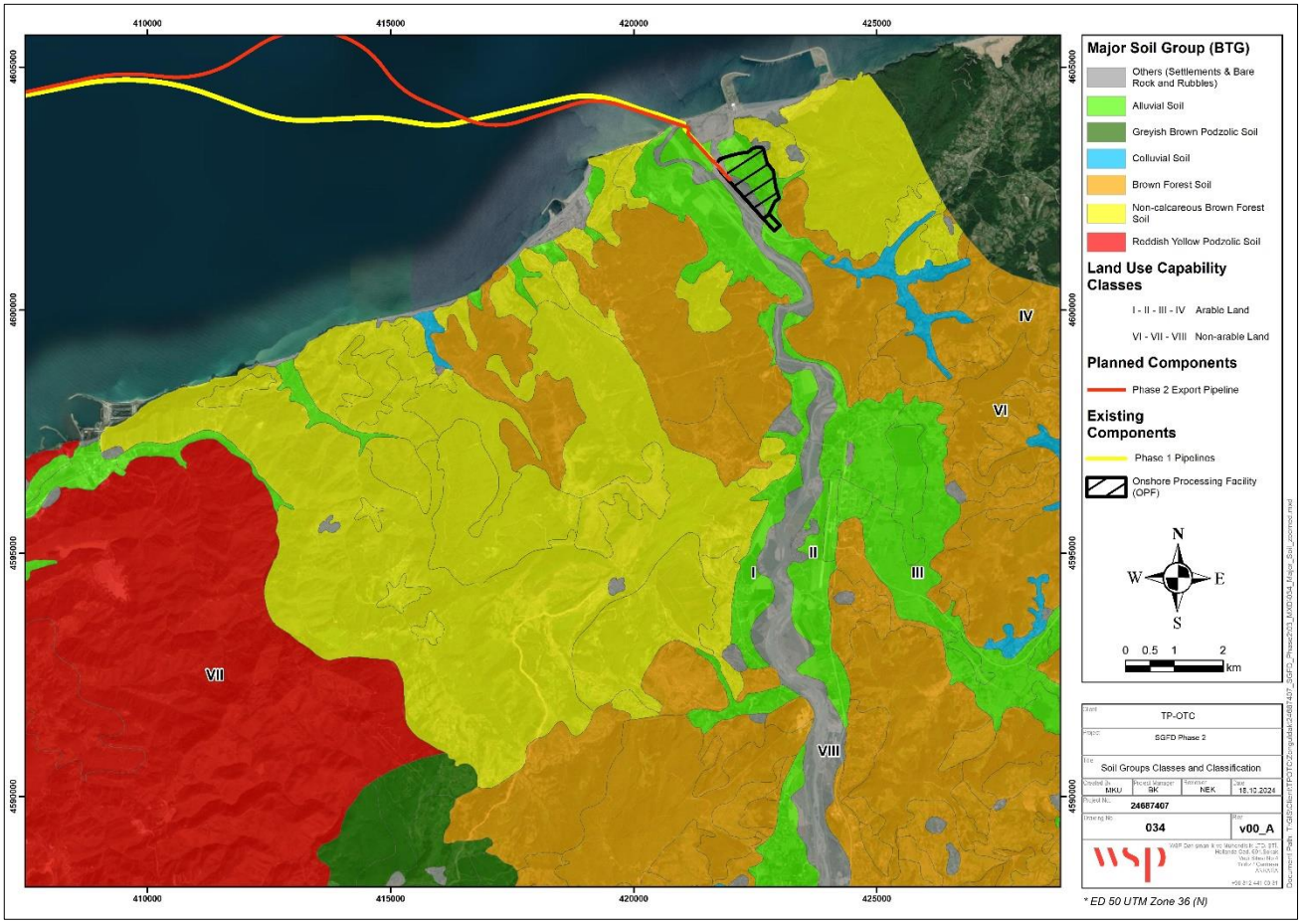


Figure 6-20: Soil Groups and Classes of the AoI

Soil classes are defined according to the suitability of soil for cultivation. Soil classes used by the Ministry of Agriculture and Rural Affairs are shown in Table below. Generally, two soil classes were identified at the AoI. Most of the soils are included in class II and class VIII. Class II is suitable for cultivation; while class VIII is not suitable for agriculture.

Table 6-12: Soil Classes according to Suitability for Cultivation

Class	Suitability for Cultivation	Cultivation Limiting factors
I	Suitable for many crop types.	No limitations.
II	Suitable for long term cultivation of various crops	It requires measures against soil and water loss.
III	Suitable for cultivation of certain types of crops for which special protection measures are provided	It is open to erosion and requires artificial drainage for cultivation
IV	Suitable for some crops. It requires special care when used for agricultural purposes	There are limitations in terms of depth of soil, stone content, humidity and slope.
V	Plain or slight slope, stony or lush soil. It is not suitable for ploughing or cultivation. It is grassland or forest area.	It has a weak drainage and a structure that is not suitable for ploughing.

Class	Suitability for Cultivation	Cultivation Limiting factors
VI	Not suitable for ploughing or cultivation. It is generally used as grazing area or forest area.	There are limitations in terms of slope and shallow soil.
VII	Not economically feasible for agriculture but it is suitable for some grazing or forestation	There are limitations in terms of shallow soil, stone content, slope and erosion
VIII	Not suitable for flora habitats. It may be used for recreational purposes or can be designated as protection area for wild life.	Poor soil content.

Soil Quality

In order to source data for the soil quality baseline of the site, a soil sampling was carried out in May 2021 within the scope of the EIA. A total of 7 soil samples were collected throughout the Aol. In addition to the sampling campaign completed in May 2021, other soil samples were collected from 20 more locations on 01-03.2022 within the scope of baseline studies of the ESIA.

Soil samples were collected and analysed, from the locations presented in Figure 6-21.

While determining the parameters to be analysed in soil samples, soil pollution indicator parameters listed in Table-1 of Annex-2 of the Regulation on Soil Pollution Control and Point Source Contaminated Sites were taken into consideration.

Soil samples were analysed for (May 2021):

- TOX
- BTEX
- Speciated TPH
- Oil & Grease
- Heavy Metals (Ag, As, Ba, Be, B, Cd, Cu, Co, Cr, Hg, Mo, Ni, Ti, Tl, Pb, Sb, Se, Sn, U, V, Zn)

Soil samples were analysed for (January-March 2022):

- TOX
- BTEX
- TVOCs
- Speciated TPH
- Heavy Metals (As, Ba, Cd, Cr, Co, Cu, Pb, Hg, Mo, Ni, Sb, Se, U, V, Zn)

The analytical results were compared to the generic limit values mentioned in the Annex I of the Soil Regulation. Annex I of the updated regulation defines different generic limit values depending on the exposure pathways:

- Generic Limit Value-1: Soil ingestion and absorption through skin contact.
- Generic Limit Value-2: Inhalation of volatile matter in external environment.
- Generic Limit Value-3: Inhalation of fugitive dust in the external environment.
- Generic Limit Value-4: Transport of pollutants into groundwater and drinking of groundwater (Safety Factor (SF) = 1 or 10).

The Generic Limit Value-1 and Generic Limit Value-3 are used for the surface/shallow soil samples and Generic Limit Value-2 and Generic Limit Value-4 are used for sub-soil samples.

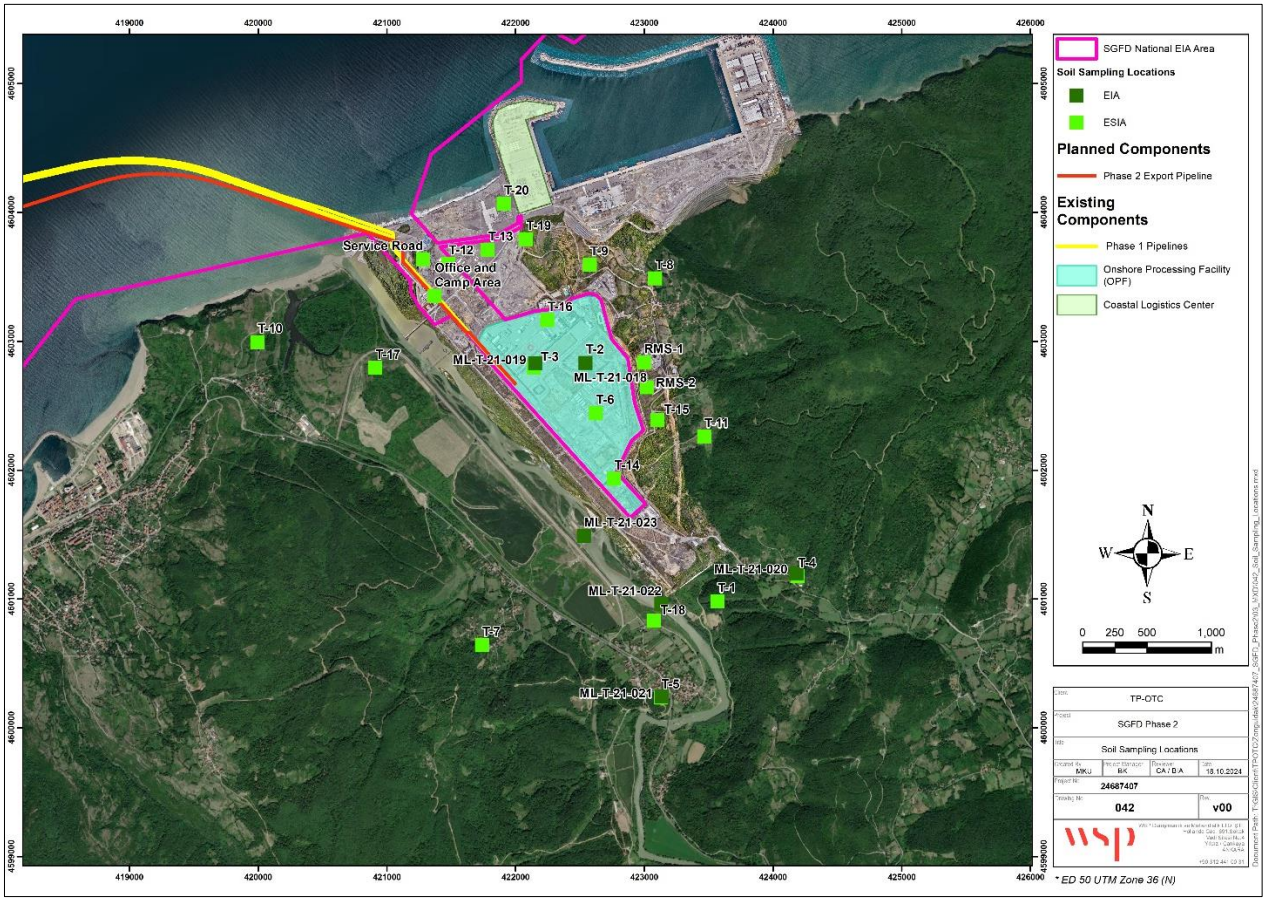


Figure 6-21: Soil Sampling Locations

Soil Sampling Study Results **(May 2021)**

Chemical analyses results show that Total Petroleum Hydrocarbons (TPH), Benzene, Toluene, Ethyl benzene and Xylenes (BTEX) and Total Organic Halogens (TOX) concentrations for all samples are below their respective laboratory detection limits.

The Oil & Grease concentrations at ML-T-21-017, ML-T-21-018, ML-T-21-019, ML-T-21-020, ML-T-21-021 and ML-T-21-023 were reported as 0.071, 0.078, 0.051, 0.102, 0.053 and 0.075 mg/kg respectively.

Table 6-13: Heavy Metal Anaytical Results (May 2021)

Parameter	Unit	GLV:1 Soil ingestion and absorption through skin contact	GLV:3 Inhalation of fugitive dust in the external environment	ML-T-21-017	ML-T-21-018	ML-T-21-019	ML-T-21-020	ML-T-21-021	ML-T-21-022	ML-T-21-023
Antimony (Sb)	mg/kg	31	-	0.39	0.495	0.45	0.415	0.508	0.626	0.409
Arsenic (As)	mg/kg	0.4	471	5.38	4	5.23	3.45	3.4	5.359	3.364
Barium (Ba)	mg/kg	15643	433702	182.3	170.5	162.9	110.42	187.52	127.46	312.76
Berylium (Be)	mg/kg	0.1	843	<0.05	0.102	0.099	0.28	0.166	0.121	0.234
Boron (B)	mg/kg	-	-	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3
Cadmium (Cd)	mg/kg	70	1124	0.173	0.117	0.128	0.146	0.205	0.171	0.19
Chromium (Cr)	mg/kg	235	24	5.89	4.27	3.82	3.52	10.934	4.32	4.43
Cobalt (Co)	mg/kg	23	225	2.4	1.69	1.82	1.94	2.247	2.07	2.42
Copper (Cu)	mg/kg	3129	-	5.65	3.87	-	8.92	5.34	4.907	9.516
Lead (Pb)	mg/kg	400	-	16.79	11.22	-	17.44	12.36	14.47	27.242
Mercury (Hg)	mg/kg	23	-	0.593	0.334	0.122	0.091	0.184	0.1	0.069
Molybdeium (Mo)	mg/kg	391	-	0.5	0.5	0.37	0.357	0.691	0.471	0.531
Nickel (Ni)	mg/kg	1564	-	4	2.76	-	2.12	9.01	3.761	6.643
Selenium (Se)	mg/kg	391	-	0.91	0.706	0.78	0.598	0.804	0.917	1.288
Silver (Ag)	mg/kg	391	-	0.59	0.22	0.169	0.512	0.578	0.181	0.209
Talyum (Tl)	mg/kg	5	-	0.25	0.158	<0.125	0.137	0.152	0.131	0.15
Tin (Sn)	mg/kg	46929	-	2.76	1.69	166	1.49	2.51	1.79	4.02
Titanium (Ti)	mg/kg	312857	-	272.306	301.7	353.937	755.503	450.197	295.558	391.585
Uranium (U)	mg/kg	-	-	0.37	0.364	0.304	1.35	0.624	0.283	0.663
Vanadium (V)	mg/kg	548	-	16.96	11.5	11.73	30.59	13.344	12.76	15.57
Zinc (Zn)	mg/kg	23464	-	38.87	26.32	28.66	26.91	44.67	34.348	28.617

Arsenic: All samples exceed the regulatory limit concentration for Arsenic which is 0.4 mg/kg and the exceeding concentrations vary between 3.364 to 5.38 mg/kg.

Beryllium: All samples but ML-T-21-017 and ML-T-21-019 slightly exceed the regulatory limit concentration for Beryllium which is 0.1 mg/kg and the exceeding concentrations vary between 0.102 to 0.28 mg/kg, where 0.05 mg/kg is also the laboratory detection limit for this parameter.

Soil Sampling Study Results **(January – March 2022)**

Chemical analyses results show that Total Volatile Organic Compounds (TVOCs), Total Petroleum Hydrocarbons (TPH), Benzene, Toluene, Ethyl benzene and Xylenes (BTEX) concentrations for all samples are below their respective laboratory detection limits.

Arsenic: All samples exceed the regulatory limit concentration for Arsenic which is 0.4 mg/kg. where 0.05 mg/kg is also the laboratory detection limit for this parameter.

Chromium: S45873 (Service Road1) exceed the regulatory limit concentration for Chromium which is 24 mg/kg and the exceeding concentration is 31.3 mg/kg.

Table 6-14: Heavy Metal Analytical Results (January-March 2022).

Parameter	Unit	LOQ	GLV:1 Soil ingestion and absorption through skin contact	GLV:3 Inhalation of fugitive dust in the external environment	S45873 - S	S45874 -	T-1	T-2	T-3	T-4	T-5	T-6	T-7	T-8	T-9	T-10	T-11	T-12	T-13	T-14	T-15	T-16	T-17	T-18	T-19	T-20	RMS-1	RMS-2
Antimony (Sb)	mg/kg	<0,05	31	-	0,14	0,23	<0.05	0,73	0,13	0,14	0,14	0,24	0,16	0,18	0,17	0,19	0,22	0,12	<0,05	0,27	0,27	0,68	0,16	0,24	<0,05	<0,05	0,23	0,18
Arsenic (As)	mg/kg	<0,05	0,4	471	4,95	11,06	8,24	66,50	13,64	4,08	3,92	10,32	7,94	9,03	11,54	5,47	7,23	5,58	4,46	18,99	6,68	22,66	7,94	6,53	4,08	3,61	9,48	7,28
Barium (Ba)	mg/kg	<2	15643	433702	33,90	43,10	562,69	147,95	93,44	183,52	103,10	105,28	302,10	195,01	141,29	196,97	167,30	27,94	15,45	107,24	259,99	126,55	175,80	110,38	158,62	21,69	197,93	146,10
Cadmium (Cd)	mg/kg	<0,05	70	1124	<0,05	<0,05	<0,05	<0,05	0,11	0,17	0,17	0,12	<0,05	0,15	0,14	0,12	<0,05	<0,05	<0,05	0,22	0,32	0,12	0,11	0,14	0,05	<0,05	0,15	0,22
Chromium (Cr)	mg/kg	<0,05	235	24	31,30	0,63	7,03	2,95	5,13	11,21	11,82	7,23	15,34	9,04	13,56	8,39	12,32	27,16	17,43	0,87	10,45	3,14	20,05	20,87	5,36	6,11	19,65	10,68
Cobalt (Co)	mg/kg	<0,05	23	225	6,53	7,76	6,97	8,73	8,76	10,78	8,39	8,01	9,58	11,14	13,23	9,20	10,57	6,29	5,01	9,02	15,24	7,45	11,05	9,37	4,22	3,65	16,82	10,73
Copper (Cu)	mg/kg	<0,1	3129	-	8,76	32,50	22,22	44,90	37,68	35,31	21,39	33,49	51,75	36,64	21,98	29,75	26,16	6,10	4,76	47,41	29,07	40,18	24,86	20,86	17,66	5,20	16,62	32,47
Lead (Pb)	mg/kg	<0,05	400	-	8,43	7,09	17,96	12,37	12,23	21,57	16,86	13,67	30,96	15,67	17,15	22,68	21,25	5,28	4,06	12,56	28,05	14,41	18,21	10,19	6,83	2,58	22,17	15,95
Mercury (Hg)	mg/kg	<0,1	23	-	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
Molybdeium (Mo)	mg/kg	<0,05	391	-	0,25	0,52	0,22	0,79	0,38	0,62	0,28	0,34	0,14	0,24	0,22	0,17	0,50	0,23	0,16	0,63	0,61	0,32	0,21	0,36	0,12	0,11	0,39	0,67
Nickel (Ni)	mg/kg	<0,1	1564	-	18,30	2,08	10,35	5,00	13,56	14,62	41,04	9,88	21,67	17,70	22,72	11,67	16,77	18,39	13,63	4,57	19,97	6,97	32,84	37,41	6,89	9,94	26,68	20,04
Selenium (Se)	mg/kg	<0,05	391	-	0,66	0,91	1,36	0,71	0,87	1,06	5,60	0,70	0,82	1,03	1,02	0,88	1,00	0,81	0,72	0,87	1,11	0,90	1,04	1,01	0,76	0,69	1,10	1,14
Uranium (U)	mg/kg	<0,05	-	-	0,40	0,32	2,04	0,36	0,34	1,15	0,75	0,32	0,86	0,44	0,39	0,53	1,03	0,45	0,28	0,39	0,86	0,40	0,65	0,46	0,28	0,16	0,35	1,23
Vanadium (V)	mg/kg	<0,05	548	-	45,50	17,80	34,65	26,56	21,43	44,96	37,37	28,94	34,37	33,60	28,41	32,66	43,97	37,21	32,93	25,74	40,29	24,70	30,10	25,86	20,65	13,12	33,09	29,05
Zinc (Zn)	mg/kg	<0,5	23464	-	29,30	37,50	47,72	46,04	49,53	57,62	32,98	44,59	42,91	60,51	60,30	39,68	39,01	26,13	20,80	57,28	55,32	59,57	50,61	54,53	28,36	15,86	33,04	131,24
BTEX	mg/kg	<0,1	-	-	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
TVOCs (w/ PID)	ppm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH (speciated fractions)	mg/kg	<100	-	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
TOX	mg/kg	-	-	-	39.3	29,30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sensitivity Assessment

Sensitivity features	Supported by	Sensitivity value
Limited presence of soil with agricultural potential. Presence of some zones with soil potential erosion. Limited soil contamination.	Primary data and secondary data	**Medium**

6.1.6 Hydrology and Surface Water Quality

Definition	Hydrology is the scientific study of the movement, distribution, and management of water on Earth and other planets, including the water cycle, water resources, and environmental watershed sustainability. Hydrology subdivides into surface water hydrology, groundwater hydrology (hydrogeology), and marine hydrology. Domains of hydrology include hydrometeorology, surface hydrology, hydrogeology, drainage-basin management, and water quality, where water plays the central role.
Study areas	**RSA:** Water catchment of the Filyos River. **Rationale:** Catchment of the Filyos River has been determined as RSA, since the drainage of the sub-basins associated with the Project Site and the AoI is to Filyos River.
	AoI: AoI is defined as sub-catchments (micro catchments) of Filyos River where the project units are in a relation with. The border of this area is also used as a boundary of the groundwater flow model. **Rationale:** Since the physical factors affecting the direction and accumulation of the movement of surface waters are the basin boundaries, the sub-basin boundaries are determined as the hydrological AoI.
Data sources	**Primary sources**: Primary data from field works conducted by Çınar Laboratories since March 2022.
	Secondary sources: Secondary data from scientific papers, grey literature and government agency reports & databases.

Methodological approach

Baseline hydrological characterizations and surface water quality assessments were made according to the primary and secondary data sources. Primary data were sourced from the fieldworks involving a hydrocensus survey in the AoI which aims at determining the groundwater and surface water resources and stakeholder water users in and around the AoI. Based on this hydrocensus survey a comprehensive water sampling study was conducted in the AoI.

All fieldworks including hydrocensus and water sampling study were conducted according to local and international standards and guidelines where applicable.

The following regulations and guidelines were taken into consideration during the baseline hydrological characterization and surface water quality assessment studies:

- Surface Water Quality Management Regulation (SWQMR)
- Irrigation Water Classification by US Salinity Laboratory
- IFC General EHS Guideline for Effluent Discharge Limits
- During the baseline studies, the reports which were used as secondary data sources are listed below:
- Western Black Sea Basin Flood Management Plan, Ministry of Agriculture and Forestry General Directorate of Water Management, Akar-Su Mühendislik Müşavirlik Ltd. Şti., July 2019.
- Preparation of Basin Protection Action Plans Project West Black Sea Basin, TUBITAK - The Scientific and Technological Research Council of Türkiye, Marmara Research Center, November 2013.
- Sakarya Gas Field-Onshore Production Facility Flood Risk Analysis, SUİŞ Proje Engineering and Consulting Co. Ltd., January 2022.
- Renewable Energy List, EPDK - Energy Market Regulatory Authority of Türkiye, 2022.
- Filyos River (ID:1335) – Derecikivan, Stream Gauge Data, Elektrik İşleri Etüt İdaresi, 2009.
- Phase 1 Environmental and Social Impact Assessment (Phase 1 ESIA),

The regional hydrology and the baseline of the TP-OTC Sakarya Gas Field Project are discussed herein.

Regional context (RSA)

Hydrology and Surface Water Quality

The Project Site is located in the Filyos Basin, which is the sub-basin of the Western Black Sea Basin. The length of the Filyos River, located in the Filyos Basin, is 360 km. A map showing the Filyos River and other surrounding streams in the Western Black Sea Basin and their classifications according to Surface Water Quality Management Regulation is presented in Figure 6-22.

The Filyos River originates from the Benli Mountain, in the north of Seben Town, under the name Ulusu. The stream descends to the Gerede Plateau and merges with the Gerede Stream. The stream flows in northeast direction. It turns northwest by merging with many streams on the foothills of the Ilgaz Mountains. The Araç Stream and Soğanlı Stream merge in Karabük City Center and downstream takes the name Yenice Stream and, passing through Yenice, turns north and descends to the Çaycuma Plain. In this part, it is named Filyos River, which arises from Efteni Lake in the Bolu Mountains, joins with Devrek Stream and reaches the Black Sea in Hisarönü. Filyos River splits into many tributaries upstream. For this reason, it has been called by different

names in many regions. Some of its names are Yenice River, Köroğlu Stream, Ulusu, Gerede Stream, Melan Stream, Akçay, Soğanlı Stream etc.[2]

Water quality assessments between 2000 and 2011 were reported by TUBITAK for the more important streams in the Filyos sub-basin.[3] Evaluations were made in accordance with the Water Pollution Control Regulation and the Surface Water Quality Management Regulation. The evaluations in the sub-basin are summarized below.

Important parameters showing organic matter, nitrogen and phosphorus pollution were evaluated according to the aforementioned regulations. For what concerns COD (Chemical Oxygen Demand) and BOD (Biochemical Oxygen Demand), which are important parameters indicating organic pollution in the Western Black Sea Basin, streams are predominantly classified as Class I (very good) or II (good). However, while the COD parameter falls in Class III for the Gerede Stream in Bahçedere, the BOD parameter sometimes is Class III or IV (poor) for the streams Gerede, Büyüksu, Devrek Stream, Markusa Stream, Mudurnu, Ulusu and Zonguldak Acılık.

Although the water quality in the sub-basin is either in Class I or Class II in terms of important nitrogen parameters (NH_4-N and NO_3-N), NH_4-N parameter in the Gerede Stream and the Filyos River, and NO_3-N parameter in the Devrek Stream and in the Yenice Stream is in Class III and Class IV. On the other hand, as for NO_2-N streams mostly fall in Class III and Class IV throughout the sub-basin. Total Phosphorus parameter generally varies between Class II and Class III along the sub-basin.

According to group A parameters showing physical and inorganic chemical pollutants, it is observed that water quality is predominantly in Class III and Class IV. Dissolved oxygen was classified as Class III in the Devrek Stream, the Yenice Stream and the Filyos River. In the Gerede Stream, sodium, chloride, sulfate, total dissolved matter, and dissolved oxygen parameters were measured as Class III and Class IV, and water quality problems in terms of salinity and dissolved matter were determined in the Gerede Stream.

Group B (organic) parameters, which are related with organic matter pollution, are predominantly in Class I and Class II throughout the sub-basin. However, in terms of organic substances, the water quality decreases to class III in the Devrek Stream and to class IV in the Gerede Stream.

Group C, which shows inorganic pollution, is mostly between Class II and Class III throughout the sub-basin. It is calculated as Class IV only in the Gerede Stream due to chromium concentration. In the Filyos River, the Yenice Stream, the Ilgaz Stream and the Devrek Stream, it falls to Class III due to iron concentration.

When evaluated for the general conditions in the Surface Water Quality Management Regulation, the Gerede Stream was observed as Class III due to its color, and the other streams as Class II, for temperature, pH, conductivity and color parameters. The conductivity in the Gerede Stream is Class IV, while in the remaining streams it is predominantly Class II. The temperature parameter varies between Class III in the Filyos River and between Class I and Class II in other streams. In all streams in the Filyos sub-basin, the pH parameter is at Class I level.

In the Surface Water Quality Management Regulation, group A is defined as oxygenation parameters and includes dissolved oxygen, COD and BOD parameters. BOD parameter is Class IV in the Gerede Stream, Class III in the Devrek Stream and the Filyos River, and Class II in other streams. The COD parameter was observed

[2] Akar-Su Mühendislik Müşavirlik Ltd. Şti., (July 2019). Ministry of Agriculture and Forestry General Directorate of Water Management. Western Black Sea Basin Flood Management Plan, Ankara.

[3] TUBITAK - The Scientific and Technological Research Council of Türkiye. (November 2013). Marmara Research Center, Preparation of Basin Protection Action Plans Project West Black Sea Basin.

as Class I across the sub-basin. Alternatively, dissolved oxygen is Class IV in the Gerede Stream and Class II in the remaining streams.

In the Surface Water Quality Management Regulation, group B is defined as nutrient parameters and includes ammonium, nitrite, nitrate, total Kjeldahl nitrogen and total phosphorus parameters. NH_4-N parameter varies between Class IV in the Gerede Stream and between Class I and Class II in other streams. NO_3-N parameter is at Class I level throughout the sub-basin. Insufficient data are available for classification of total Kjeldahl nitrogen.

In the Surface Water Quality Management Regulation, group C parameters are defined as trace elements (metals) and include mercury, cadmium, lead, copper, nickel, and zinc parameters. In this parameter group, there is no measurement in most stations, and the cadmium parameter in the Filyos River and the Yenice Stream is at Class II level. Lead parameter is Class III in the Yenice Stream and Class II in the Filyos River. The copper parameter, on the other hand, varies between Class II and Class III over the Gerede Stream and is at Class II level in the Filyos River.

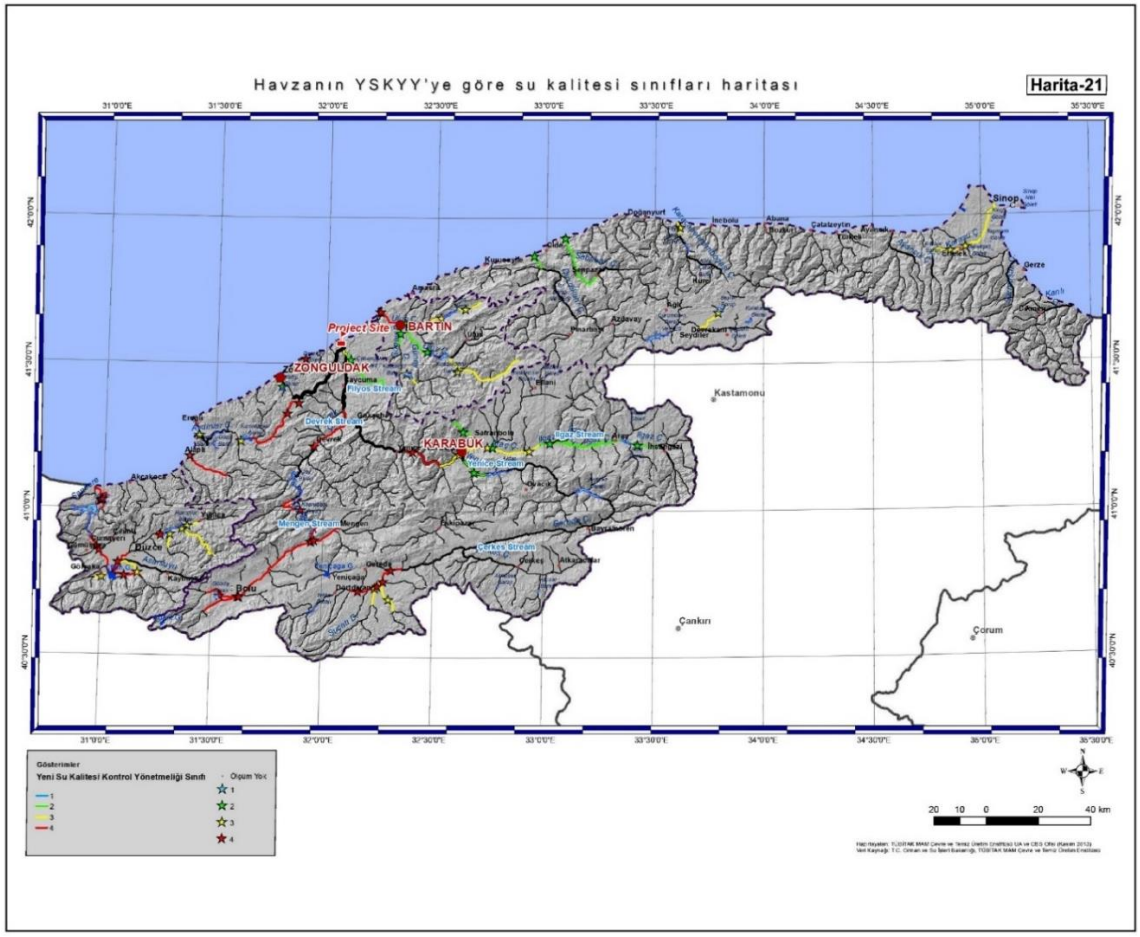


Figure 6-22: Streams in Western Black Sea Basin and their Classifications according to Surface Water Quality Management Regulation[4]

[4] TUBITAK - The Scientific and Technological Research Council of Türkiye. (November 2013). Marmara Research Centre, Preparation of Basin Protection Action Plans Project West Black Sea Basin.

There are not sufficient measurements for group D (bacteriological parameters) in both Water Pollution Control Regulation and the Surface Water Quality Management Regulation.

- **Surface Water Resources:** There is no hydroelectric power plant (HEPP) or dam located within the AoI. HEPPs or dams in the RSA are shown in and related information is given in Table 6-15 below. The Kışla Dam, the Kozcağız Dam and the Kirazlıköprü Dam do not affect the sub-basin where the Project is located. They are included because of their proximity to the Project Site. The other dams are located upstream of the Filyos River.

Table 6-15: Dams in the RSA

ID	Type	Status	Operation Start Year	Operation End Year
Çayaltı	HEPP	In Operation	2016	2026
Tefen	HEPP	In Operation	2011	-*
Pirinçlik	HEPP	In Operation	2014	2025
Eren	HEPP	In Operation	2014	2025
Kirazlıköprü	HEPP & Dam	In Operation	2020	2030
Araç	HEPP & Dam	In Operation	2021	2030
Köprübaşı	HEPP	In Operation	2012	2022
Yalnızca	HEPP	In Operation	2009	-*
Aktaş	HEPP	In Project Planning	-	-
Aldeğirmen	HEPP	In Project Planning	-	-
Kışla	Dam	In Operation	2018	-*
Kozcağız	Dam	In Project Planning	-	-
Akhasan	Irrigation Pond	In Operation	2016	-*
Hacılar	Dam	In Project Planning	-	-
Tekke	Dam	In Project Planning	-	-
Çay	Dam	In Project Planning	-	-
Andıraz	Dam	In Project Planning	-	-

* Operation end year information is not available

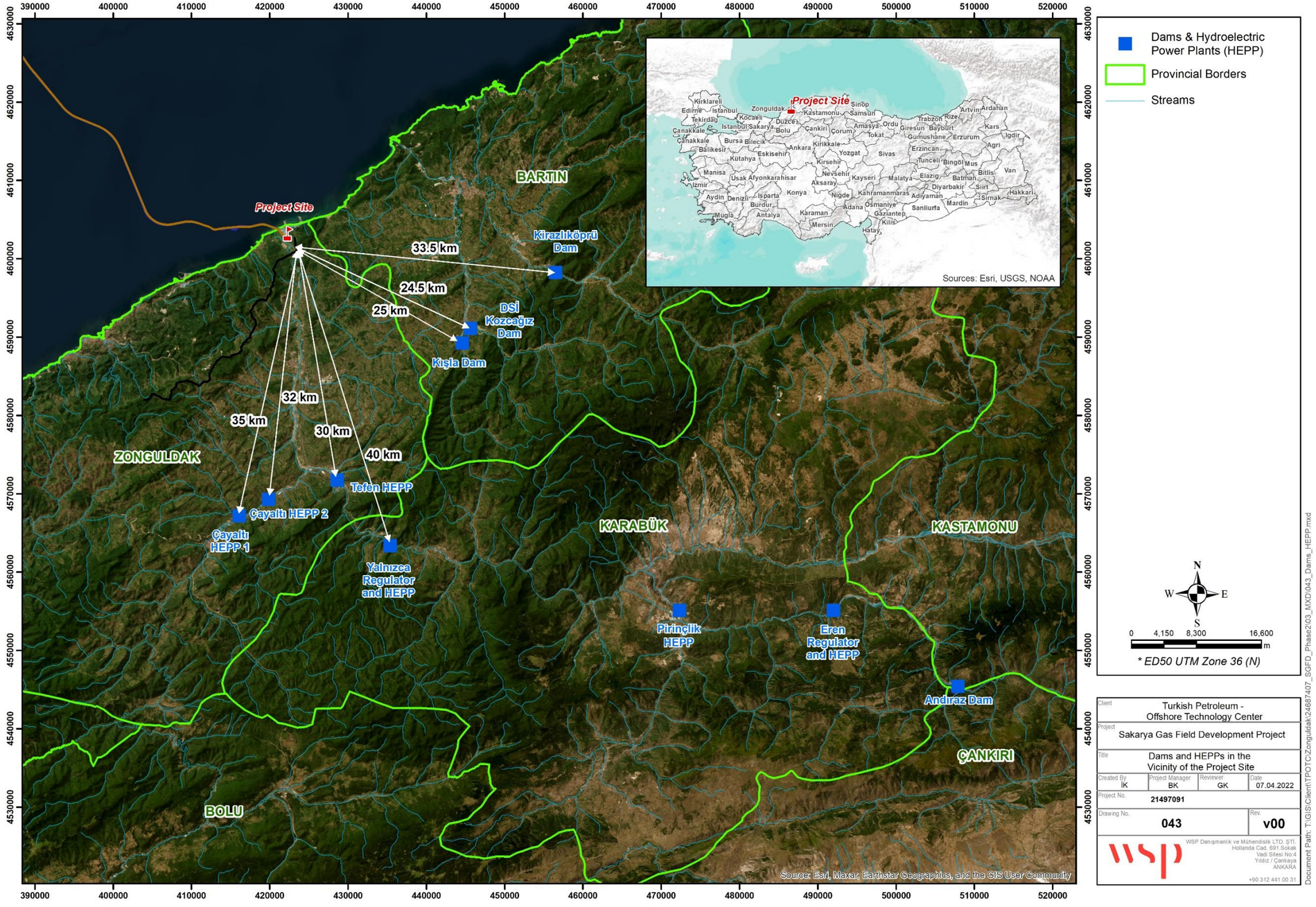
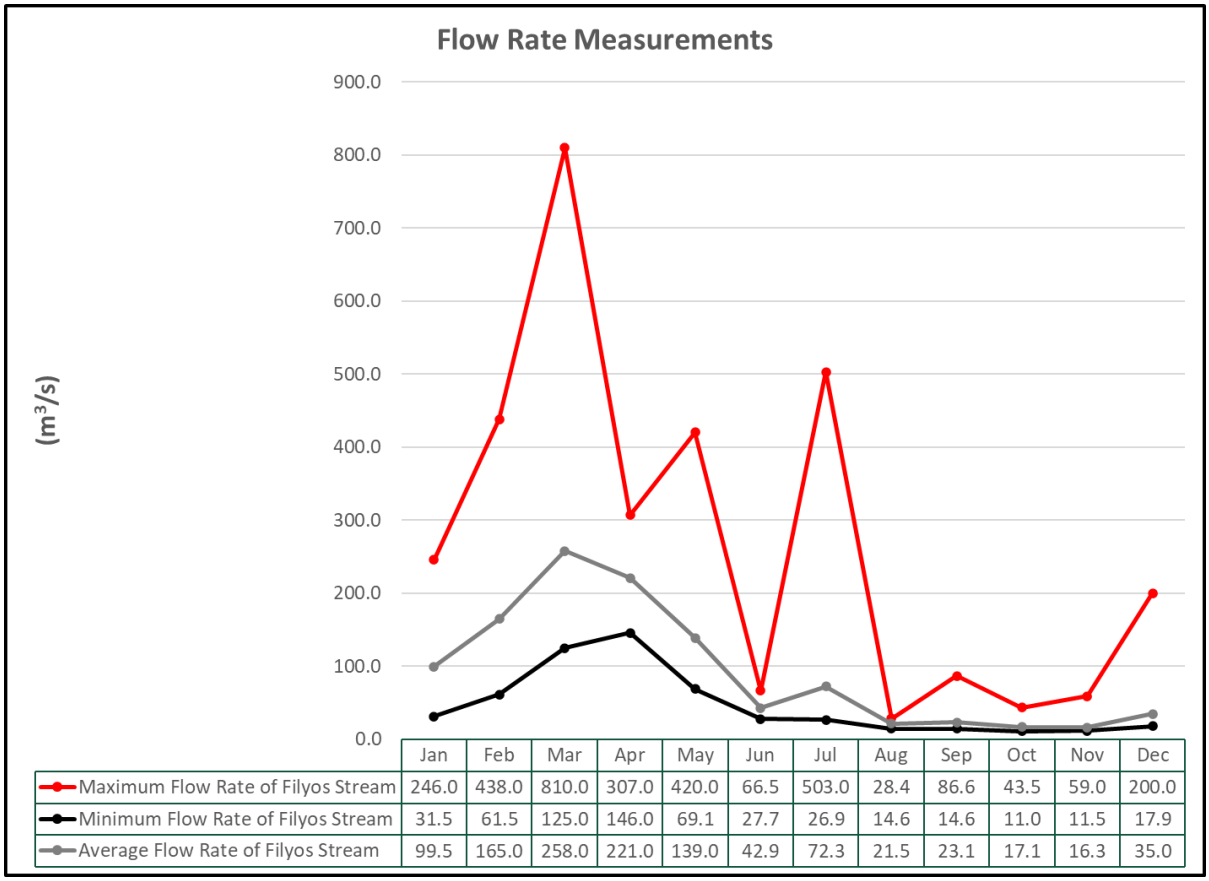


Figure 6-23: Location Map of the Nearby Dams and HEPPs

- ***Flow Rate Measurement:*** Continuous surface water flow measurements of the Filyos River were recorded at stream gauge ID 1335. Information about stream gauge is given in Table 6-16 below. The stream gauge was operated from 1963 to 2009[5]. A graph showing the monthly flow rate measurements from the stream gauge is presented in Figure 6-24.. The maximum flow rate was 810.0 m^3/s in March and the minimum flow rate was 16.3 m^3/s in November. A map showing the location of the stream gauge is presented in Figure 6-25.

Table 6-16: Stream Gauge Information

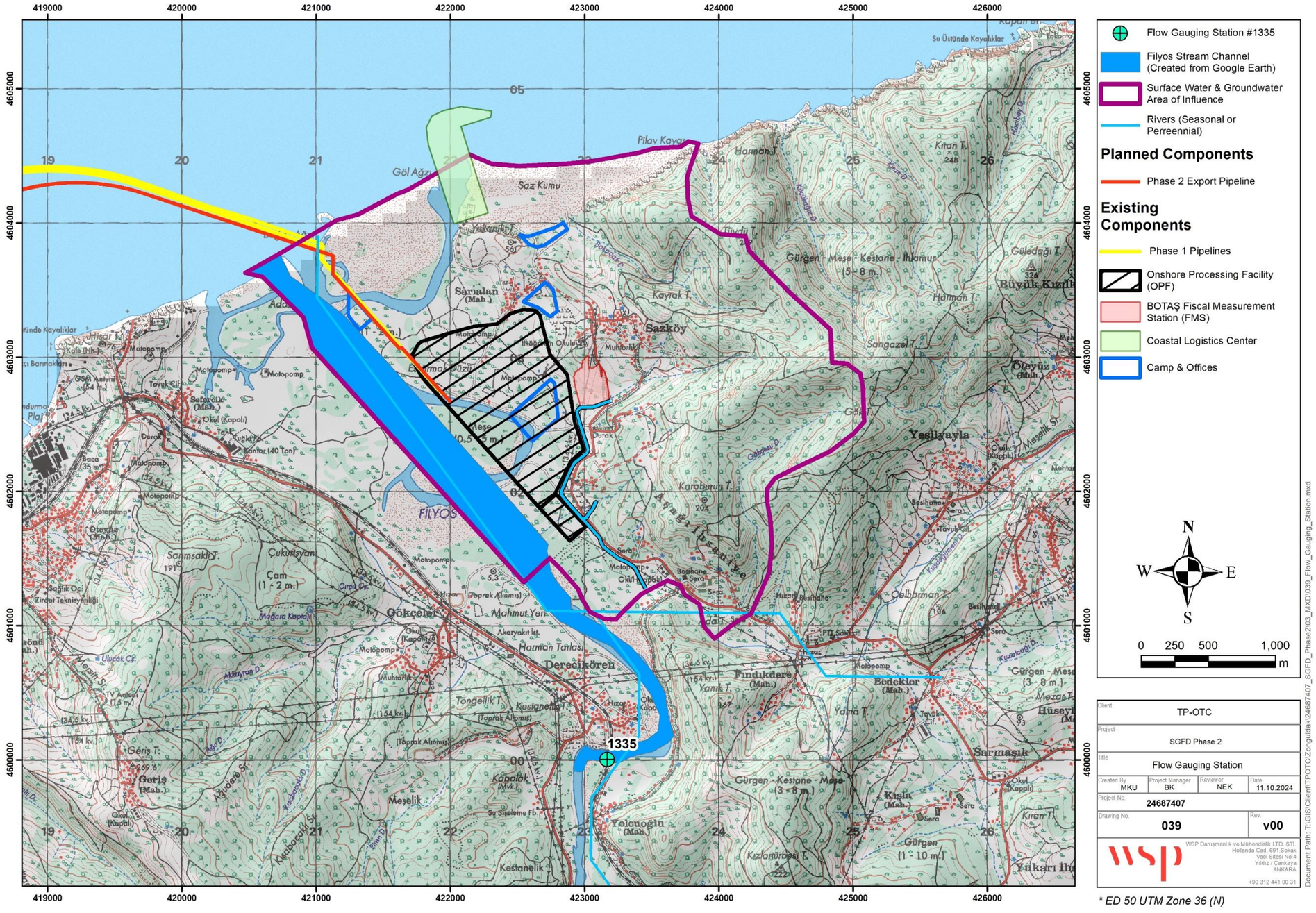
ID	UTM ED50 (m) Zone 36		Elevation	Stream Name	Catchment Area in km2	Description
	X	Y	(m)			
1335	423169.27	4600002.82	2.0	Filyos	13,300.4	Upstream of Project Site (South EIA)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Maximum Flow Rate of Filyos Stream	246.0	438.0	810.0	307.0	420.0	66.5	503.0	28.4	86.6	43.5	59.0	200.0
Minimum Flow Rate of Filyos Stream	31.5	61.5	125.0	146.0	69.1	27.7	26.9	14.6	14.6	11.0	11.5	17.9
Average Flow Rate of Filyos Stream	99.5	165.0	258.0	221.0	139.0	42.9	72.3	21.5	23.1	17.1	16.3	35.0

Figure 6-24: Graph showing the Flow Rate Measurements at the Stream Gauge on the Filyos River

[5] Elektrik İşleri Etüt İdaresi. (2009). Filyos Stream (ID:1335) – Derecikivan, Stream Gauge Data (1963 – 2009)



* *ED 50 UTM Zone 36 (N)*

Figure 6-25: Location of the Stream Gauge on the Filyos River

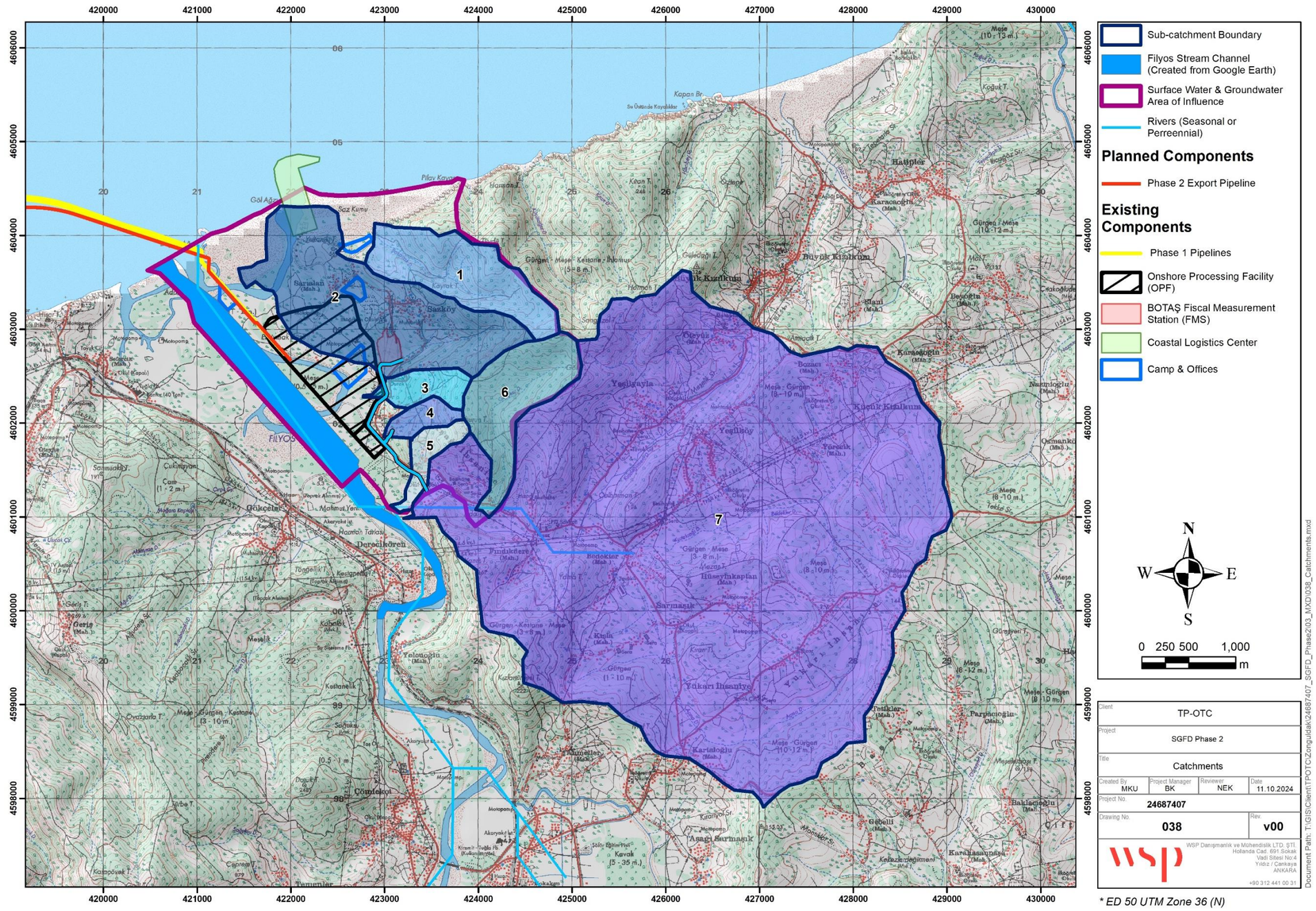
Local context (AoI)

Hydrology and Surface Water Quality

- ***Hydrologic Characteristics:*** The Project Site is located in the Filyos Sub-basin, which is one of the sub-basins of the Western Black Sea Basin. The Filyos sub-basin covers an area of about 13,300 km².
- ***Catchment Characteristics:***
  - The Filyos River flows into the Black Sea from the west of the Project Site. Other streams around the Project Site are mostly dry streams with seasonal flow. The AoI is divided into seven (7) micro-catchments according to the creeks in and around it. The sub-basins and their physical characteristics such as maximum elevation, minimum elevation, average elevation, and slope grades are presented in Table 6-17. The map of the micro-catchments is presented in Figure 6-26 .
  - The stream located in micro-catchment #1 flows into the Black Sea from the northeast. The streams in micro-catchments #2, #3, #4 and #5 flow into the Filyos River with the surface water diversion channel. The diversion starts from the south of the FMS, passes through the southeast of the Onshore Processing Facility (OPF) and directing to the southeast of the Transformer Station. It collects surface water from the upstream and diverts to the Kuşdeğirmeni Stream. The stream in micro-catchment #6 joins the Kuşdeğirmeni Stream from micro-catchment #7 and then flows into the Filyos River.
  - The highest and lowest elevation values in the micro-catchments were observed at 316.0 m in micro-catchment #7 and 0.0 m in micro-catchment #2, respectively. Elevation decreases from southeast to northwest.
  - The steepest slope values were observed in micro-catchment 1#, whereas the gentlest slope values were observed in micro-catchment #2 and #7.

Table 6-17: Stream Gauge Information

TMicro Catchment ID	Surface Area (km^2)	Elevation			Slope Degree				
		Minimum Elevation (m asl)	Maximum Elevation (m asl)	Mean Elevation (m asl)	0°–10° (%)	10°–20° (%)	20°–30° (%)	30°–40° (%)	>40° (%)
1	1.18	3.6	310.7	135.6	5.9	14.1	26.3	26.7	27.0
2	2.69	0.0	292.7	48.7	46.3	22.8	13.5	12.2	5.3
3	0.32	4.3	196.6	86.6	15.8	39.4	23.3	13.6	8.0
4	0.20	5.1	201.8	76.8	9.3	45.4	17.5	8.2	19.5
5	0.26	3.8	205.5	63.9	32.9	23.0	14.2	13.7	16.3
6	1.08	10.1	310.9	179.1	5.0	23.1	33.9	25.4	12.6
7	19.59	4.5	316.0	81.8	22.7	41.0	21.9	9.7	4.8



* *ED 50 UTM Zone 36 (N)*

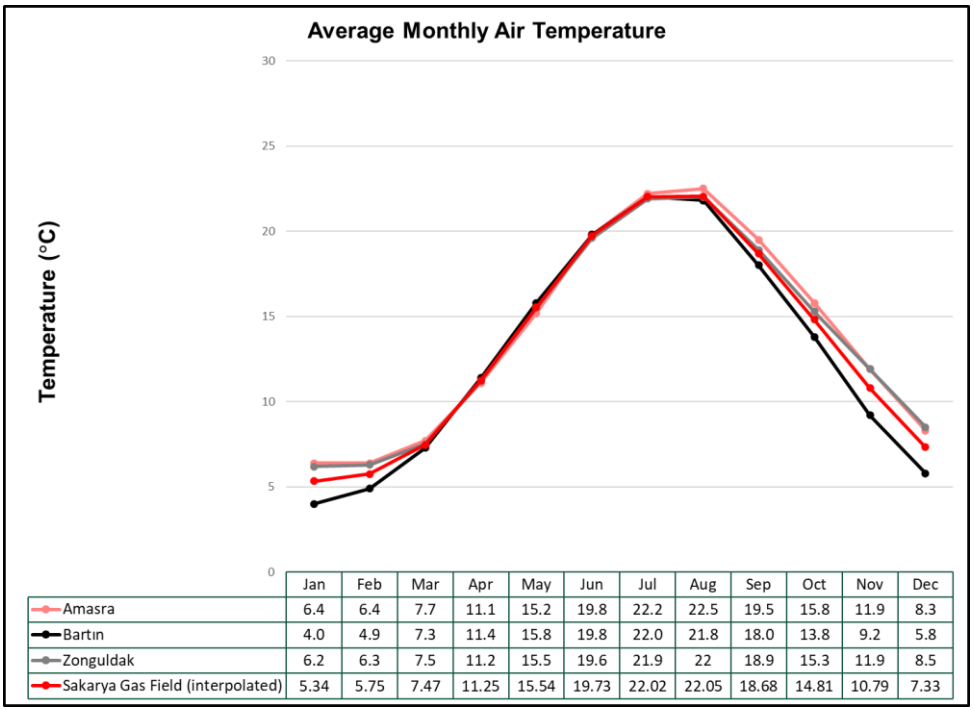
Figure 6-26: Map of the Micro-catchments

- ***Hydrometeorological Conditions:*** Meteorological data were obtained from the Amasra, Bartın and the Zonguldak Automatic Meteorological Observation Stations located around the Project Site. The recorded data is available for long periods at the Amasra Station between 1970 and 2021, at the Bartin Station between 1961 and 2021 and at the Zonguldak Station between 1939 and 2021. Stations details are provided in Table 6-18 below. Data from these stations were interpolated to obtain hydrometeorological data of the Sakarya Gas Field Project Site.

Table 6-18: Information about nearby Meteorological Stations

Station Number	Station Name	Latitude	Longitude	Elevation (m asl)	Data Interval
17602	Amasra	41.7526	32.3827	73.0	1970-2021
17020	Bartın	41.6248	32.3569	33.0	1961-2021
17022	Zonguldak	41.4492	31.7779	135.0	1939-2021

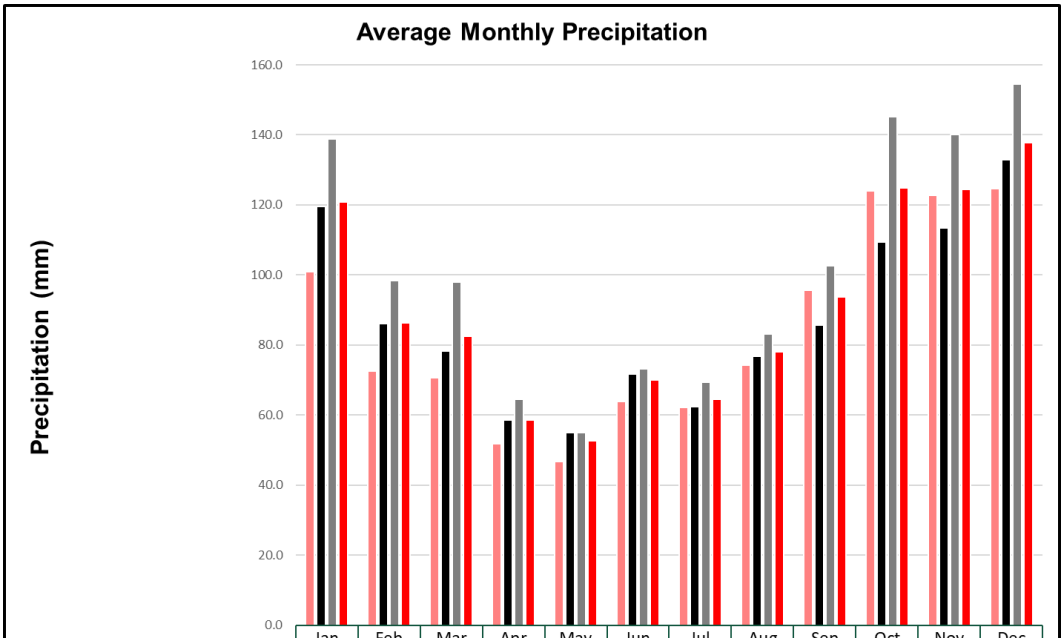
- *Air Temperature:* According to the Automatic Meteorological Observation Stations around the Project Site, the average monthly air temperature varies between 4.0 °C and 22.5 °C, and the annual average air temperature varies between 12.8 °C and 13.9 °C. The warmest months are between June and September, and the coldest months are between December and March. The data obtained from three (3) Meteorological Observation Stations was used to produce interpolated data of the Sakarya Gas Field Project. The average monthly air temperature graph for the Project Site and nearby districts are shown in Figure 6-27.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Amasra	6.4	6.4	7.7	11.1	15.2	19.8	22.2	22.5	19.5	15.8	11.9	8.3
Bartın	4.0	4.9	7.3	11.4	15.8	19.8	22.0	21.8	18.0	13.8	9.2	5.8
Zonguldak	6.2	6.3	7.5	11.2	15.5	19.6	21.9	22	18.9	15.3	11.9	8.5
Sakarya Gas Field (interpolated)	5.34	5.75	7.47	11.25	15.54	19.73	22.02	22.05	18.68	14.81	10.79	7.33

Figure 6-27: Average Monthly Air Temperature

- *Precipitation:* The average annual precipitation around the Project Site was measured between 1009.6 mm and 1222.7 mm. The wettest month is December with an average monthly precipitation between 124.7 mm and 154.6 mm, and the driest month is May with an average precipitation between 46.7 mm and 54.9 mm. The data obtained from three (3) Meteorological Observation Stations was used to produce interpolated data for the Sakarya Gas Field Project. The average monthly precipitation graph for the Project Site and nearby districts are shown in Figure 6-28.



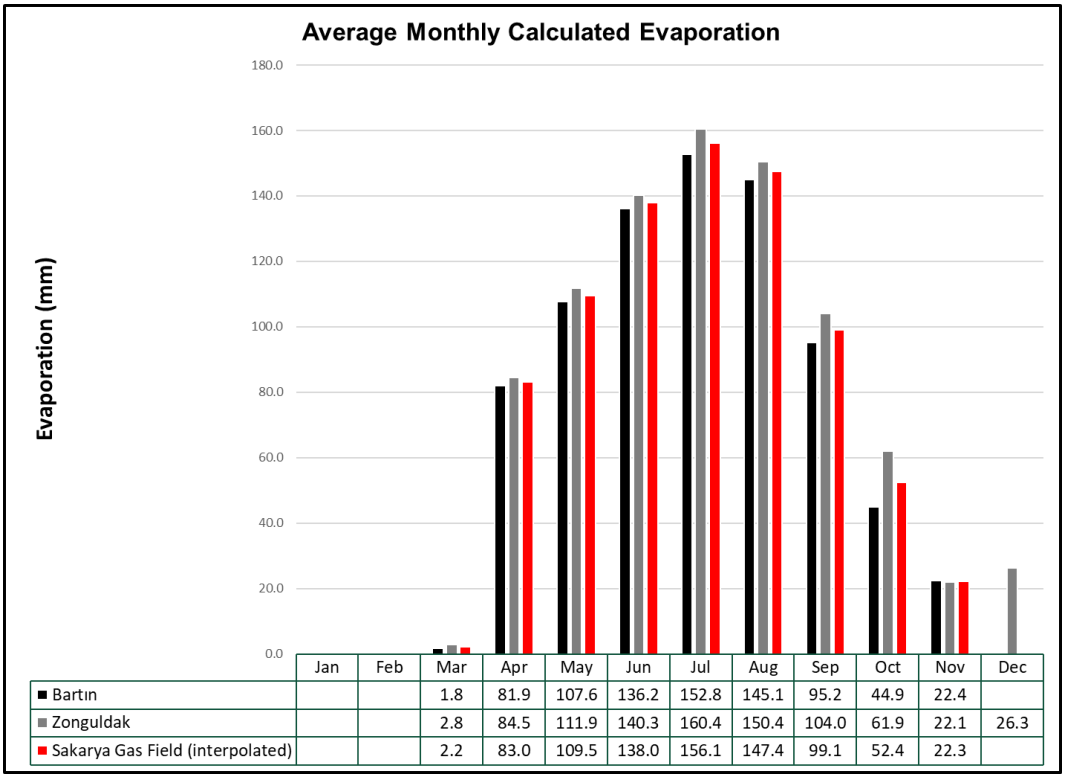
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Amasra	101.0	72.5	70.6	51.7	46.7	63.8	62.2	74.2	95.6	123.9	122.7	124.7
Bartın	119.5	86.0	78.2	58.6	54.9	71.7	62.3	76.7	85.6	109.3	113.4	132.9
Zonguldak	138.9	98.3	97.9	64.4	54.9	73.2	69.3	83.2	102.7	145.2	140.1	154.6
Sakarya Gas Field (interpolated)	120.9	86.4	82.6	58.7	52.7	70.1	64.5	78.1	93.8	124.8	124.5	137.8

Figure 6-28: Average Monthly Precipitation

- Evaporation: No evaporation data could be found for the Amasra station, while in the Bartın and the Zonguldak Stations January and February data were not recorded, like for December data in the Bartın station. The maximum evaporation amount was calculated between 152.8 mm and 160.4 mm in July, and the minimum evaporation amount was calculated between 1.8 mm and 2.8 mm in March. The available data from two (2) Meteorological Observation Stations was used to derive interpolated data of the Sakarya Gas Field Project. The graph of the average monthly evaporation for the Project Site and nearby districts are shown in Figure 6-29.

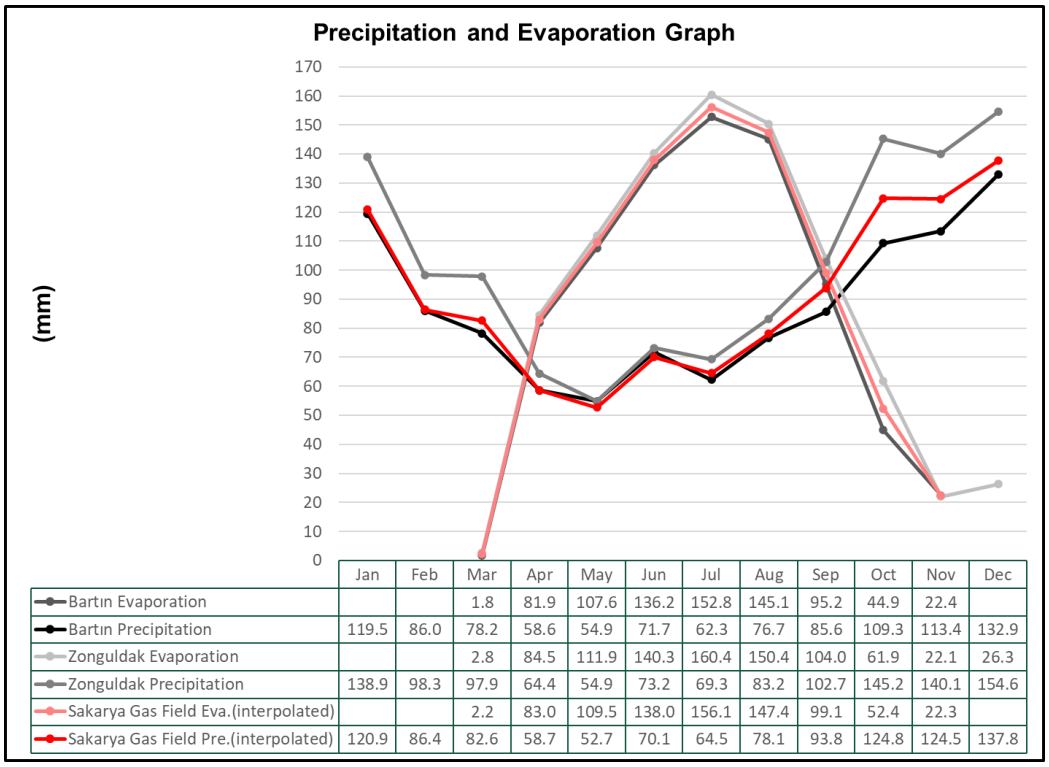
- Water Budget: Monthly average precipitation and monthly average evaporation values were assessed together to determine the water surplus and deficit budget for the Project Site. According to this evaluation, the water budget has positive water amount (surplus) in three (3) months, March, October, and November, in a year. In six (6) months, April, May, June, July, August, and September, the water intake in the around of the Project Site has negative values (deficit). Three (3) months, January, February and December, could not be evaluated since the evaporation data is missing for these months. Also, the Amasra Station is not included in the graphs because evaporation data is completely missing. The monthly average precipitation and monthly average evaporation data derived for the

Project Site by the interpolation method are shown in Figure 6-30 and the water surplus & deficit graph is shown in Figure 6-31.



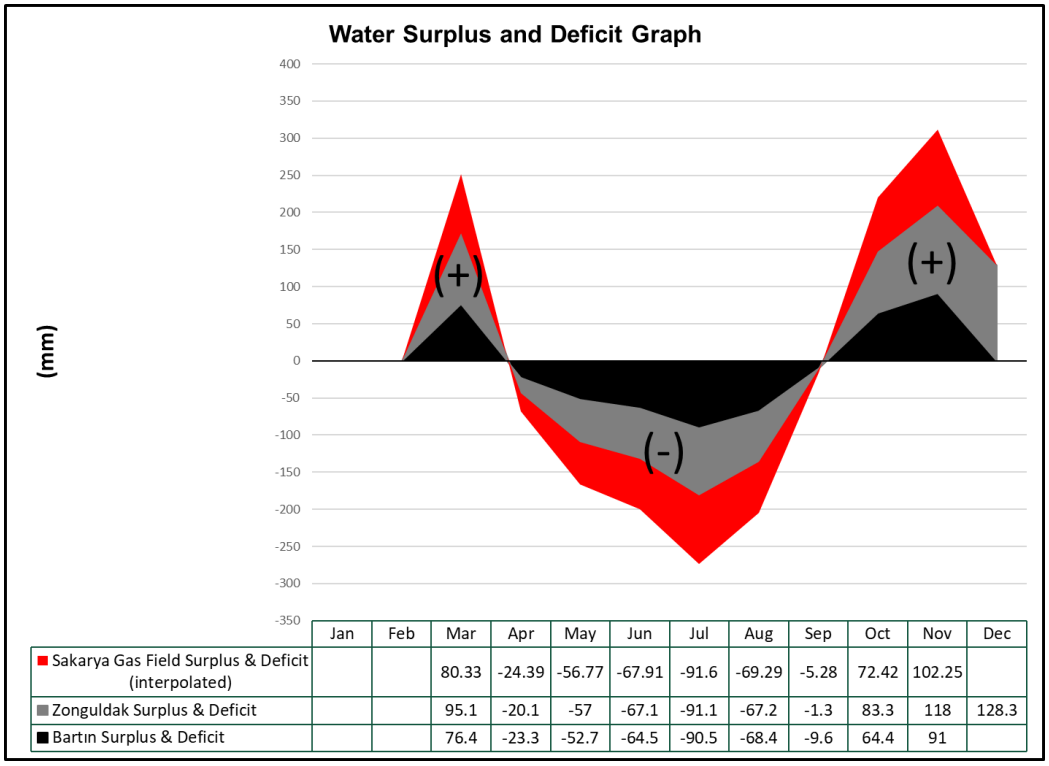
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Bartın			1.8	81.9	107.6	136.2	152.8	145.1	95.2	44.9	22.4	
Zonguldak			2.8	84.5	111.9	140.3	160.4	150.4	104.0	61.9	22.1	26.3
Sakarya Gas Field (interpolated)			2.2	83.0	109.5	138.0	156.1	147.4	99.1	52.4	22.3	

Figure 6-29: Average Monthly Calculated Evaporation



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Bartın Evaporation			1.8	81.9	107.6	136.2	152.8	145.1	95.2	44.9	22.4	
Bartın Precipitation	119.5	86.0	78.2	58.6	54.9	71.7	62.3	76.7	85.6	109.3	113.4	132.9
Zonguldak Evaporation			2.8	84.5	111.9	140.3	160.4	150.4	104.0	61.9	22.1	26.3
Zonguldak Precipitation	138.9	98.3	97.9	64.4	54.9	73.2	69.3	83.2	102.7	145.2	140.1	154.6
Sakarya Gas Field Eva.(interpolated)			2.2	83.0	109.5	138.0	156.1	147.4	99.1	52.4	22.3	
Sakarya Gas Field Pre.(interpolated)	120.9	86.4	82.6	58.7	52.7	70.1	64.5	78.1	93.8	124.8	124.5	137.8

Figure 6-30: Precipitation and Evaporation Values



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sakarya Gas Field Surplus & Deficit (interpolated)			80.33	-24.39	-56.77	-67.91	-91.6	-69.29	-5.28	72.42	102.25	
Zonguldak Surplus & Deficit			95.1	-20.1	-57	-67.1	-91.1	-67.2	-1.3	83.3	118	128.3
Bartın Surplus & Deficit			76.4	-23.3	-52.7	-64.5	-90.5	-68.4	-9.6	64.4	91	

Figure 6-31: Water Surplus & Deficit Graph

Surface Water Quality Sampling and Monitoring

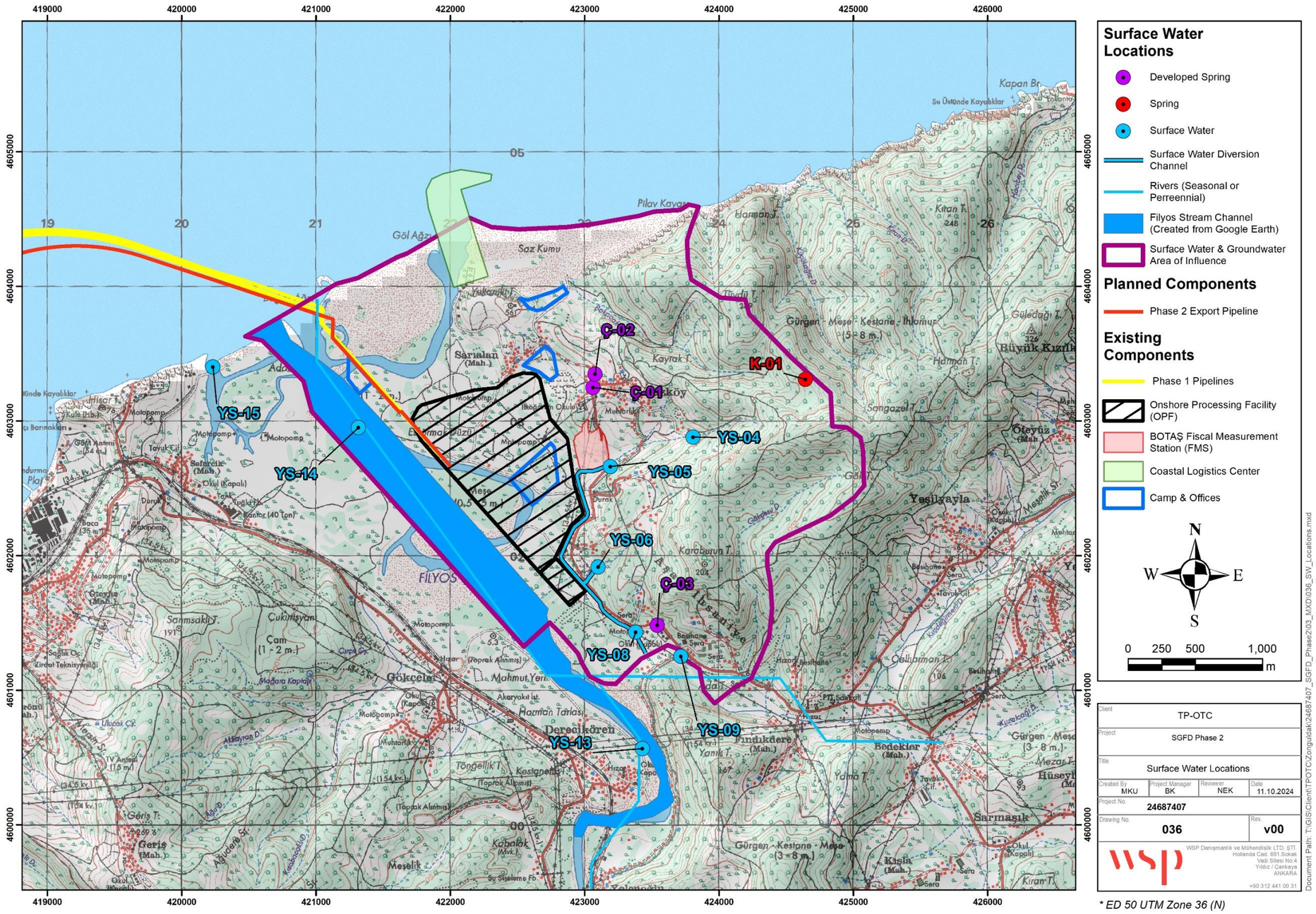
Therefore, surface water and contact water monitoring activities have been conducted at YS-04, YS-05, YS-06, YS-08, YS-09, YS-13, YS-14 and YS-15, since March 2022. The monitoring process and the chemical analysis results collected from these locations are further explained in relevant sub-sections of the present report.

The information regarding the ESIA sampling locations is reported in Table 6-19, and the map showing the sampling locations of 2022 sampling program is presented in Figure 6-32.

Table 6-19: Surface Water Sampling and Monitoring Locations

Type	ID	Coordinates*		Location
		X (Easting)	Y (Northing)	
Surface Water	YS-04	32.0843	41.5721	Upstream of the stream located south of the Sazköy village.
	YS-05	32.0782	41.5704	Downstream of the stream located south of the Sazköy village. Water is diverted into a drainage channel after this point.
	YS-06	32.0775	41.5651	Downstream of the stream located at the eastern part of transformer station. Water is diverted into a drainage channel after this point.
	YS-08	32.0807	41.5591	Downstream of surface water divergent channel before it mixes with the Filyos River.
	YS-09	32.0848	41.5579	Downstream of the Kuşdeğirmeni stream.
	YS-13	32.0814	41.5515	Upstream of the Filyos River.
	YS-14	32.0557	41.5727	Downstream of the Filyos River.
	YS-15	32.0428	41.5766	

* WGS 1984



** ED 50 UTM Zone 36 (N)*

Figure 6-32: Surface Water Sampling and Monitoring Locations

In-Situ Parameters

The in-situ (physicochemical) parameters (Temperature (T), pH, Electrical Conductivity (EC_{25}), Dissolved Oxygen (DO), flow rate) parameters have been monitored every month since March 2022. Average temperature of the surface waters is 10.57 °C. While YS-06 and YS-08 have the lowest long-term average (4.9 °C) The mean pH value is 7.67. While YS-14 has the highest mean at 8.02, YS-15 has the lowest mean at 7.01. The minimum pH value was measured at YS-09 on June 2022 with 6.01, and the maximum pH value was recorded at point YS-08 with 8.97. The average of all EC_{25} measurements from surface water monitoring points is 471.62 µS/cm. The highest average according to more than one measurement is at point YS-15 (661.00 µS/cm), while YS-06 has the lowest average (312.69 µS/cm). The average dissolved oxygen concentration is 8.43 mg O_2/L. While the lowest average dissolved oxygen is at YS-15 with 7.11 mg O_2/L, the maximum average dissolved oxygen concentration was at point YS-06 at 8.85 mg O_2/L. The surface water monitoring point with the highest average flow rate is YS-09 with the rate of 0.142 m^3/sec. The average flow rate of other points are between 0.0040 and 0.0072 m^3/sec.

Table 6-20: Long-term Averages of In-Situ Parameters of Surface Waters

Row Labels	Temperature, °C	pH	Conductivity @ 25°C, µS/cm	Dissolved Oxygen, mg/L	Flow Rate, m^3/sec
YS-04	13.7	7.57	385.33	8.54	0.00414
YS-05	6.8	7.74	457.48	8.72	0.00714
YS-06	4.9	7.77	312.69	8.85	0.00550
YS-08	4.9	7.76	503.22	8.65	0.00514
YS-09	13.9	7.62	502.55	8.41	0.14222
YS-13	15.1	7.89	467.67	8.58	-
YS-14	14.7	8.02	483.00	8.59	-
YS-15		7.01	661.00	7.11	
AVERAGE	**10.57**	**7.67**	**471.62**	**8.43**	**0.02**
MIN	**4.90**	**7.01**	**312.69**	**7.11**	**0.00**
MAX	**15.10**	**8.02**	**661.00**	**8.85**	**0.14**

Baseline Surface Water Chemistry

To understand the water-rock relationship and basic characteristics of waters in the basin, hydrochemical analysis were done for both surface waters and groundwater. In hydrochemistry, several different graphical approaches can depict the abundance or relative abundance of ions in individual water samples to determine the sources of water. The most common diagram is the Piper diagram[6], which includes three (3) separate diagrams. The relative abundance of cations with the % meq/L of $Na^+ + K^+$, Ca^{+2} and Mg^{+2} assumed to equal %100 is first plotted on the cation triangle. Similarly, the anion triangle displays the relative abundance of HCO_3^-

[6] Piper, A. M., 1944. A graphic procedure in the geochemical interpretation of water analyses. American Geophysical Union Transactions, 25: 914-928.

+ CO_3^{2-}, $Cl^-$and SO_4^{2-}. Straight lines projected from the two triangles into the quadrilateral filed define a point on the third field (Figure 6-33). With the Piper diagram, samples can be classified according to facies[7].

In order to understand the characteristics of groundwater and surface waters, all groundwater and surface water samples, where major cations (Calcium – Ca^{2+}, Magnesium – Mg^{2+}, Sodium – Na^+ and Potassium – K^+) and major anions (Carbonate – CO_3^{2-}, Bicarbonate – HCO_3^-, Sulphate – SO_4^{2-}.and Chloride – Cl^-) were measured, were plotted on Piper and Schoeller diagrams.

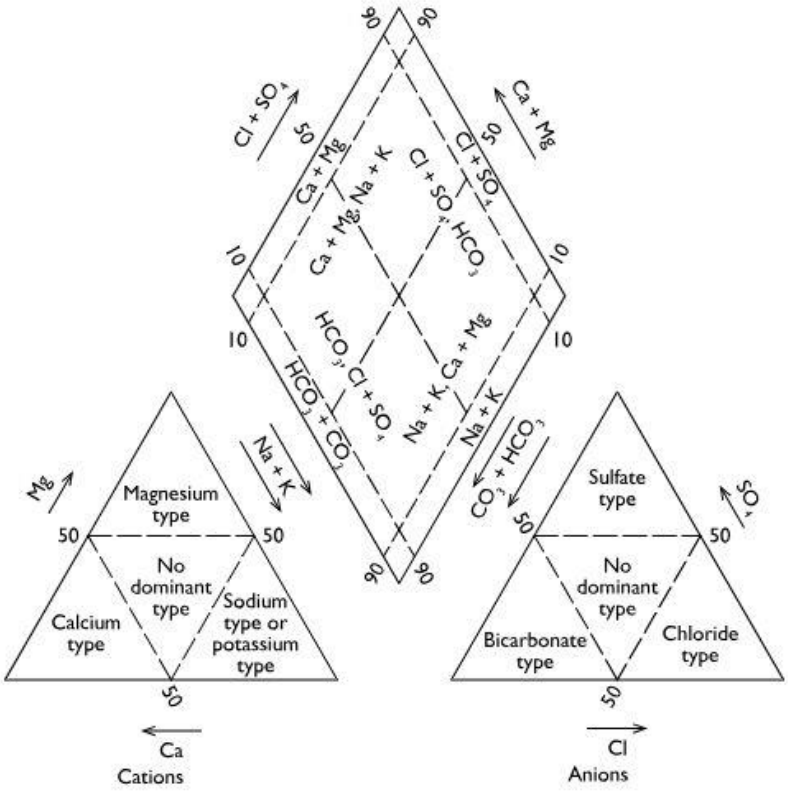


Figure 6-33: Piper Diagram[8]

Before plotting these diagrams, the quality control for the testing process were made through the calculation of the charge balances.

An indication of the accuracy of water analysis data can be obtained using the charge-balance equation. For example, if a water sample is analysed for the major constituents, and if the concentration values are substituted into as

$$(Na^+) + 2(Mg^{2+}) + 2(Ca^{2+}) = (Cl^-) + (HCO_3^-) + 2(SO_4^{2-})$$

the quantities obtained on the left- and right-hand sides of the equation should be approximately equal. Silicon is not included in this relation because it occurs in a neutral rather than in a charged form. If significant deviation from equality occurs, there must be analytical errors in the concentration determinations or ionic species at

[7] Domenico, P. A., & Schwartz, F. W. (1997). Physical and Chemical Hydrogeology - 2nd ed. John Wiley & Sons.

[8] Domenico, P.A. and Schwartz, F.W. (1998) Physical and Chemical Hydrogeology. 2nd Edition, John Wiley & Sons Inc., New York.

significant concentration levels that were not included in the analysis. It is widespread practice to express the deviation from equality in the form:

$$E\ (\%) = \frac{\sum zm_c - \sum zm_a}{\sum zm_c + \sum zm_a} \times 100$$

where E is the charge-balance error expressed in percent, z is the ionic valence, m_c is the molality of cation species, and m_a is the molality of anion species[9]. The charge-balance error should be less than ± 5% for good measurement. But for surface water, up to ± 10% of charge-balance error (CBE) is acceptable[10, 11, 12]. Therefore, the CBE criteria was assumed as ± 10% in this study.

Since calculated CBEs were below the 10% limit at all surface water monitoring points where all major ions were analyzed, all samples were considered for the hydrochemical analysis. According to the Piper plot (Figure 6-34), all samples except for YS-06-March 2022, YS-08-March 2022, YS-09-March 2022 and YS-04-June 2022, which were Ca-Mixed(Cl-HCO_3), Ca-Mixed(CO_3-HCO_3), Ca-Mixed(HCO_3-SO_4) and Mixed(Ca-Na)-HCO_3 were Ca-HCO_3 waters (Table 6-21).

[9] Freeze and Cherry (1979), Groundwater

[10] Hem, J.D. (1985) Study and Interpretation of the Chemical Characteristics of Natural Water. 3rd Edition, US Geological Survey Water-Supply Paper 2254, University of Virginia, Charlottesville, 263 p.

[11] Hounslow, A.W. (1995) Water Quality Data: Analysis and Interpretation. CRC Press LLC, Lewis Publishers, Boca Raton

[12] Katz, Brian & Collins, Jerilyn. Evaluation of Chemical Data from Selected Sites in the Surface-Water Ambient Monitoring Program (SWAMP) in Florida. 60.

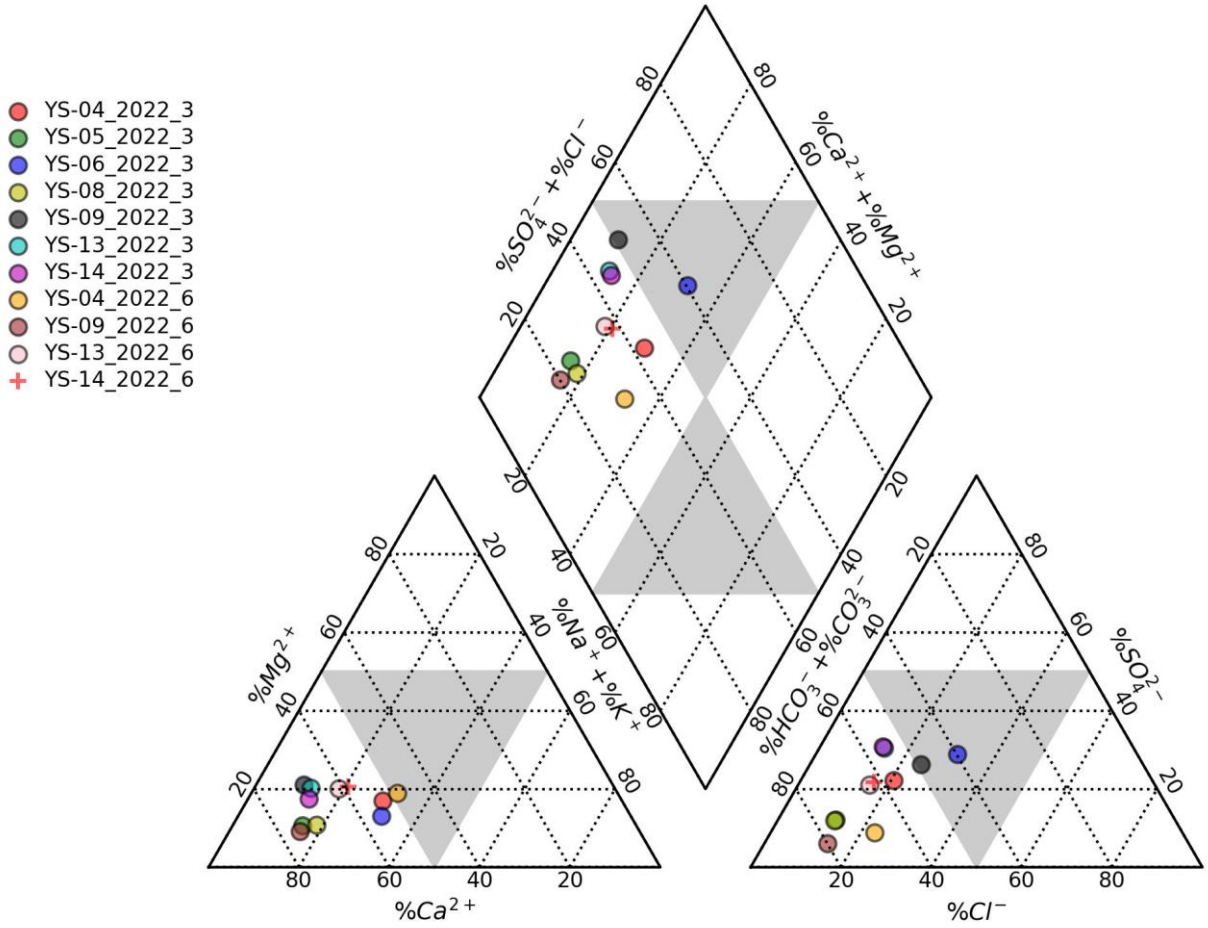


Figure 6-34: Piper Diagram of Surface Water Samples

Table 6-21: Major Ion Concentrations and Water Facies of Surface Waters

Sampling Location	Sampling Date	EC_{25}	Ca^{2+}			Mg^{2+}			Na^{+}			K^{+}			∑Cations	HCO_3^{-}			CO_3^{2-}			Cl^{-}			SO_4^{2-}			∑Anions	CBE %	Water Facies
		µS/cm	mg/L	meq/L	%	mg/L	meq/L	%	mg/L	meq/L	%	mg/L	meq/L	%	meq/L	mg/L	meq/L	%	mg/L	meq/L	%	mg/L	meq/L	%	mg/L	meq/L	%	meq/L		
YS-04	2022/03	178.2	21.96	1.10	52.97	4.26	0.35	16.92	13.82	0.60	29.05	0.85	1.06	0.02	2.07	65.40	1.07	57.27	0.00	0.00	0.00	13.70	0.39	20.62	19.90	0.41	22.12	1.87	5.08	Ca-HCO3
YS-05	2022/03	396	66.17	3.30	73.95	5.76	0.47	10.62	14.90	0.65	14.51	1.59	0.92	0.04	4.46	192.60	3.16	75.16	0.00	0.00	0.00	18.90	0.53	12.69	24.50	0.51	12.15	4.20	3.00	Ca-HCO3
YS-06	2022/03	132.4	16.29	0.81	55.31	2.34	0.19	13.06	9.44	0.41	27.89	2.15	3.74	0.06	1.47	35.80	0.59	39.74	0.00	0.00	0.00	16.40	0.46	31.35	20.50	0.43	28.91	1.48	-0.34	Ca-Mixed(Cl-HCO3)
YS-08	2022/03	315	52.18	2.60	70.74	4.86	0.40	10.87	14.58	0.63	17.22	1.68	1.17	0.04	3.68	114.20	1.87	45.00	38.00	1.27	30.43	18.50	0.52	12.55	24.00	0.50	12.02	4.16	-6.12	Ca-Mixed(CO3-HCO3)
YS-09	2022/03	381	70.49	3.52	68.39	13.18	1.08	21.07	11.29	0.49	9.55	1.99	0.99	0.05	5.14	175.40	2.88	49.17	0.00	0.00	0.00	50.80	1.43	24.51	73.90	1.54	26.32	5.85	-6.46	Ca-Mixed(HCO3-SO4)
YS-13	2022/03	434	71.13	3.55	67.32	12.94	1.07	20.20	13.71	0.60	11.30	2.44	1.18	0.06	5.27	194.60	3.19	51.31	7.20	0.24	3.86	31.50	0.89	14.30	91.10	1.90	30.52	6.22	-8.27	Ca-HCO3
YS-14	2022/03	434	68.68	3.43	69.02	10.58	0.87	17.52	13.94	0.61	12.21	2.40	1.25	0.06	4.96	185.60	3.04	50.90	8.00	0.27	4.47	29.20	0.82	13.79	88.50	1.84	30.84	5.98	-9.32	Ca-HCO3
YS-04	2022/06	475	51.47	2.57	48.76	12.16	1.00	19.01	37.89	1.65	31.29	1.95	0.95	0.05	5.27	226.00	3.70	68.19	0.00	0.00	0.00	44.20	1.25	22.96	23.10	0.48	8.85	5.43	-1.50	Mixed(Ca-Na)-HCO3
YS-09	2022/06	552	93.83	4.68	75.20	7.01	0.58	9.27	20.17	0.88	14.09	3.53	1.45	0.09	6.23	296.80	4.86	79.89	0.00	0.00	0.00	30.10	0.85	13.95	18.00	0.38	6.16	6.09	1.14	Ca-HCO3
YS-13	2022/06	482	69.93	3.49	61.18	13.96	1.15	20.15	22.10	0.96	16.85	4.06	1.82	0.10	5.70	207.00	3.39	63.18	0.00	0.00	0.00	30.10	0.85	15.81	54.20	1.13	21.01	5.37	2.98	Ca-HCO3
YS-14	2022/06	493	67.14	3.35	58.77	14.28	1.18	20.61	24.52	1.07	18.71	4.25	1.91	0.11	5.70	208.40	3.42	61.88	0.00	0.00	0.00	32.10	0.91	16.40	57.60	1.20	21.73	5.52	1.60	Ca-HCO3

Surface Water Quality

Surface water quality was evaluated based on measured parameters that are listed in the Table 2 of Appendix 5 of the "Surface Water Quality Management Regulation (SWQMR)". This table also allows for the classification of water quality.

According to SWQMR Article-1 (Amended: Official Gazette No. 29327 – 15.04.2015), the purpose of the regulation is to determine the biological, chemical, physicochemical and hydro-morphological qualities of surface water bodies and coastal - transitional waters; to provide classification thereof; to monitor the water quality and quantity thereof; to identify potential uses for such waters; to protect such waters; and to determine the measures to be adopted in order to achieve good water status. In this context, water bodies are classified based on the criteria presented in Annex-5, Table-2 of the revised regulation.

The parameters and the limit values are presented in Table 6-22.

Water Quality Classes: The intended use for waters according to quality classes:

Class I: High-quality water (Very Good);

- High potential drinking water supply,
- Suitable for recreational purposes (including body contact, such as swimming),
- Suitable for trout farming, and
- Suitable for animal breeding and farming needs,

Class II: Slightly polluted water (Good);

- Potential drinking water supply,
- Suitable for recreational purposes,
- Suitable for fish farming other than trout,
- Irrigation water, provided that the water quality parameters comply with the criteria set forth in the legislation in force.

Class III: Polluted water (Medium);

- Can be used as water and industrial water for the production of aquaculture products after being subjected to suitable treatment, excluding facilities that require qualified water, such as food and textiles.

According to this, except YS-15, all surface waters were classified as either Class-II (good) or Class-III (medium,Figure 6-35. On the other hand, YS-15 was classified as Class-I (very good) water eleven (11) times and Class-III water just once due to the dissolved oxygen concentration (7.11 mg/L) measured in June 2022. Parameters most frequently exceeding the Class-III limit is Biological Oxygen Demand (BOD) with 34 times (Figure 6-36, Table 6-23).

Table 6-22: Quality Criteria for the Surface Water Sources According to SWQMR Annex-5 Table-2 in terms of General Chemical and Physicochemical Parameter Classes

Parameters	Unit	Water Quality Classes		
		I (very good)	II (good)	III (medium)
pH	-	6.0-9.0	6.0-9.0	6.0-9.0
Colour	(m^{-1})	RES 436 nm: ≤ 1.5	RES 436 nm: 3.0	RES 436 nm: > 4.3
		RES 525 nm: ≤ 1.2	RES 525 nm: 2.4	RES 525 nm: > 3.7
		RES 620 nm: ≤ 0.8	RES 620 nm: 1.7	RES 620 nm: 2.5
Electrical Conductivity at 20°C	µS/cm	< 400	1000	> 1000
Oil and Grease	mg/L	< 0.2	0.3	> 0.3
Dissolved Oxygen	mg/L	> 8	6	< 6
Chemical Oxygen Demand (COD)	mg/L	< 25	50	> 50
Biochemical Oxygen Demand (BOD)	mg/L	< 4	8	> 8
Ammonium as N (NH_4^+-N)	mg/L	< 0.2	1	> 1
Nitrate as N (NO_3^--N)	mg/L	< 3	10	> 10
Total Kjeldahl as N	mg/L	< 0.5	1.5	> 1.5
Total Nitrogen as N	mg/L	<3.5	11.5	> 11.5
Orthophosphate Phosphorus (o-PO_4-P)	mg/L	< 0.05	0.16	> 0.16
Total Phosphorus (P)	mg/L	< 0.08	0.2	> 0.2
Fluoride (F)	µg/L	≤ 1000	1500	> 1500
Manganese (Mn)	µg/L	≤ 100	500	> 500
Selenium (Se)	µg/L	≤ 10	15	> 15
Sulphide	µg/L	≤ 2	5	> 5

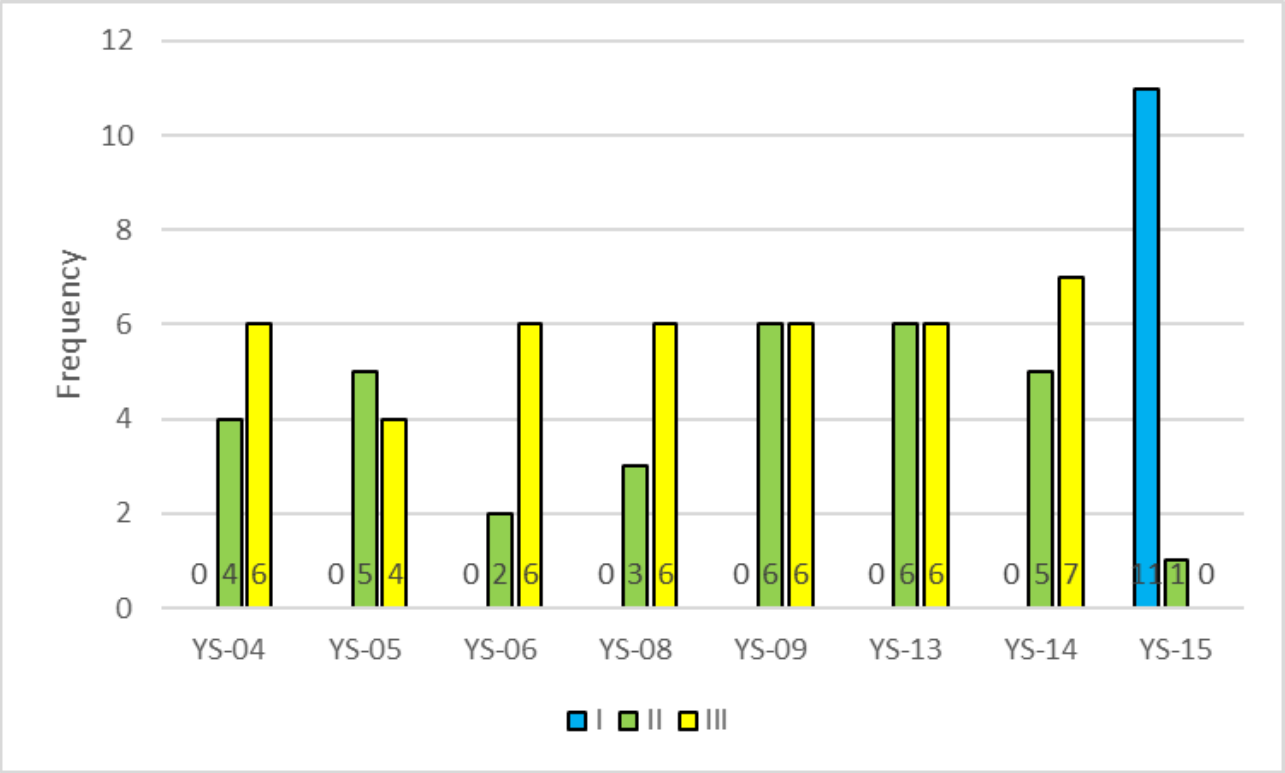


Figure 6-35: Frequency Distribution of the Water Quality Classes of Surface Waters

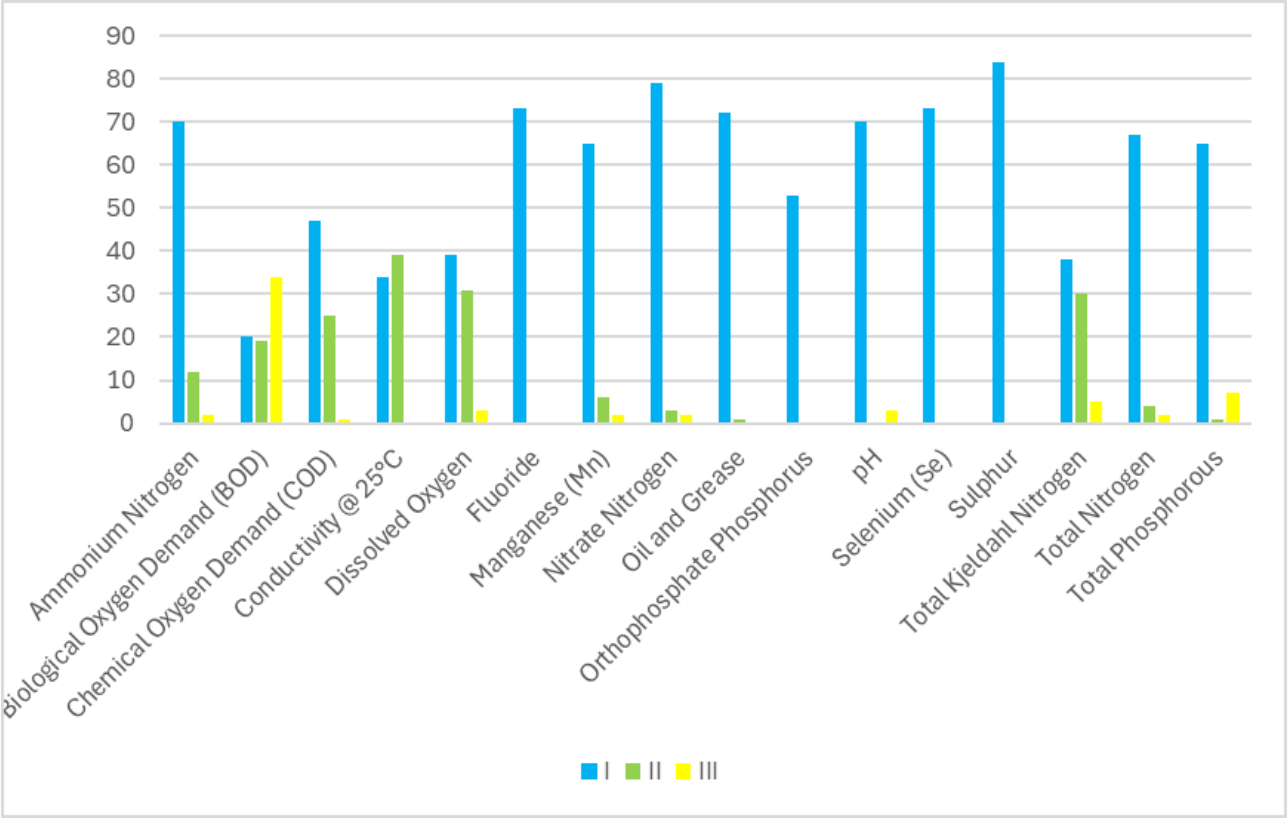


Figure 6-36: Frequency Distribution of the Water Quality Classes of Parameters

Table 6-23: Surface Water Sampling Results as per SWQMR Annex.5 Table-2

Parameter	Unit	LoQ	YS-04			YS-05			YS-06			YS-08			YS-09			YS-13			YS-14			YS-15	
			I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II
March '22																									
Ammonium	mg/L	<0.021	<0.021			0.07													0.46			0.43			
Ammonium Nitrogen	mg/L	<0.016	<0.016			0.06													0.36			0.33			
Biological Oxygen Demand (BOD)	mg/L	<3	<3	6.30		3.70				7.40			4.20			6.00			4.60						
Chemical Oxygen Demand (COD)	mg/L	<10	17.50			11.70			19.50			11.30			14.50			12.50							
Conductivity @ 25°C	µS/cm	0.00	178.20			396.00			132.40			315.00			381.00			434.00			434.00				
Dissolved Oxygen	mg/L	0.00	12.40			12.48			13.49			17.16			12.98			12.76			12.58				
Fluoride	mg/L	<0.1	<0.1																						
Manganese (Mn)	µg/L	<0.5	23.11			27.93			36.82			11.58			37.42			67.64			57.20				
Nitrate	mg/L	<0.45	0.56			2.20			1.59			0.59				8.22				10.10		9.61			
Nitrate Nitrogen	mg/L	<0.1	0.13			0.50			0.36			0.13			1.85			2.29			2.17				
Oil and Grease	mg/L	<0.050	<0.050										0.24												
pH	-	0.00	6.74			7.57			7.93			8.97			8.37			8.36			8.38				
Selenium (Se)	µg/L	<0.5	<0.5																						
Sulphur	mg/L	<0.002	<0.002																						
Total Kjeldahl Nitrogen	mg/L	<0.1	<0.1	1.39			0.83			1.15			0.81			0.82			1.48			0.97			
Total Nitrogen	mg/L	<0.1	1.52			1.32			1.51			0.94			2.67			3.79		3.16					
Total Phosphorous	mg/L	<0.005	0.01			0.04			0.02			0.06			0.06			0.07			0.06				
June '22																									
Ammonium	mg/L	<0.021	<0.021	0.71											0.20						0.22				
Ammonium Nitrogen	mg/L	<0.016	<0.016	0.55											0.15						0.17			0.11	
Biological Oxygen Demand (BOD)	mg/L	<3	<3		15.80											6.50			6.30				9.60		7.00
Chemical Oxygen Demand (COD)	mg/L	<10	<10	35.80											16.60			14.60			23.20			16.00	
Conductivity @ 25°C	µS/cm	0.00		475.00												552.00			482.00			493.00			661.00
Dissolved Oxygen	mg/L	0.00		7.60												6.17			7.99			7.32			7.11
Fluoride	mg/L	<0.1	<0.1												0.21			0.12			0.19			0.00	
Manganese (Mn)	µg/L	<0.5	85.51													209.13			108.60			108.99		0.72	
Nitrate	mg/L	<0.45	1.65												1.28				8.87				11.70		
Nitrate Nitrogen	mg/L	<0.1	0.37												0.29			2.00			2.63			0.24	
Oil and Grease	mg/L	<0.050	<0.050																						

Parameter	Unit	LoQ	YS-04			YS-05			YS-06			YS-08			YS-09			YS-13			YS-14			YS-15	
			I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II
Orthophosphate Phosphorus	mg o-PO4 P/L	<0.05	<0.05																						
pH	-	0.00	6.71														6.01	6.77			7.14			7.01	
Selenium (Se)	µg/L	<0.5	<0.5																						
Sulphur	mg/L	<0.002	<0.002																						
Total Kjeldahl Nitrogen	mg/L	<0.1	<0.1	1.43												1.06				1.52			2.36		1.36
Total Nitrogen	mg/L	<0.1	1.83												1.36				3.56			5.02		1.63	
Total Phosphorous	mg/L	<0.005	0.04														0.99			0.85			0.78		
Jan '23																									
Ammonium Nitrogen	mg/L	<0.016	<0.016																						
Biological Oxygen Demand (BOD)	mg/L	<3	<3	7.32				12.04			12.20			16.20			17.08			8.66			9.40		
Chemical Oxygen Demand (COD)	mg/L	<10	23.50				30.84			30.48			41.66			41.66		24.30				26.50			
Conductivity @ 25°C	µS/cm	0.00	222.00			235.00			201.90			264.00			241.00				529.00			520.00			
Dissolved Oxygen	mg/L	0.00	8.56			8.21				7.78			7.64			7.03		10.40			9.95				
Fluoride	mg/L	<0.1	<0.1						0.13			0.12													
Manganese (Mn)	µg/L	<0.5	1.16			1.11				205.00		35.60			17.00										
Nitrate Nitrogen	mg/L	<0.1	0.22			0.23			0.14			0.53			0.48			1.39			1.44				
Oil and Grease	mg/L	<0.050	<0.050																						
Orthophosphate Phosphorus	mg o-PO4 P/L	<0.05	<0.05																						
pH	-	0.00	6.91			6.82			6.54					6.19			6.16	8.61			8.49				
Selenium (Se)	µg/L	<0.5	<0.5																						
Sulphur	mg/L	<0.002	<0.002																						
Total Kjeldahl Nitrogen	mg/L	<0.1	<0.1	0.58			0.76			0.90			1.42			0.90		0.45			0.49				
Total Nitrogen	mg/L	<0.1	0.80			0.99			1.04			1.95			1.38			1.84			1.93				
Total Phosphorous	mg/L	<0.005	0.02			0.03			0.01			0.06			0.07					74.80					
Feb '23																									
Ammonium Nitrogen	mg/L	<0.016	<0.016												0.07			0.07			0.09				
Biological Oxygen Demand (BOD)	mg/L	<3	<3		8.06			15.60			12.72			19.40			11.92			13.08			14.20		
Chemical Oxygen Demand (COD)	mg/L	<10	19.99				39.98			32.61			47.34			30.51			32.61			34.57			
Conductivity @ 25°C	µS/cm	0.00	274.00				484.00		303.00			370.00				592.00		408.00			408.00				
Dissolved Oxygen	mg/L	0.00	9.49			8.82			8.86			9.40			9.21			9.70			9.91				
Fluoride	mg/L	<0.1	<0.1						0.20																

Parameter	Unit	LoQ	YS-04			YS-05			YS-06			YS-08			YS-09			YS-13			YS-14			YS-15	
			I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II
Manganese (Mn)	µg/L	<0.5	<0.5							364.00		3.80			15.70			2.73			4.26				
Nitrate Nitrogen	mg/L	<0.1	<0.1												0.37			0.93			0.88				
Oil and Grease	mg/L	<0.050	<0.050																						
Orthophosphate Phosphorus	mg o-PO4 P/L	<0.05	<0.05																						
pH	-	0.00	8.21			8.21			8.77			8.75			8.55			8.15			8.24				
Selenium (Se)	µg/L	<0.5	2.97			3.10			4.80			7.00			3.10			4.31			6.06				
Sulphur	mg/L	<0.002	<0.002																						
Total Kjeldahl Nitrogen	mg/L	<0.1	0.27			0.23			0.28			0.32						0.31			0.32				
Total Nitrogen	mg/L	<0.1	0.27			0.23			0.28			0.32			0.37			1.60			1.55				
Total Phosphorous	mg/L	<0.005	<0.005			0.02									0.03			0.02			0.02				
March '23																									
Ammonium Nitrogen	mg/L	<0.016	<0.016									0.05							0.30			0.28			
Biological Oxygen Demand (BOD)	mg/L	<3	<3		10.00		6.36				10.10			9.86		7.74			5.34			5.60			
Chemical Oxygen Demand (COD)	mg/L	<10	24.60			17.20				26.60			25.10		19.70			14.20			14.70				
Conductivity @ 25°C	µS/cm	0.00	297.00				515.00		322.00				469.00			612.00			530.00			531.00			
Dissolved Oxygen	mg/L	0.00	10.28			9.55			9.71			10.17			9.97				6.82			6.68			
Fluoride	mg/L	<0.1	<0.1																						
Manganese (Mn)	µg/L	<0.5	<0.5							289.00								13.10			5.60				
Nitrate Nitrogen	mg/L	<0.1	<0.1			0.13						0.15			0.38			1.61			1.60				
Oil and Grease	mg/L	<0.050	<0.050																						
Orthophosphate Phosphorus	mg o-PO4 P/L	<0.05	<0.05																						
pH	-	0.00	7.59			7.65			7.57			8.05			7.64			7.74			7.60				
Selenium (Se)	µg/L	<0.5	<0.5			1.50			3.00			1.67			1.38			3.90			2.30				
Sulphur	mg/L	<0.002	<0.002																						
Total Kjeldahl Nitrogen	mg/L	<0.1	<0.1									0.27			0.18			0.35			0.31				
Total Nitrogen	mg/L	<0.1	<0.1			0.13						0.41			0.56			1.96			1.91				
Total Phosphorous	mg/L	<0.005	<0.005									0.01						0.03							
April '23																									
Ammonium Nitrogen	mg/L	<0.016	<0.016	0.28			0.28		0.20				0.21		0.15				0.20		0.15				
Biological Oxygen Demand (BOD)	mg/L	<3	<3		12.60			15.30			14.70			12.10			17.80								
Chemical Oxygen Demand (COD)	mg/L	<10	<10	36.80			48.50			39.70			29.90			47.50		16.70								

Parameter	Unit	LoQ	YS-04			YS-05			YS-06			YS-08			YS-09			YS-13			YS-14			YS-15	
			I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II
Conductivity @ 25°C	µS/cm	0.00	140.10			206.30			143.20			222.00			193.60			317.00			318.00				
Dissolved Oxygen	mg/L	0.00	8.36			8.40			8.08				7.91			7.99			7.00			6.89			
Fluoride	mg/L	<0.1	<0.1																						
Manganese (Mn)	µg/L	<0.5	1.94			1.05			20.70			1.65			1.73										
Nitrate Nitrogen	mg/L	<0.1	2.13												0.44			0.27			0.57				
Oil and Grease	mg/L	<0.050	<0.050																						
Orthophosphate Phosphorus	mg o-PO4 P/L	<0.05	<0.05																						
pH	-	0.00	7.79			7.67			7.78			7.76			8.06			7.72			7.80				
Selenium (Se)	µg/L	<0.5	1.21												1.66										
Sulphur	mg/L	<0.002	<0.002																						
Total Kjeldahl Nitrogen	mg/L	<0.1	<0.1	1.07			0.98			0.99			0.90			1.21		0.37			0.33				
Total Nitrogen	mg/L	<0.1	3.20			0.98			0.99			0.90			1.65			0.64			0.90				
Total Phosphorous	mg/L	<0.005	<0.005			0.03			0.01			0.02			0.06										
May '23																									
Ammonium Nitrogen	mg/L	<0.016	<0.016		14.90			21.81																	
Biological Oxygen Demand (BOD)	mg/L	<3	<3		12.20			15.30		5.52				8.10						22.30			17.10		
Chemical Oxygen Demand (COD)	mg/L	<10	<10	33.70			41.80		16.12			20.28			14.04					63.73		47.84			
Conductivity @ 25°C	µS/cm	0.00		809.00			812.00			536.00			857.00			641.00		405.00			399.00				
Dissolved Oxygen	mg/L	0.00		6.77			6.79		8.39					4.56	9.83			9.07			8.89				
Fluoride	mg/L	<0.1	<0.1						0.21									0.29							
Manganese (Mn)	µg/L	<0.5	67.50			51.30					1351.00	9.20			2.30										
Nitrate Nitrogen	mg/L	<0.1	<0.1									0.87			0.34			1.12			1.02				
Oil and Grease	mg/L	<0.050	<0.050																						
Orthophosphate Phosphorus	mg o-PO4 P/L	<0.05	<0.05																						
pH	-	0.00	7.82			7.84			7.85			7.55			8.02			8.26			8.34				
Selenium (Se)	µg/L	<0.5	<0.5						1.20			1.22			1.85			2.40			2.43				
Sulphur	mg/L	<0.002	<0.002																						
Total Kjeldahl Nitrogen	mg/L	<0.1	<0.1		15.60			32.00	0.14			0.23			0.17					2.44		1.29			
Total Nitrogen	mg/L	<0.1	<0.1		15.60			32.00	0.14			1.10			0.51				3.56		2.31				
Total Phosphorous	mg/L	<0.005	<0.005		3.50			3.20							0.03			0.02			0.02				
June '23																									

Parameter	Unit	LoQ	YS-04			YS-05			YS-06			YS-08			YS-09			YS-13			YS-14			YS-15	
			I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II
Ammonium Nitrogen	mg/L	<0.016	<0.016			0.03																			
Biological Oxygen Demand (BOD)	mg/L	<3	<3				6.80							11.40			10.60			8.50			13.20		
Chemical Oxygen Demand (COD)	mg/L	<10	14.56			16.64							29.10			26.52		22.36				33.28			
Conductivity @ 25°C	µS/cm	0.00	414.00			415.00			405.00			350.00				473.00		369.00			392.00				
Dissolved Oxygen	mg/L	0.00		7.32			7.30			7.62			7.93			7.94		8.01			8.33				
Fluoride	mg/L	<0.1	<0.1						0.20			0.16													
Manganese (Mn)	µg/L	<0.5	<0.5						3.60																
Nitrate Nitrogen	mg/L	<0.1	0.21			0.27			0.12			0.36			0.70			1.02			0.78				
Oil and Grease	mg/L	<0.050	<0.050																						
Orthophosphate Phosphorus	mg o-PO4 P/L	<0.05	<0.05																						
pH	-	0.00	7.78			7.71			7.82			7.97			7.45			7.66			7.96				
Selenium (Se)	µg/L	<0.5	<0.5						1.26																
Sulphur	mg/L	<0.002	<0.002																						
Total Kjeldahl Nitrogen	mg/L	<0.1	0.37				0.62						0.97		0.32			0.44				0.61			
Total Nitrogen	mg/L	<0.1	0.57			0.92			0.12			1.33			1.02			1.46			1.39				
Total Phosphorous	mg/L	<0.005	0.03			0.03									0.03										
July '23																									
Ammonium Nitrogen	mg/L	<0.016	<0.016						0.04						0.08			0.02							
Biological Oxygen Demand (BOD)	mg/L	<3	<3	6.52							8.40														
Chemical Oxygen Demand (COD)	mg/L	<10	16.20						20.50						12.96			14.04			15.12				
Conductivity @ 25°C	µS/cm	0.00		598.00			613.00			458.00			782.00			632.00			501.00			499.00			
Dissolved Oxygen	mg/L	0.00			5.18		7.63			6.83			6.65			7.91		9.41			8.56				
Fluoride	mg/L	<0.1	<0.1						0.00			0.00			0.00										
Manganese (Mn)	µg/L	<0.5	<0.5								1773.00	32.50			5.30										
Nitrate Nitrogen	mg/L	<0.1	<0.1									0.64			0.33			0.95			0.98				
Oil and Grease	mg/L	<0.050	<0.050																						
Orthophosphate Phosphorus	mg o-PO4 P/L	<0.05	<0.05																						
pH	-	0.00	8.06			8.01			7.93			7.70			8.06			8.30			8.18				
Selenium (Se)	µg/L	<0.5	<0.5																						
Sulphur	mg/L	<0.002	<0.002																						
Total Kjeldahl Nitrogen	mg/L	<0.1	0.21				0.51		0.48				0.73			0.56		0.40			0.48				

Parameter	Unit	LoQ	YS-04			YS-05			YS-06			YS-08			YS-09			YS-13			YS-14			YS-15	
			I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II
Total Nitrogen	mg/L	<0.1	0.21			0.51			0.48			1.38			0.88			1.52			1.61				
Total Phosphorous	mg/L	<0.005	0.04			0.05									0.06										
Aug '23																									
Ammonium Nitrogen	mg/L	<0.016	<0.016																						
Biological Oxygen Demand (BOD)	mg/L	<3	<3										6.10										8.10		
Chemical Oxygen Demand (COD)	mg/L	<10	<10									17.00			12.80						23.90				
Conductivity @ 25°C	µS/cm	0.00											900.00			618.00			573.00			571.00			
Dissolved Oxygen	mg/L	0.00											6.42			6.62			6.37			6.61			
Fluoride	mg/L	<0.1	<0.1																						
Manganese (Mn)	µg/L	<0.5	<0.5																						
Nitrate Nitrogen	mg/L	<0.1	<0.1									0.14						0.92			0.93				
Oil and Grease	mg/L	<0.050	<0.050																						
Orthophosphate Phosphorus	mg o-PO4 P/L	<0.05	<0.05																						
pH	-	0.00										6.93			7.36			7.51			7.48				
Selenium (Se)	µg/L	<0.5	<0.5												3.30			1.75			1.20				
Sulphur	mg/L	<0.002	<0.002																						
Total Kjeldahl Nitrogen	mg/L	<0.1	<0.1										0.58			0.56		0.44			0.38				
Total Nitrogen	mg/L	<0.1	<0.1									0.58			0.56			1.35			1.31				
Total Phosphorous	mg/L	<0.005	<0.005												0.02			0.01							
Sept '23																									
Ammonium Nitrogen	mg/L	<0.016	<0.016												0.10										
Biological Oxygen Demand (BOD)	mg/L	<3	<3																			7.80			
Chemical Oxygen Demand (COD)	mg/L	<10	<10												13.06			15.05			18.91				
Conductivity @ 25°C	µS/cm	0.00														645.00			567.00			731.00			
Dissolved Oxygen	mg/L	0.00															5.76		6.12			7.75			
Fluoride	mg/L	<0.1	<0.1																						
Manganese (Mn)	µg/L	<0.5	<0.5												67.40										
Nitrate Nitrogen	mg/L	<0.1	<0.1												0.16			2.21			2.24				
Oil and Grease	mg/L	<0.050	<0.050																						
Orthophosphate Phosphorus	mg o-PO4 P/L	<0.05	<0.05																						
pH	-	0.00													7.63			7.36			8.24				

Parameter	Unit	LoQ	YS-04			YS-05			YS-06			YS-08			YS-09			YS-13			YS-14			YS-15	
			I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II
Selenium (Se)	µg/L	<0.5	<0.5												1.10						2.40				
Sulphur	mg/L	<0.002	<0.002																						
Total Kjeldahl Nitrogen	mg/L	<0.1	<0.1													0.50		0.42			0.31				
Total Nitrogen	mg/L	<0.1	<0.1												0.66			3.03			2.83				
Total Phosphorous	mg/L	<0.005	<0.005												0.03			0.01					4.10		
Dec '23																									
Ammonium Nitrogen	mg/L	<0.016	<0.016												0.04										
Biological Oxygen Demand (BOD)	mg/L	<3	<3																			5.92			
Chemical Oxygen Demand (COD)	mg/L	<10	12.80												13.10			12.00			17.30				
Conductivity @ 25°C	µS/cm	0.00		446.00			441.00									450.00			497.00			500.00			
Dissolved Oxygen	mg/L	0.00	9.45			9.28									9.47			9.27			9.56				
Fluoride	mg/L	<0.1	<0.1																						
Manganese (Mn)	µg/L	<0.5	2.26			1.84									23.90			33.00			25.10				
Nitrate Nitrogen	mg/L	<0.1	0.22			0.22									0.34			1.20			1.19				
Oil and Grease	mg/L	<0.050	<0.050																						
Orthophosphate Phosphorus	mg o-PO4 P/L	<0.05	<0.05																						
pH	-	0.00	8.11			8.21									8.12			8.23			8.33				
Selenium (Se)	µg/L	<0.5	7.11			6.64									4.40			2.80							
Sulphur	mg/L	<0.002	<0.002																						
Total Kjeldahl Nitrogen	mg/L	<0.1	0.22			0.19																			
Total Nitrogen	mg/L	<0.1	0.44			0.41									0.34			1.20			1.19				
Total Phosphorous	mg/L	<0.005	<0.005	0.14		0.06									0.04			0.02			0.01				

Sufficient data was collected to make an assessment according to SWQMR Annex-5 Table 4&5 only in 2022 March and June. Therefore, only Maximum Permissible Environmental Quality Standards were considered. Based on these calculations, Iron concentrations exceeded at every location in March 2022, whereas it exceeded the same standards except for YS-05, YS-06 and YS-08 in June 2022 (Table 6-25). Additionally, both Aluminium and Zinc concentrations measured in July 2022 at the same locations exceeded Maximum Permissible Environmental Quality Standards for River/Lakes According to SWQMR. Furthermore, Copper concentrations in June 2022 at YS-13 and YS-14 and Silicon concentration in YS-15 in June 2022 were above the SWQMR.

Table 6-24: Maximum Permissible Environmental Quality Standards for River/Lakes According to SWQMR

Parameter	Units	Maximum-Environmental Quality Standards for Rivers/Lakes	Annual Average-Environmental Quality Standards for Rivers/Lakes
Aluminium (Al), Total	mg/L	0.027	0.0022
Antimony (Sb), Total	mg/L	0.103	0.0078
Arsenic (As), Total	mg/L	0.053	0.053
Barium (Ba), Total	mg/L	0.68	0.68
Beryllium (Be), Total	mg/L	0.0039	0.0025
Boron (B), Total	mg/L	1.472	0.707
Cadmium (Cd), Total	mg/L	< 0.00045 (Class 1) 0.00045 (Class 2) 0.0006 (Class 3) 0.0009 (Class 4) 0.0015 (Class 5)	<0.00008 (Class 1) 0.00008 (Class 2) 0.00009 (Class 3) 0.00015 (Class 4) 0.00025 (Class 5)
Chromium (Cr), Total	mg/L	0.142	0.0016
Cobalt (Co), Total	mg/L	0.0026	0.0003
Copper (Cu), Total	mg/L	0.0031	0.0016
Iron (Fe), Total	mg/L	0.101	0.036
Lead (Pb), Total	mg/L	0.014	0.0012
Mercury (Hg), Total	µg/L	0.07	-
Nickel (Ni), Total	mg/L	0.034	0.004
Silver (Ag), Total*	mg/L	0.0015	0.0015
Vanadium (V), Total*	mg/L	0.097	0.0016
Zinc (Zn), Total	mg/L	0.231	0.0059

Table 6-25: Evaluation of 2022 Annual Average Concentrations Surface Water Samples According to SWQMR Annex-5 Table-4&5

Parameter	Units	YSKY Annex5 Table 4&5 Maximum	LoD	YS-04	YS-05	YS-06	YS-08	YS-09	YS-13	YS-14	YS-15
2022 March											
Aluminium (Al)	mg/L	0.027	<0.02	0.6199	0.3017	0.3904	0.7788	0.3626	0.3328	0.3188	
Antimony (Sb)	µg/L	103	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Arsenic (As)	µg/L	53	<0.5	0.76970	<0.5	<0.5	0.78827	<0.5	1.22378	1.19459	
Biological Oxygen Demand (BOD)	mg/L	50	<3	6.3	3.7	7.4	4.2	6	4.6	<3	
Boron (B)	mg/L	1.472	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.04088	0.04304	
Cadmium (Cd)	µg/L	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Chemical Oxygen Demand (COD)	mg/L	125	<10	17.5	11.7	19.5	11.3	14.5	12.5	<10	
Chromium (Cr)	mg/L	0.142	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Copper (Cu)	mg/L	0.0031	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
Iron (Fe)	µg/L	101	<5	645.264	274.620	306.798	494.695	442.722	454.785	416.754	
Lead (Pb)	µg/L	14	<0.5	<0.5	<0.5	0.76739	<0.5	<0.5	1.54821	1.1768	
Mercury (Hg)	mg/L	0.00007	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Nickel (Ni)	µg/L	34	<5	<5	<5	<5	<5	<5	<5	<5	
Oil and Grease	mg/L	10	<0.050	<0.050	<0.050	<0.050	0.237	<0.050	<0.050	<0.050	
Silver (Ag)	mg/L	0.0015	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
Total Suspended Solids	mg/L	50	<10	<10	14.9	23.5	14.4	20.9	81.2	57.1	
Vanadium (V)	mg/L	0.097	<0.0005	0.00467	0.00264	0.00202	0.00391	0.00154	0.0017	0.00155	
Zinc (Zn)	µg/L	231	<1	66.784	30.034	73.503	22.568	123.060	34.720	82.847	
2022 June											
Aluminium (Al)	mg/L	0.027	<0.02	0.279	<0.02	<0.02	<0.02	0.191	0.411	0.547	<0.02
Antimony (Sb)	µg/L	103	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Arsenic (As)	µg/L	53	<0.5	1.527	<0.5	<0.5	<0.5	1.916	1.779	2.198	1.842
Barium (Ba)	mg/L	0.68	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0727
Benzene	µg/L	50	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Beryllium (Be)	µg/L	3.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Biological Oxygen Demand (BOD)	mg/L	50	<3	15.80	<3	<3	<3	6.5	6.3	9.6	7

Parameter	Units	YSKY Annex5 Table 4&5 Maximum	LoD	YS-04	YS-05	YS-06	YS-08	YS-09	YS-13	YS-14	YS-15
Boron (B)	mg/L	1.472	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.063	0.067	0.081
Cadmium (Cd)	µg/L	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chemical Oxygen Demand (COD)	mg/L	125	<10	35.80	<10	<10	<10	16.6	14.6	23.2	16
Chromium (Cr)	mg/L	0.142	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt (Co)	µg/L	0.0026	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Copper (Cu)	mg/L	0.0031	<0.001	0.00256	<0.001	<0.001	<0.001	0.00147	0.00311	0.0036	0.0026872
Iron (Fe)	µg/L	101	<5	370.209	<5	<5	<5	268.675	540.116	883.471	<5
Lead (Pb)	µg/L	14	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.25788	1.67343	<0.5
Mercury (Hg)	mg/L	0.00007	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel (Ni)	µg/L	34	<5	<5	<5	<5	<5	<5	<5	<5	<5
Oil and Grease	mg/L	10	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Silicon	µg/L	1830	<100	<100	<100	<100	<100	<100	<100	<100	4816.45
Silver (Ag)	mg/L	0.0015	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Tin	µg/L	13	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Titanium	µg/L	42	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Suspended Solids	mg/L	50	<10	119.1	<10	<10	<10	13.2	137.3	125.5	<10
Vanadium (V)	mg/L	0.097	<0.0005	0.00432	<0.0005	<0.0005	<0.0005	0.00184	0.00235	0.0032	0.0013883
Zinc (Zn)	µg/L	231	<1	854.458	<1	<1	<1	672.045	295.405	832.581	<1

Irrigation Water Quality

The surface waters in the Project Area also have been used as irrigation water by the surrounding villages. Therefore, its quality for use as irrigation water should also be considered.

Soil salinity, as measured by the sodium adsorption ratio (SAR), can have negative impacts on soil permeability and infiltration. When sodium ions are present in soil in exchangeable form, they can replace calcium and magnesium ions that are adsorbed on soil clays. This replacement can cause soil particles to become dispersed, leading to the breakdown of soil aggregates. As a result, the soil may become hard and compact when dry, reducing the infiltration rates of water and air into the soil and negatively affecting its structure. The SAR is a useful metric for quantifying the impact of high sodium ion levels on soil, and is calculated as follows:

$$SAR = \frac{Na^{+}}{\sqrt{\frac{1}{2}(Ca^{2+} + Mg^{2+})}}$$

The salinity diagram developed by the US Salinity Laboratory[13] is widely used for the classification of irrigation waters. As shown in Table 6-26, irrigation waters are classified based on their Sodium Absorption Ratios (SAR) and Electrical Conductance values.

According to this assessment, except for samples taken from YS-04 and YS-06 in March 2023, which are classified as C1-S1 (low salinity-low sodium), all samples are in C2-S1 (medium salinity-low sodium) class (Figure 6-37).

Table 6-26: Irrigation Water Classification

Salinity Hazard Class	EC_{25} µS/cm	Irrigation Water Class	Sodium Hazard Class	SAR	Irrigation Water Class
C1	100-250	Low Salinity	S1	<10	Low Sodium
C2	250-750	Medium Salinity	S2	10-18	Medium Sodium
C3	750-2250	High Salinity	S3	18-26	High Sodium
C4	>2250	Very High Salinity	S4	>26	Very High Sodium

[13] Richards, L. A. (1954). Diagnosis and Improvement of Saline and Alkali Soils. Washington D.C.: US Department of Agriculture.

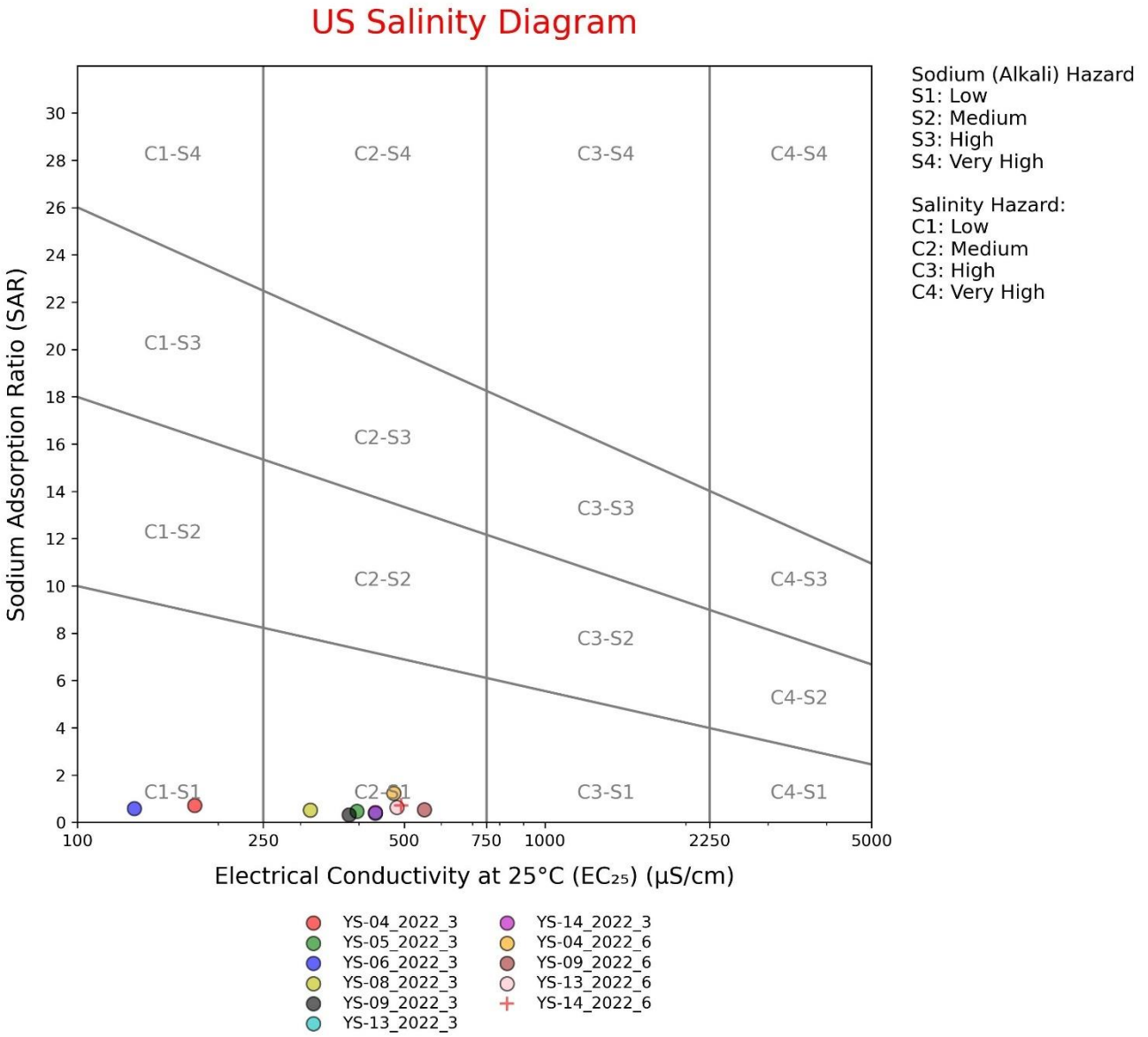


Figure 6-37: U.S. Salinity Chart for Surface Waters

Sensitivity Assessment

Sensitivity features	Supported by	Sensitivity value
Presence of waterbody (Filyos River) in AoI. Presence of water/sediment pollution.	Primary and secondary data	High

Sensitivity features	Supported by	Sensitivity value
Presence of hydrological changes in sub-catchments of Creeks in AoI.		

6.1.7 Hydrogeology and Groundwater Quality

Definition	Hydrogeology is the area of geology that deals with the distribution and movement of groundwater in the soil and rocks of the Earth's crust (commonly in aquifers). The terms groundwater hydrology, geohydrology, and hydrogeology are often used interchangeably.
Study areas	RSA: The Filyos Basin. Rationale: The Filyos Basin is considered as RSA since the regional groundwater flow is towards the Black Sea along the Filyos Basin.
	AoI: The AoI is defined as the groundwater flow model area. Rationale: In order to represent the shallow aquifer system and its flow towards the Filyos River and the Black Sea, an AoI was defined by considering the basin boundaries of the Project Site and its immediate surroundings as no-flow boundary conditions in the conceptual and numerical model.
Data sources	Primary sources: Primary data from field works conducted by Toker, WSP (then-WSP-Golder), and Çınar Laboratories in 2021, 2022 and 2023.
	Secondary sources: Secondary data from scientific papers, grey literature and government agency reports & databases.

Methodological approach

Baseline hydrogeological characterization and groundwater quality assessment were made according to the primary and secondary data sources. Primary data is sourced from the fieldworks involving a hydrocensus survey in the AoI which aims at determining the groundwater and surface water resources and stakeholder water users in and around the AoI. Based on this hydrocensus survey; a comprehensive water sampling study was conducted in the AoI. Additionally, groundwater exploration and testing program were conducted by Toker in 2021. The findings from these studies were also used as primary data source during the baseline characterization studies.

All fieldworks including hydrocensus and water sampling were conducted according to the local and international standards and guidelines where applicable.

The following regulations and guidelines were taken into consideration during the baseline hydrogeological characterisation and groundwater quality assessment studies.

- Regulation on the Protection of Groundwater against Pollution and Deterioration (PGPD) (Official Gazette No. 28257 Date: 07.04.2012).
- “Regulation of Water intended for Human Consumption” (RWHC), Official Gazette No: 25730, Dated: 17.02.2005.
- “European Union Directive on the Quality of Water Intended for Human Consumption” no. 98/83/EC dated 3 November 1998.
- “Drinking Water Quality Guidelines” developed by the World Health Organization (2011).

- "Irrigation Water Standards" of the US Salinity Laboratory (1954).
- During the baseline studies, the reports used as secondary data sources are listed below.
- Sakarya Gas Field Submarine Production Facilities, Submarine Transmission Lines and Onshore Natural Gas Processing Facility Integrated Project Report, AREN MÜŞAVİRLİK MÜHENDİSLİK LTD. ŞTİ., September 2021.
- TP-OTC Filyos Natural Gas Processing Plant, Analysis of Step-Drawdown Tests of Water Wells. TOKER Drilling and Construction Engineering Consulting. Co., 2021.
- TP-OTC Filyos Natural Gas Processing Plant, Groundwater Model Report, Toker Drilling and Construction Engineering Consulting. Co., December 2021.
- TP-OTC Filyos Natural Gas Processing Plant, Analysis of Step-Drawdown Tests of WEL-01, WEL-02, WEL-03, WEL-04, WEL-05, WEL-06 and BACK-UP Well. TOKER Drilling and Construction Engineering Consulting. Co., 2022.

The regional hydrogeological characteristics and the baseline hydrogeological conditions of the Phase-2 of the TP-OTC Sakarya Gas Field Project are discussed herein.

Regional context (RSA)

The structural and lithological features of the geological formations outcropping throughout the Filyos Basin, which is the sub-basin of the Western Black Sea Basin, where the Project Site is located, have been evaluated in terms of hydrogeology, permeability and aquifer properties.

There is no unit that shows impermeable characteristic in the project impact area and in its immediate vicinity. However, the permeability of the very fine-grained levels forming the upper parts of the alluvium is quite low, and there is very little infiltration into the ground after precipitation, and therefore flooding and ponding occur in the region.

The Çaycuma Formation, which consists of alternations of sandstone, siltstone, claystone and shale intercalated with volcanic rocks, and the Yemişliçay Formation, which consists of volcanic sandstone, siltstone, claystone, shale and pyroclastic rocks, and pelagic-semi-pelagic limestones, are the units that show low permeability characteristics.

Units showing aquifer characteristics in and around the Project Site are Quaternary alluvium and Maestrichtian-Lower Eocene aged Akveren formations.[14]

Local context (AoI)

The Project Site and its surroundings mainly consist of Quaternary aged Alluviums and Upper Createse aged Yemişliçay formation, the upper parts of which are composed of very fine-grained materials. The Project Site is mainly located on Quaternary aged alluvium.

[14] AREN MÜŞAVİRLİK MÜHENDİSLİK LTD. ŞTİ., (September 2021). Sakarya Gas Field Submarine Production Facilities, Submarine Transmission Lines and Onshore Natural Gas Processing Facility Integrated Project Report

Quaternary-aged alluvium, which covers a large part of the RSA, is considered a permeable unit. The Upper Cretaceous Yemişliçay formation, which occupies less space in and around the Project Site compared to the alluvium unit, consists of volcanic sandstone, siltstone, claystone, shale and pyroclastic rocks and pelagic-semi-pelagic limestones, and it is defined as semi-permeable.

Many studies have been carried out to determine the hydrogeological and hydraulic characteristics of the Project site by utilising the groundwater monitoring wells drilled in and around the Project site, mainly conducted by TOKER in 2021 and 2022 in order to calculate the water supply potential for the fire extinguishing.

Activities at WaterWell (WW) Coded Wells

Between 22 May-3 August 2022, 5 different water wells were drilled (Figure 6-38). To find the appropriate flow rate to be used for sustainable water usage, step-drawdown tests were carried out. Using AquiferWin32, step-drawdown test data was analysed and aquifer parameters – transmissivity and well loss - were determined using the Eden-Hazel method (Eden & Hazel, 1973), which is based on Jacob's approximation (Jacob, 1947) of the Theis equation (Theis, 1935). The basic information on the tests performed in the wells is given in Table 6-27.

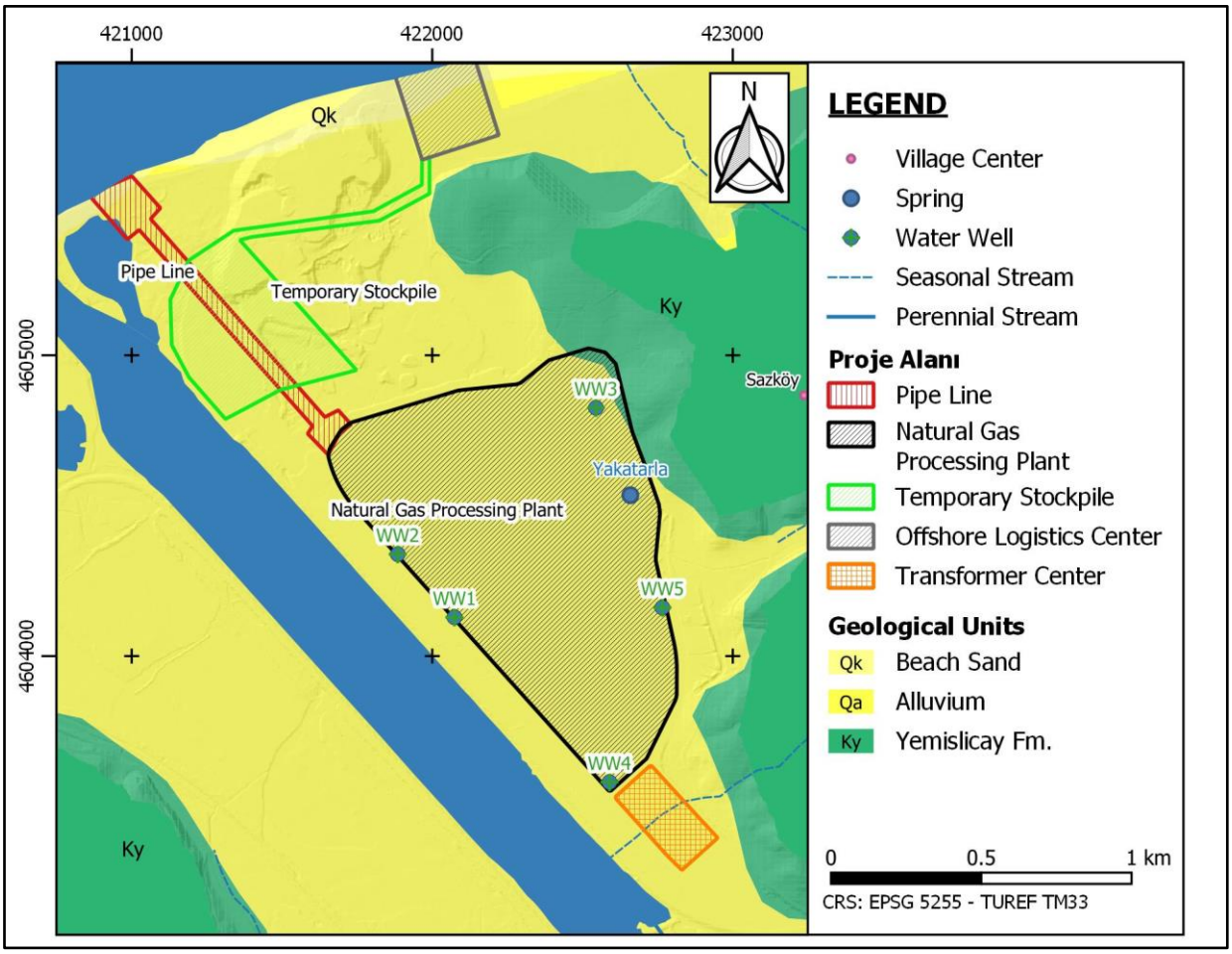


Figure 6-38: Locations of the WaterWell Coded Wells (TOKER, 2021)

Table 6-27: Basic Information on the Water Well Coded Wells (TOKER, 2021)

Well Name	WaterWell-1	WaterWell-2	WaterWell-3	WaterWell-4	WaterWell-5
X (TUREF TM33, m)	422073.94	421885.26	422545.41	422590	422765
Y (TUREF TM33, m)	4604128.22	4604338.06	4604824.95	4603580	4604160
Elevation (m)	5.98	6.21	7.15	5.95	6.2
Depth (m)	71	75	35	55	43
Gravelled and Screened Part of the Well (from the Surface, m)	50 - 71 m	0 - 75 m	5 - 35 m	38 - 55 m	4 - 43 m

Well Name	WaterWell-1	WaterWell-2	WaterWell-3	WaterWell-4	WaterWell-5
Gravelled and Screened Lithological Unit	Bottom of the Alluvium (Sandy and Gravelly Part + Last 3 metres of the Clay)	Alluvium (Clay, Sand, Gravel)	Alluvium (Clay)+ Residual Clay/Claystone	Bottom (Sandy and Gravelly Part) of the Alluvium + Volcanogenic Sandstone + Conglomerate	Alluvium (Clay)+ Residual Clay/Claystone
Static Hydraulic Head (GW Elevation, m)	1.52	1.6	6.135	1.655	6.05
Discharge Rates (L/sec)	4.50 - 8.50 - 12.50 - 18.35	3.90 - 7.75 - 11.75 - 13.25	1.45 - 2.25 - 3.10 - 4.50	3.92 - 5.86 - 7.97 - 9.05	0.40 - 0.95 - 1.45 - 1.95
Hydraulic Head at the end of the Test (GW Elevation, m)	-0.116	0.915	-13.79	-24.105	-11.64
T (m^2/day)	1240	1638.81	14.1254	14.7837	4.51319
r^2S, m^2	0.000653873	0.00316423	0.0226344	0.0642971	0.0265382
a, min/m^2	0.359973	0.18	-32.2788	-39.6264	-137.452
b, min/m^2	0.21255	0.16	18.1611	17.8277	58.3979
C, min^2/m5	0.228964	0.021	104.938	19.5274	365.353
The radius of Influence, m	1800	3000	7500	6500	3000
Suggested Discharge Rate for the GW Usage (L/sec)	Minimum 30 L/sec		3.5 - 4 L/sec	8-10 L/sec	2-2.5 L/sec

Activities at WEL-Coded Wells

A groundwater flow model built in November 2021 with the available data to determine the locations and the discharge rates of the wells to be drilled in order to provide water for at least 24 hours with a total discharge rate of 1000 m^3/h for the purpose of fire extinguishing in a possible fire (TOKER, 2021).

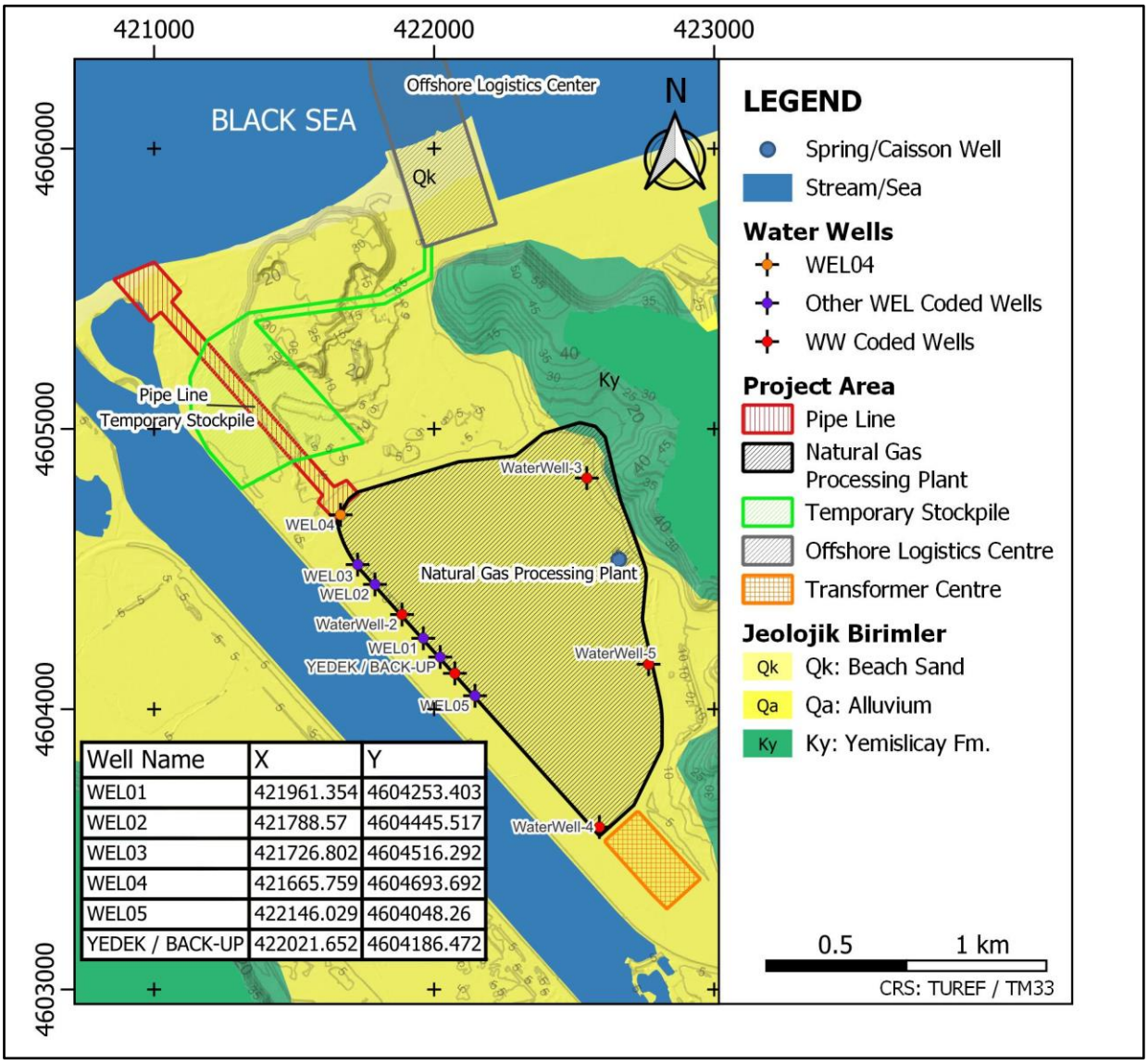
In this study, in which groundwater flow between May 30 and June 11, 2021, has been modelled, step-drawdown tests performed at WaterWell-2 on May 30, 2021, and at WaterWell-1 on June 11, 2021, have been simulated. Aquifer parameters and boundary conditions have been calibrated according to the tests in both wells and the pore water pressures measured in the PZ-coded well between these dates. All the drainage wells that have been or are planned to be constructed have been added to this model after the calibration, and the hydraulic conductivity coefficient has been assigned to these wells by using the Kozeny-Carmen Bear (1972) equation. Finally, 5 wells have been proposed according to this new model, 150 metres apart, to provide a total discharge of 1000 m^3/hour for 24 hours. In addition, a backup well has been proposed to step in should any of them fail

during use (Figure 6-39). The discharge rates of the wells vary between 30 and 55 L/sec. Also, the expected groundwater levels in these wells as a result of the 24-hour discharge and its recovery have been calculated (Figure 6-40). The details of this groundwater flow model will be discussed in the Impact Assessment.

Within this study, WEL-01, WEL-02, WEL-03, WEL-04, WEL-05 and BACK-UP coded wells were drilled and instrumented between the 21st of April and the 1st of June 2022. Well-development operations, which were conducted by using a truck-mounted compressor, were on April 26, 2022, at WEL-04, between May 12 and 18, 2022 at WEL-05, between May 23 and 24, 2022 for WEL-01, between June 1 and 3, 2022 for WEL-02, and between June 9 and 13, 2022 for WEL-03. Step-drawdown tests were conducted on May 21, 2022, at WEL-04, June 4, 2022, at WEL-01, June 18 at WEL-02, July 12, 2022, at WEL-05, and August 6, 2022, at WEL-03.

Using AquiferWin32, step-drawdown test data were analysed and aquifer parameters –transmissivity and well loss– were calculated using the Eden-Hazel method (Eden & Hazel, 1973), which is based on Jacob's approximation (Jacob, 1947) of the Theis equation (Theis, 1935). Furthermore, the results of the step-drawdown tests were compared with the groundwater flow model built using MODFLOW.

The basic information about the tests performed at WEL-coded wells are given in Table 6-28.



Well Name	X	Y
WEL01	421961.354	4604253.403
WEL02	421788.57	4604445.517
WEL03	421726.802	4604516.292
WEL04	421665.759	4604693.692
WEL05	422146.029	4604048.26
YEDEK / BACK-UP	422021.652	4604186.472

Figure 6-39: Location of the Water Wells (TOKER, 2022)

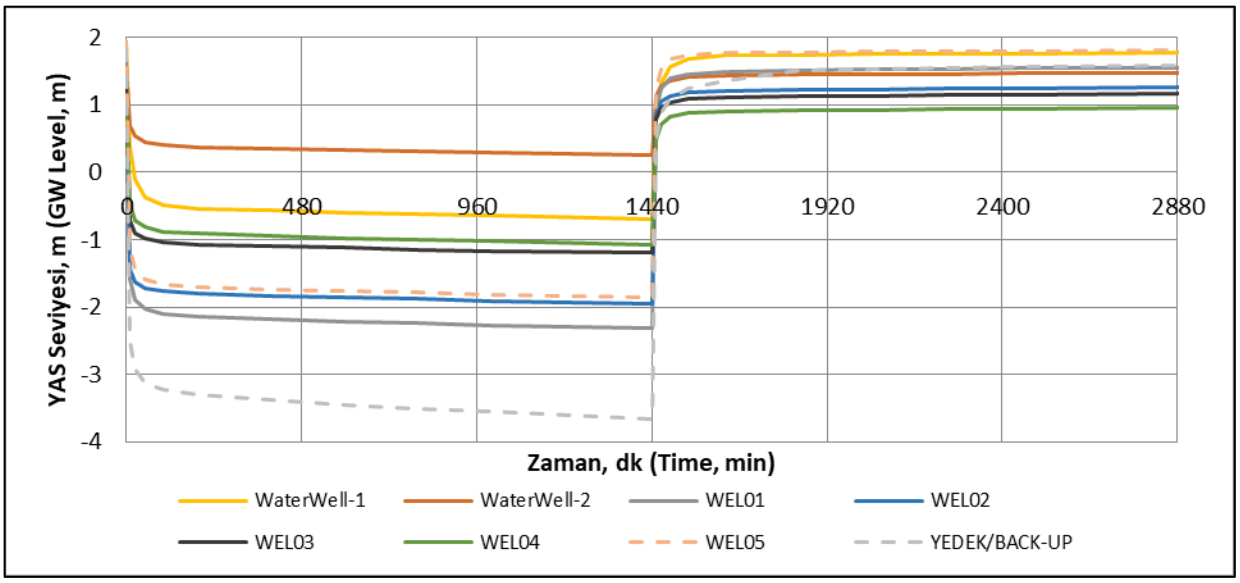


Figure 6-40: Calculated Groundwater Levels in Case of a 24-Hour Discharge from the Wells (TOKER, 2022)

Table 6-28: Basic Information on WEL Coded Wells (TOKER, 2022)

Well Name	WEL-01	WEL-02	WEL-03	WEL-04	WEL-05	BACK-UP
X (TUREF TM33, m)	421961.354	421788.57	421726.802	421665.759	422146.029	422021.652
Y (TUREF TM33, m)	4604253.403	4604445.517	4604516.292	4604693.692	4604048.26	4604186.472
Ground Elevation (m)	5.929	6.445	7.35	6.76	7.05	6.25
Starting Date of Drilling	May 18, 2022	May 28, 2022	June 4, 2022	April 21, 2022	May 7, 2022	October 23, 2022
Ending Date of Drilling	May 21, 2022	June 1, 2022	June 9, 2022	April 26, 2022	May 11, 2022	October 28, 2022
Borehole Depth (m)	72	72	72	72	72	71
Gravelled and Screened Part of the Well (from the Surface, m)	4 - 72 m	4 - 72 m	4 - 72 m	4 - 72 m	4 - 72 m	4 - 71 m
Gravelled and Screened Lithological Unit	Alluvium (Clay, Sand, Gravel)	Alluvium (Clay, Sand, Gravel)	Alluvium (Clay, Sand, Gravel)	Alluvium (Clay, Sand, Gravel)	Alluvium (Clay, Sand, Gravel)	Alluvium (Clay, Sand, Gravel)
Date of Well Development	May 23-24, 2022	June 1-3, 2022	June 9-13, 2022	April 26, 2022	May 12-18, 2022	October 30-31, 2022
Date of Equipment Test	June 4, 2022	June 18, 2022	August 6, 2022	May 21, 2022	July 12, 2022	November 1, 2022
Date of Step-Drawdown Test	June 5, 2022	June 19, 2022	August 7, 2022	May 22,2022	July 24, 2022	November 2, 2022

Well Name		WEL-01	WEL-02	WEL-03	WEL-04	WEL-05	BACK-UP
Static Hydraulic Head (GW Elevation, m)		1.287	1.182	1.05	1.377	1.946	0.921
Discharge Rates (l/sec)		16.43-25.29-45.21-56.54	13.79-28.44-44.91-56.60	3.97-6.67-9.10-13.50	15.42-28.59-41.45-52.52	4.41-7.07-11.08-17.35	14.13-29.21-43.39-53.84
Hydraulic Head at the end of the Test (GW Elevation, m)		-0.783	-1.525	0.153	-0.719	-0.887	-12.869
Drawdown at the end of the Test (m)		2.07	2.707	0.897	2.096	2.833	13.79
T (m²/day)		2438.93	2369.28	1867.99	2878.66	2470.4	2133.72
r²S, m²		0.0484154	0.0533063	0.0445461	0.0106024	1.45E-13	0.0263619
a, min/m²		0.0127391	0.00706506	0.00539446	0.0801468	1.24235	0.04
b, min/m²		0.108064	0.11124	0.141093	0.0974697	0.106688	0.123522
C, min²/m5		0.0419324	0.0893769	0.582296	0.051715	0.949878	0.792593
Radius of Influence, m		>10000	7500	3000	>10000	5000	6000
Diameter of the Pump Planned to Be Used (inch)		8	8	6	8	6	8
Planned Discharge Rate	l/sec	55	55	20	55	20	55
	m³/h	198	198	72	198	72	198

Well Name	WEL-01	WEL-02	WEL-03	WEL-04	WEL-05	BACK-UP
Estimated Drawdown for the Single-Well Usage with the Planned Discharge Rate (m)	2.1	2.7	1.55	2.1	3.25	-
Notes			Additional filter attachments are recommended.		Additional filter attachments are recommended.	

Hydrogeochemical Characteristics of the Groundwater Resources

A hydrocensus fieldwork was conducted by Golder in and around the Project site in February 2022 and then a sampling program was established for the Phase-1 ESIA. Within the scope of the sampling program, twelve (12) groundwater points (eight (8) groundwater wells, one (1) spring point and three (3) developed springs, namely WaterWell-1, WaterWell-2, WaterWell-3, WaterWell-4, WaterWell-5, SK-01, SK-03, SK-04, K-01, Ç-01, Ç-02 and Ç-03, were identified. Sampling activities were conducted at eight (8) points out of twelve (12) points in March 2022 by Çınar. SK-03 is the water supply well of the Sazköy village. It is understood that SK-03 will be replaced with SK-04 in the future. K-01 is the only spring well of the Sazköy Village. Developed spring wells of the Sazköy village are Ç-01 and Ç-02. Ç-01 is being fed by K-01 spring and Ç-02 is being fed by SK-03 well. On the other hand, Ç-03 is the developed spring well of the Aşağıihsaniye Village but its spring could not be reached.

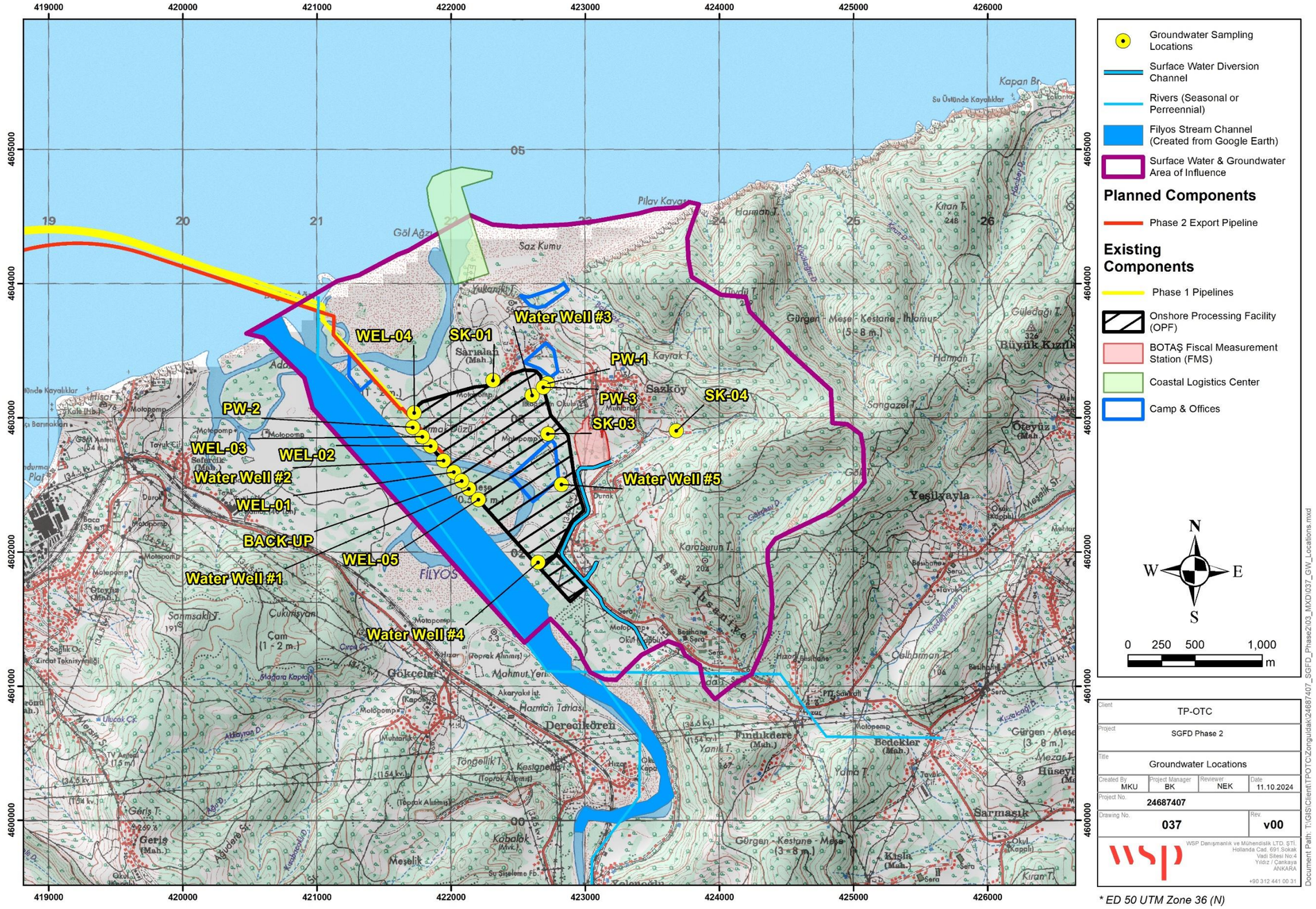
Since the Phase-1 ESIA, groundwater sampling and monitoring studies have been conducted from not only these locations but also WEL-Coded wells and BACK-UP well. The information regarding the additional sampling locations is given in Table 6-29, and the map showing the sampling locations of 2022 sampling program is presented in Figure 6-41.

The results of the physico-chemical parameters measured at the site and the hydrogeochemical characteristics of the groundwater resources in the Project site are discussed in the following sections.

Table 6-29: Additional Groundwater Quality Sampling and Monitoring Locations

Type	ID	Coordinates*		Scope	Location
		X (Easting)	Y (Northing)		
Wells	SK-01	422314.00	4603279.00	ESIA	Project Site Water Supply Well
	SK-03	422723.00	4602881.00	ESIA	Sazköy Water Supply Well.
	SK-04	423681.00	4602903.00	ESIA	Sazköy New Water Supply Well.
Spring	K-01	424645.85	4603309.13	ESIA	Sazköy Spring.
Developed Spring	Ç-01	423062.00	4603249.00	ESIA	Sazköy Fountain. (Being fed from K-01 spring).
	Ç-02	423079.00	4603349.00	ESIA	Sazköy Fountain. (Being fed from the SK-03 well).
	Ç-03	423541.00	4601484.00	ESIA	Aşağı İhsaniye Fountain. (Spring could not be reached).

* ED 50 UTM Zone 36 N



* ED 50 UTM Zone 36 (N)

Figure 6-41: Groundwater Sampling and Monitoring Locations

In-Situ Measurements

pH, Temperature, Specific Electrical Conductivity (EC_{25}) and Dissolved Oxygen (DO) were measured by using a multiparameter water quality meter (Table 6-30) before sampling. According to these measurements, average temperatures varied between 14.23 and 20.29°C. While pH values ranged from 6.28 to 8.51, long-term averages varied between 6.99 and 7.88. Electrical Conductivity at 25°C (EC_{25}) values are between 365 and 12610 µS/cm, with a standard deviation of 2962.96 µS/cm. EC_{25} values greater than 1000 indicate saltwater intrusion. Finally, long-term averages of dissolved oxygen (DO) values varied between 3.50 and 8.41 mg/L.

Table 6-30: Measured In-Situ Parameters of Groundwater Sampling and Monitoring Locations

	BACK-UP	Ç-01	Ç-02	Ç-03	SK-01	SK-04	WaterWell-1	WaterWell-2	WaterWell-3	WaterWell-4	WEL-01	WEL-02	WEL-03	WEL-04	WEL-05
Temperature															
March 2022															
April 2022						16.3									
June 2022								20		26.3		17.7			
September 2022															
January 2023	12.3	12.4	12.4	12.8	11.1						11.1			11.4	12.3
February 2023	17	13.2	14.5	14.6	21.5	11.6		16.8	16.4	21.2	16.6			18.6	16.1
March 2023	17	13.5	13.6	16.4	16.1	12.7		17.5	16.3	22.7	16.8			14.7	16
April 2023	15.1	14.4	14	15.1	14.8						15.1			15.2	14.5
May.23		19.8	16.6	17.8	18.5	19.5			18.6	21.8					17.3
June 2023		27.6	20	17.8	21	28	26.6	26.4	18.8	21.2	26.5	26.4	20.1	26.4	
July 2023	27.3	26.5	27	27.5	27.2			27.6	26.8	26.9	27.4	26.9	27		
August 2023	24.6		25.8	25.8		25.6	24.5	24.4	24.6	24.8	24.5	24.2	23.9	24.7	
September 2023	24.3	21.9		22.4		22.2		24.3	24.3	24.3		24.3	24.3	24.3	
October 2023	20.9	20.2		20.5			20.9				21.2	21.1	20.9	22	20.2
November 2023	16.4	16.2		16.3		16.3	16.1	16.2	16.3	16.1	16	16.2	16	16.2	16.5
December 2023	8	9	9	8		7	8	8	7	7	9	7			8
January 2024	10	10.2	10.5	10			10.1				10.3	9.8	10	9.9	10.4

	BACK-UP	Ç-01	Ç-02	Ç-03	SK-01	SK-04	WaterWell-1	WaterWell-2	WaterWell-3	WaterWell-4	WEL-01	WEL-02	WEL-03	WEL-04	WEL-05
February 2024		11.4	11.2	11		11.1	11	11.2	11.1	10.9	11	11.2	10.6	10.8	11
AVERAGE	**17.54**	**16.64**	**15.87**	**16.86**	**18.6**	**17.03**	**16.74**	**19.24**	**18.02**	**20.29**	**17.13**	**18.48**	**19.1**	**17.65**	**14.23**
pH															
March 2022															
April 2022						7.83									
June 2022								6.76		7.41		6.28			
September 2022															
January 2023	6.98	6.86	6.86	6.72	6.63	7.76		7.6	7.14		6.64			6.57	6.83
February 2023	8.25	7.91	8.06	7.69	7.11	8.17		7.62	7.97	7.2	7.51			7.78	7.76
March 2023	7.52	7.34	6.67	6.86	6.84	7.38		7.55	7.12	7.69	7.21			7.6	7.04
April 2023	7.35	7.59	7.31	7.43	7.41	7.83		7.35	7.06	7.55	7.07			7.4	7.3
May.23		7.55	7.4	7.62	7.4	8.5			7.45	7.25					7.61
June 2023		7.75	7.8	7.43	6.4	8.51	7.67	6.95	7.02	6.66	6.98	6.86	7.35	7.2	
July 2023	7.02	7.17	7.17	6.88	7.17	7.99		7.56	7.46	7.33	7.18	7.23	7.02		
August 2023	7.36		6.93	6.65		7.91	7.46	7.15	7.31	7.49	7.17	6.99	7.06	7.15	
September 2023	7.46	7.16		6.91		7.74		7.3	7.34	7.54		7.11	7.12	7.19	
October 2023	7.31	7.2		6.95			7.55				7.11	7.21	7.18	7.22	7.8
November 2023	7.46	7.33		7.34		7.17	7.56	7.48	7.37	7.4	7.37	7.3	7.35	7.38	7.71
December 2023	7.5	7.51	7.08	7.03		7.56	7.4	7.41	7.35	7.33	7.16	6.99			7.68

	BACK-UP	Ç-01	Ç-02	Ç-03	SK-01	SK-04	WaterWell-1	WaterWell-2	WaterWell-3	WaterWell-4	WEL-01	WEL-02	WEL-03	WEL-04	WEL-05
January 2024	7.31	7.6	7.11	7.06		7.81	7.49	7.46	7.42	7.37	7.27	7.34	6.98	7.36	7.87
February 2024		7.61	7.09	7.17		8.09	7.42	7.47	7.23	7.37	7.37	7.39	7.15	7.44	7.4
AVERAGE	**7.41**	**7.43**	**7.23**	**7.12**	**6.99**	**7.88**	**7.51**	**7.36**	**7.33**	**7.35**	**7.17**	**7.07**	**7.15**	**7.3**	**7.5**
Conductivity @ 25°C															
March 2022		365	815	595	569			1026	678	768					
April 2022						442									
June 2022								1294		744		11440			
September 2022															
January 2023	1003	419	859	700	5700	526		2131	548		5250			930.5	1182
February 2023	895	427	864	703	798	572		3690	796	878	6180			1592	1242
March 2023	964	426	887	694	796	536		4430	794	850	6180			1591	1240
April 2023	1179	421	878	687	798	527		4150	759	846	5210			1665	1240
May.23		413	839	623	774	526			758	893					1236
June 2023		459	942	670	746	605	918	6840	769	857	4690	10850	3470	1741	
July 2023	1128	425	866	692	853	566		6100	837	897	3680	8430	6350		
August 2023	925		570	665		574	785	6090	841	922	4210	10890	9450	11860	
September 2023	876	605		701		856		5730	836	921		11290	9060	12610	
October 2023	845	598		717			726				4250	11200	8895	11850	10560

	BACK-UP	Ç-01	Ç-02	Ç-03	SK-01	SK-04	WaterWell-1	WaterWell-2	WaterWell-3	WaterWell-4	WEL-01	WEL-02	WEL-03	WEL-04	WEL-05
November 2023	990	636		634		635	717	1095	755	851	2480	4880	3980	2990	1059
December 2023	1027	378	766	628		498	779	1695	740	855	2930	10160			919
January 2024	2760	379	855	522		498	1299	1602	739	864	1991	1382	8630	1214	887
February 2024		419	884	684		559	1944	2025	781	923	1654	1639	8460	1291	1938
AVERAGE	**1144.73**	**455**	**835.42**	**661**	**1379.25**	**565.71**	**1024**	**3421.29**	**759.36**	**862.07**	**4058.75**	**8216.1**	**7286.88**	**4484.95**	**2150.3**
Dissolved Oxygen															
March 2022		9.2	7.19	6.93	8.33			5.18	9.37	10.37					
April 2022						5.96									
June 2022								2.28		8.04		1.24			
September 2022															
January 2023	5.37	7.6	7.6	7.29	5.39						3.41			6.18	6.21
February 2023	6.34	8.2	6.02	5.65	8.04	7.2		7.24	11.25	7.22	3.45			4.49	3.31
March 2023	5.85	9.4	6.16	6.2	11.59	7.65		8.48	11.24	7.68	4.88			5.39	3.03
April 2023	9.93	10.45	10.36	10.72	10.83						10.11			10.43	10.41
May.23		8.8	5.05	5.71	9.92	7.45			8.89	4.34					3.94
June 2023		7.03	6.65	5.57	6.24	6.52	0.11	5.6	5.75	5.8	5.4	6.53	1.73	5.86	
July 2023	1.09	6.85	6.58	5.91	6.97			1.98	5.46	6.76	2.19	3.79	2.2		
August 2023	0.69		6.76	6.71		6.8	0.33	1.92	5.33	6.87	0.55	1.83	2.42	2.66	

	BACK-UP	Ç-01	Ç-02	Ç-03	SK-01	SK-04	WaterWell-1	WaterWell-2	WaterWell-3	WaterWell-4	WEL-01	WEL-02	WEL-03	WEL-04	WEL-05
September 2023	4.25	5.66		6.18		6.65		4.19	6.26	7.22		4.12	4.81	4.88	
October 2023	3.95	5.53		6.09			0.85				1.05	4.21	4.76	5	4.03
November 2023	4.56	7		6.55		6.72	4.43	0.93	6.7	7.85	2.55	2.17	6.05	4.52	7.36
December 2023	5.25	8.91	7.52	7.8		7.03	4.73	6.82	8.32	8.53	3.55	3.76			7.64
January 2024	6.18	8.23	6.3	7.25			6.55				2.79	3.08	3.79	5.7	6.81
February 2024		8.47	6.17	6.59		6.44	7.48	5.79	7.39	7.3	5.87	5.02	7.21	6.13	6.98
AVERAGE	**4.86**	**7.95**	**6.86**	**6.74**	**8.41**	**6.84**	**3.5**	**4.58**	**7.81**	**7.33**	**3.82**	**3.58**	**4.12**	**5.57**	**5.97**

Hydrochemical Analysis

In order to characterize the hydrochemistry, the cationic and anionic ratios are examined, as in surface waters. Only samples at which all major ions were analysed were used to determine the water facies. Water facies were classified by plotting charts based on these ratios on a Piper diagram. Before analyzing the data, Charge Balance Errors (CBE) were calculated. All samples collected from groundwaters are within the acceptable range of ±10%.

In the light of these analysis, all samples at which all major ions were analysed were used were Ca-HCO3 type waters except for WaterWell-2 sampled in March 2022 (Mixed(Ca-Mg)-HCO3), SK-04 sampled in April 2022 (Na-HCO3), WaterWell-2 and WEL-02 in June 2022 (Mixed(Ca-Na)-Cl and Na-Cl, respectively) .

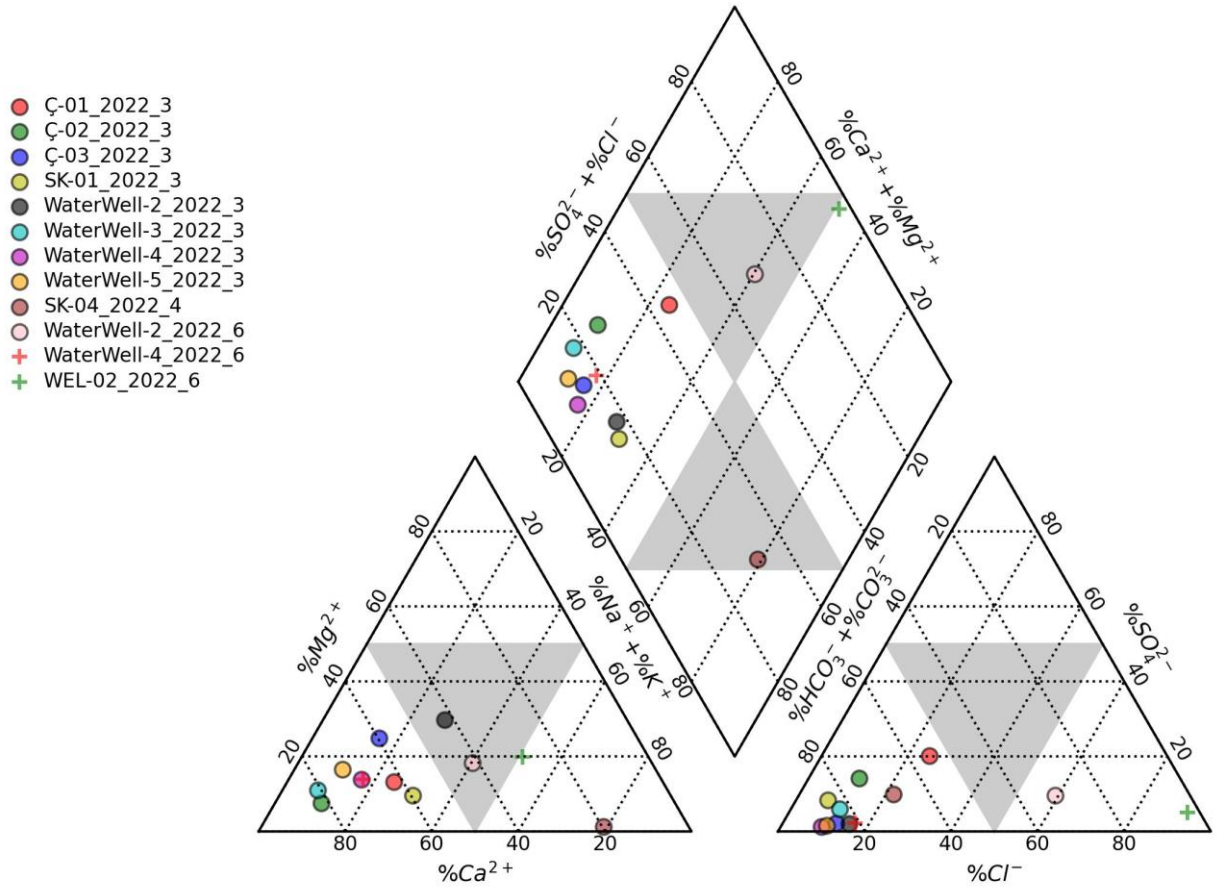


Figure 6-42: Piper Diagram for Groundwater Samples

Table 6-31: Major Ion Concentrations and Charge Balance Errors of Groundwater Samples

Sample		Ç-01	Ç-02	Ç-03	SK-01	WaterWell-2	WaterWell-3	WaterWell-4	WaterWell-5	SK-04	WaterWell-2	WaterWell-4	WEL-02
Year/Month		2022/03	2022/03	2022/03	2022/03	2022/03	2022/03	2022/03	2022/03	2022/04	2022/06	2022/06	2022/06
EC_{25}	µS/cm	365	815	595	569	1026	678	768	682	442	1294	744	11440
Ca^{2+}	mg/L	50.55	141	77.8	72.13	97.72	121.53	112.83	108.71	26.68	119.83	111.01	738.73
	meq/L	2.52	7.04	3.88	3.6	4.88	6.07	5.63	5.43	1.33	5.98	5.54	36.86
	%	62.16	81.79	59.69	59.53	42.13	80.76	69.3	72.38	19.77	41.53	68.87	29.13
Mg^{2+}	mg/L	6.54	7.86	19.65	7.07	42.01	10.12	13.75	15.07	0.99	31.95	13.54	305.07
	meq/L	0.54	0.65	1.62	0.58	3.46	0.83	1.13	1.24	0.08	2.63	1.11	25.1
	%	13.26	7.52	24.86	9.63	29.87	11.09	13.93	16.54	1.22	18.26	13.85	19.84
Na^{+}	mg/L	22.24	19.7	21.22	42.46	72.16	13.49	30.43	18.58	122.03	130.6	31.09	1475.93
	meq/L	0.97	0.86	0.92	1.85	3.14	0.59	1.32	0.81	5.31	5.68	1.35	64.2
	%	23.84	9.96	14.19	30.55	27.12	7.82	16.29	10.78	78.79	39.45	16.81	50.74
K^{+}	mg/L	1.17	2.48	3.2	0.7	4.03	0.96	1.53	0.87	0.6	4.25	1.47	14.24
	meq/L	0.74	0.73	1.26	0.3	0.89	0.33	0.48	0.29	0.22	0.76	0.47	0.29
	%	0.03	0.06	0.08	0.02	0.1	0.03	0.04	0.02	0.02	0.11	0.04	0.36
∑Cations	meq/L	4.06	8.6	6.5	6.05	11.58	7.51	8.13	7.5	6.74	14.4	8.04	126.53
HCO_3^{-}	mg/L	160.8	379.2	290.4	272	497.6	355.6	394.8	388.6	275.6	296	386.2	271.4
	meq/L	2.64	6.22	4.76	4.46	8.16	5.83	6.47	6.37	4.52	4.85	6.33	4.45
	%	54.91	74.12	85.41	84.3	82.58	82.76	89.3	87.98	68.35	31.09	81.1	2.89
CO_3^{2-}	mg/L	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
	meq/L	0	0	0	0	0	0	0	0	0	0	0	0
	%	0	0	0	0	0	0	0	0	0	0	0	0
Cl^{-}	mg/L	42.4	34.7	24.3	13.6	53.7	27.9	24.3	26.9	50.9	328	46.2	5026

Sample		Ç-01	Ç-02	Ç-03	SK-01	WaterWell-2	WaterWell-3	WaterWell-4	WaterWell-5	SK-04	WaterWell-2	WaterWell-4	WEL-02
Year/Month		2022/03	2022/03	2022/03	2022/03	2022/03	2022/03	2022/03	2022/03	2022/04	2022/06	2022/06	2022/06
	meq/L	1.2	0.98	0.69	0.38	1.52	0.79	0.69	0.76	1.44	9.25	1.3	141.77
	%	24.92	11.68	12.29	7.26	15.34	11.18	9.45	10.48	21.73	59.29	16.7	92.09
SO_4^{2-}	mg/L	46.5	57.2	6.13	21.4	9.87	20.5	4.31	5.33	31.5	72.1	8.27	371
	meq/L	0.97	1.19	0.13	0.45	0.21	0.43	0.09	0.11	0.66	1.5	0.17	7.72
	%	20.17	14.2	2.3	8.43	2.08	6.06	1.24	1.53	9.93	9.62	2.2	5.02
∑Anions	meq/L	4.8	8.38	5.57	5.29	9.88	7.04	7.24	7.24	6.61	15.6	7.8	153.94
CBE (%)		-8.35	1.3	7.71	6.7	7.92	3.23	5.79	1.76	0.97	-4	1.52	-9.77
Water Facies		Ca-HCO3	Ca-HCO3	Ca-HCO3	Ca-HCO3	Mixed(Ca-Mg)-HCO3	Ca-HCO3	Ca-HCO3	Ca-HCO3	Na-HCO3	Mixed(Ca-Na)-Cl	Ca-HCO3	Na-Cl

Groundwater Quality

The quality of the groundwater was determined by considering whether the measured values of the specified parameters exceed the quality standards. Within the scope of this study, groundwater quality standards and drinking water quality standards were used to examine groundwater quality.

Regulation on the Protection of Groundwater against Pollution and Deterioration

To evaluate groundwater quality, samples were examined in compliance with the Regulation on the Protection of Groundwater against Pollution and Deterioration" (hereinafter referred to as "Groundwater Protection Regulation, GPR"). This regulation establishes the basic conditions for ensuring the protection and preventing pollution and deterioration of the existing groundwater quality in good status, for improving the quality of the groundwater in bad status. The regulation states that the number and the types of parameters, and the threshold value to be determined for each parameter, will predicate on the groundwater body itself, taking into account the specific conditions that prevail at each groundwater body. According to the regulation, the groundwater quality standards and the threshold values, which indicate that the groundwater is in good status, are determined by the General Directorate of Water Management (Su Yönetimi Genel Müdürlüğü - SYGM).

The list of minimum parameters to be taken into consideration when setting the threshold values presented in Annex 3 (Guide for Groundwater Pollutants and Threshold Values for Pollution Symptoms) of the PGPD, which was published on April 07, 2012, and amended on May 12, 2023, to incorporate Nitrites and Phosphates thereto, is provided in Table 3. The limits for nitrates and active substances in pesticides are provided in Table 4.

Table 6-32: List of Minimum Parameters to be Considered as per the YSKBKKHY

Parameters			
Arsenic	Lead	Ammonium	Sulphate
Cadmium	Mercury	Chloride	Trichloroethylene
Tetrachloroethylene	Electrical Conductivity	Nitrite	Total Phosphorus / Phosphates

Table 6-33: Groundwater Quality Standards (YSKBKKHY Appendix 2)

Pollutant	Quality Standards
Nitrates	50 mg/L
Relevant metabolites, active matters in pesticides, including degradation and reactive products	0.1 µg/L 0.5 µg/L (total)*

The analysis results of the list of minimum parameters to be taken into consideration are presented in Table 6-34.

Table 6-34: Concentrations of Measured Groundwater Quality Regulation Parameters from March 2022 to February 2024

Term	Unit	LoQ	BACK-UP	Ç-01	Ç-02	Ç-03	SK-01	SK-04	WaterWell-1	WaterWell-2	WaterWell-3	WaterWell-4	WaterWell-5	WEL-01	WEL-02	WEL-03	WEL-04	WEL-05
March 2022																		
Ammonium	mg/L	<0.021		<0.021	<0.021	<0.021	<0.021			7.17	<0.021	<0.021	<0.021					
Ammonium Nitrogen	mg/L	<0.016		<0.016	<0.016	<0.016	<0.016			5.56	<0.016	<0.016	<0.016					
Arsenic (As)	µg/L	<0.5		<0.5	<0.5	<0.5	3.95142			13.84007	<0.5	<0.5	<0.5					
Cadmium (Cd)	µg/L	<0.5		<0.5	<0.5	<0.5	<0.5			<0.5	<0.5	<0.5	<0.5					
Chloride (Cl-)	mg/L	<1		42.4	34.7	24.3	13.6			53.7	27.9	24.3	26.9					
Conductivity @ 25°C	µS/cm	0		365	815	595	569			1026	678	768	682					
Lead (Pb)	µg/L	<0.5		<0.5	<0.5	<0.5	<0.5			<0.5	<0.5	<0.5	<0.5					
Mercury (Hg)	mg/L	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001					
Nitrate	mg/L	<0.45		0.822	34.2	0.538	7.49			<0.45	13.9	6.34	0.751					
Nitrate Nitrogen	mg/L	<0.1		0.186	7.72	0.121	1.69			<0.1	3.14	1.43	0.17					
Nitrite	mg/L	<0.002		<0.002	<0.002	<0.002	<0.002			0.019	<0.002	<0.002	0.055					
Nitrite Nitrogen	mg/L	<0.002		<0.002	<0.002	<0.002	<0.002			0.006	<0.002	<0.002	0.017					
Pesticides	µg/L	<0.005		<0.005	<0.005	<0.005	<0.005			<0.005	<0.005	<0.005	<0.005					
Sulphate	mg/L	<1		46.5	57.2	6.13	21.4			9.87	20.5	4.31	5.33					
Tetrachloroethylene	µg/L	<0.1		<0.1	<0.1	<0.1	<0.1			<0.1	<0.1	<0.1	<0.1					
Total Phosphorous	mg/L	<0.005		0.02335	0.00803	0.03396	0.05056			0.37762	<0.005	0.03707	0.01991					
Trichloroethylene	µg/L	<0.1		<0.1	<0.1	<0.1	<0.1			<0.1	<0.1	<0.1	<0.1					
April 2022																		
Ammonium	mg/L	<0.021						<0.021										
Ammonium Nitrogen	mg/L	<0.016						<0.016										
Arsenic (As)	µg/L	<0.5						2.34256										
Cadmium (Cd)	µg/L	<0.5						<0.5										
Chloride (Cl-)	mg/L	<1						50.9										
Conductivity @ 25°C	µS/cm	0						442										
Lead (Pb)	µg/L	<0.5						3.62967										
Mercury (Hg)	mg/L	<0.0001						<0.0001										
Nitrate	mg/L	<0.45						<0.45										
Nitrate Nitrogen	mg/L	<0.1						<0.1										
Nitrite	mg/L	<0.002						<0.002										
Nitrite Nitrogen	mg/L	<0.002						<0.002										
Pesticides	µg/L	<0.005						<0.005										
Sulphate	mg/L	<1						31.5										
Tetrachloroethylene	µg/L	<0.1						<0.1										
Total Phosphorous	mg/L	<0.005						0.01424										
Trichloroethylene	µg/L	<0.1						<0.1										
June 2022																		
Ammonium	mg/L	<0.021								2.28		<0.021			10.6			
Ammonium Nitrogen	mg/L	<0.016								1.84		<0.016			8.27			
Arsenic (As)	µg/L	<0.5								4.63228		<0.5			1.92486			
Cadmium (Cd)	µg/L	<0.5								<0.5		<0.5			<0.5			
Chloride (Cl-)	mg/L	<1								328		46.2			5026			
Conductivity @ 25°C	µS/cm	0								1294		744			11440			
Lead (Pb)	µg/L	<0.5								13.61229		1.15635			1.10776			
Mercury (Hg)	mg/L	<0.0001								<0.0001		<0.0001			<0.0001			
Nitrate	mg/L	<0.45								0.64		8.12			5.16			

Term	Unit	LoQ	BACK-UP	Ç-01	Ç-02	Ç-03	SK-01	SK-04	WaterWell-1	WaterWell-2	WaterWell-3	WaterWell-4	WaterWell-5	WEL-01	WEL-02	WEL-03	WEL-04	WEL-05
Nitrate Nitrogen	mg/L	<0.1								0.145		1.83			1.16			
Nitrite	mg/L	<0.002								<0.002		<0.002			<0.002			
Nitrite Nitrogen	mg/L	<0.002								<0.002		<0.002			<0.002			
Pesticides	µg/L	<0.005								<0.005		<0.005			<0.005			
Sulphate	mg/L	<1								72.1		8.27			371			
Tetrachloroethylene	µg/L	<0.1								<0.1		<0.1			<0.1			
Total Phosphorous	mg/L	<0.005								0.13829		0.4923			0.094			
Trichloroethylene	µg/L	<0.1								<0.1		<0.1			<0.1			
Jan. 2023																		
Ammonium	mg/L	<0.021	0.113	<0.021	<0.021	<0.021	7.07	0.049		5.04	<0.021			5.59			0.0195	<0.021
Arsenic (As)	µg/L	<0.5	3.4	<0.5	<0.5	<0.5	19.8	2.55		3.6	<0.5			15.7			0.55	<0.5
Cadmium (Cd)	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5			<0.5			<0.5	<0.5
Chloride (Cl-)	mg/L	<1	84	19.1	33	49.4	2125	46.17		523	40.14			1893			87.1	63.2
Conductivity @ 25°C	µS/cm	0	1003	419	859	700	5700	526		2131	548			5250			930.5	1182
Lead (Pb)	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5			<0.5			<0.5	<0.5
Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001	<0.0001			<0.0001			<0.0001	<0.0001
Nitrate	mg/L	<0.45	<0.45	<0.45	20.2	0.567	<0.45	<0.45		<0.45	24.2			<0.45			1.81	1.52
Nitrite	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002		<0.002	<0.002			<0.002			<0.002	<0.002
Pesticides	µg/L	<0.005						<0.005		<0.005	<0.005						<0.005	
Sulphate	mg/L	<1	62.6	15.9	39.4	7.92	103	20.41		24.1	29.4			89.6			40.035	116.6
Tetrachloroethylene	µg/L	<0.1						<0.1		<0.1	<0.1						<0.1	
Trichloroethylene	µg/L	<0.1						<0.1		<0.1	<0.1						<0.1	
Feb. 2023																		
Ammonium	mg/L	<0.021	0.14	<0.021	<0.021	<0.021	<0.021	<0.021		5.54	<0.021	<0.021		6.85			<0.021	<0.021
Arsenic (As)	µg/L	<0.5	4.2	1.22	<0.5	1.003	<0.5	5.46		8.4	<0.5	<0.5		23			1.6	1.3
Cadmium (Cd)	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5		0.42			<0.5	0.3
Chloride (Cl-)	mg/L	<1	86	19	30	48.2	31.7	48.6		1166	32	53.7		2116			275	60
Conductivity @ 25°C	µS/cm	0	895	427	864	703	798	572		3690	796	878		6180			1592	1242
Lead (Pb)	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5		<0.5			<0.5	<0.5
Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001		<0.0001			<0.0001	<0.0001
Nitrate	mg/L	<0.45	<0.45	0.488	19.92	0.559	22.63	<0.45		<0.45	22.71	3.45		<0.45			9.71	4.67
Nitrite	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002		<0.002	<0.002	<0.002		<0.002			<0.002	<0.002
Sulphate	mg/L	<1	65	16.8	44.8	7.2	28.6	25.4		52.5	29	6.5		105			190	155
March 2023																		
Ammonium	mg/L	<0.021	0.133	<0.021	<0.021	<0.021	<0.021	<0.021		4.68	<0.021	<0.021		3.99			<0.021	<0.021
Arsenic (As)	µg/L	<0.5	2.3	1.3	<0.5	<0.5	<0.5	3.7		9.64	<0.5	9		12.4			1.7	<0.5
Cadmium (Cd)	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5		<0.5			<0.5	<0.5
Chloride (Cl-)	mg/L	<1	72.2	15.1	22	36.6	25	26		1141	22.4	40		1652			227	46
Conductivity @ 25°C	µS/cm	0	964	426	887	694	796	536		4430	794	850		6180			1591	1240
Lead (Pb)	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5		<0.5			<0.5	<0.5
Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001		<0.0001			<0.0001	<0.0001
Nitrate	mg/L	<0.45	<0.45	<0.45	19.8	0.725	24.2	<0.45		<0.45	22.4	4.61		<0.45			8.75	2.26
Nitrite	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002		<0.002	<0.002	<0.002		<0.002			<0.002	<0.002
Sulphate	mg/L	<1	73.2	17.6	44.5	7.84	27	23		73.2	23.7	11		114			179	156
April 2023																		
Ammonium	mg/L	<0.021	0.17	<0.021	<0.021	<0.021	<0.021	<0.021		4.79	<0.021	<0.021		9.23			0.087	<0.021
Arsenic (As)	µg/L	<0.5	2	1.2	<0.5	<0.5	<0.5	3.38		10	<0.5	1.2		8.9			2.4	1.04

Term	Unit	LoQ	BACK-UP	Ç-01	Ç-02	Ç-03	SK-01	SK-04	WaterWell-1	WaterWell-2	WaterWell-3	WaterWell-4	WaterWell-5	WEL-01	WEL-02	WEL-03	WEL-04	WEL-05
Cadmium (Cd)	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5		<0.5			<0.5	<0.5
Chloride (Cl-)	mg/L	<1	72.1	16.3	21.3	35.2	20.6	29.2		1145	20.9	43.5		1448			214	44.3
Conductivity @ 25°C	µS/cm	0	1179	421	878	687	798	527		4150	759	846		5210			1665	1240
Lead (Pb)	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5		<0.5			<0.5	<0.5
Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001		<0.0001			<0.0001	<0.0001
Nitrate	mg/L	<0.45	<0.45	<0.45	18.43	<0.45	19.8	<0.45		<0.45	20.1	3.05		<0.45			13.11	0.55
Nitrite	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002		<0.002	<0.002	<0.002		<0.002			<0.002	<0.002
Pesticides	µg/L	<0.005						<0.005		<0.005	<0.005	<0.005						
Sulphate	mg/L	<1	70	17	40	6.8	20.8	21.8		75	30.7	6.54		91.8			177	131
Tetrachloroethylene	µg/L	<0.1						<0.1		<0.1	<0.1	<0.1						
Trichloroethylene	µg/L	<0.1						<0.1		<0.1	<0.1	<0.1						
May 2023																		
Ammonium	mg/L	<0.021		<0.021	<0.021	<0.021	<0.021	<0.021			<0.021	<0.021						<0.021
Arsenic (As)	µg/L	<0.5		1.2	<0.5	<0.5	<0.5	3.1			<0.5	<0.5						<0.5
Cadmium (Cd)	µg/L	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5			<0.5	<0.5						<0.5
Chloride (Cl-)	mg/L	<1		16.4	43.4	41.3	25.3	31.6			25.3	49.6						51
Conductivity @ 25°C	µS/cm	0		413	839	623	774	526			758	893						1236
Lead (Pb)	µg/L	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5			<0.5	<0.5						<0.5
Mercury (Hg)	mg/L	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001						<0.0001
Nitrate	mg/L	<0.45		<0.45	32.8	<0.45	20.9	<0.45			20.3	3.29						3.25
Nitrite	mg/L	<0.002		<0.002	<0.002	<0.002	<0.002	<0.002			<0.002	<0.002						<0.002
Sulphate	mg/L	<1		15.8	70.1	7.3	22.2	21.2			22.52	6.45						139
June 2023																		
Ammonium	mg/L	<0.021		<0.021	<0.021	<0.021	<0.021	<0.021	2.89	5.91	<0.021	<0.021		4.5	7.457	2.18	0.657	
Arsenic (As)	µg/L	<0.5		1.1	<0.5	<0.5	<0.5	3.2	8.2	12	9.1	<0.5		7.7	19.4	17.1	1.1	
Cadmium (Cd)	µg/L	<0.5		<0.5	<0.5	0.326	<0.5	<0.5	<0.5	0.367	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	
Chloride (Cl-)	mg/L	<1		17.6	28.1	37.3	29.8	43.1	34	2325	29.7	52		1444	3124	3606	256	
Conductivity @ 25°C	µS/cm	0		459	942	670	746	605	918	6840	769	857		4690	10850	3470	1741	
Lead (Pb)	µg/L	<0.5		<0.5	<0.5	3.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	
Mercury (Hg)	mg/L	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	
Nitrate	mg/L	<0.45		<0.45	18.6	<0.45	20.7	<0.45	<0.45	<0.45	20.4	3		<0.45	<0.45	<0.45	3.99	
Nitrite	mg/L	<0.002		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002		<0.002	0.07	26.4	3.46	
Sulphate	mg/L	<1		15.4	38.8	6.75	22.5	22.4	2.3	135	22.6	6.05		79.1	340.7	156	158	
July 2023																		
Ammonium	mg/L	<0.021	5.63	<0.021	<0.021	<0.021	<0.021	<0.021		3.65	<0.021	<0.021		4.12	2.84	5.64		
Arsenic (As)	µg/L	<0.5	9.3	1.56	<0.5	<0.5	<0.5	3.02		11	<0.5	1.04		7	8.8	15.6		
Cadmium (Cd)	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5		
Chloride (Cl-)	mg/L	<1	0.63	18.3	25.5	41.5	38	37.2		2000	37.5	56		1141	2449	2935		
Conductivity @ 25°C	µS/cm	0	1128	425	866	692	853	566		6100	837	897		3680	8430	6350		
Lead (Pb)	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5		
Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001		
Nitrate	mg/L	<0.45	0.558	<0.45	17	<0.45	20.2	<0.45		1.07	19.9	3.05		0.642	<0.45	1.9		
Nitrite	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002		<0.002	<0.002	<0.002		<0.002	<0.002	<0.002		
Pesticides	µg/L	<0.005						<0.005										
Sulphate	mg/L	<1	0.184	16.8	43.4	7.9	23.3	24.1		119	22.9	6.61		71.3	293	139		
Tetrachloroethylene	µg/L	<0.1						<0.1										
Trichloroethylene	µg/L	<0.1						<0.1										

Term	Unit	LoQ	BACK-UP	Ç-01	Ç-02	Ç-03	SK-01	SK-04	WaterWell-1	WaterWell-2	WaterWell-3	WaterWell-4	WaterWell-5	WEL-01	WEL-02	WEL-03	WEL-04	WEL-05
August 2023																		
Ammonium	mg/L	<0.021	2.65		0.031	<0.021		<0.021	2.19	4.596	<0.021	<0.021		4.288	6.075	5.779	4.397	
Arsenic (As)	µg/L	<0.5	3.73		1.16	<0.5		3.8	5.2	14.3	<0.5	<0.5		8.5	27	20.7	22.6	
Cadmium (Cd)	µg/L	<0.5	<0.5		<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	
Chloride (Cl-)	mg/L	<1	54.4		27.6	40.1		41.4	20.3	2069	37.5	60.2		1279	704	2849	3599	
Conductivity @ 25°C	µS/cm	0	925		570	665		574	785	6090	841	922		4210	10890	9450	11860	
Lead (Pb)	µg/L	<0.5	<0.5		<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	
Mercury (Hg)	mg/L	<0.0001	<0.0001		<0.0001	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	
Nitrate	mg/L	<0.45	<0.45		12.45	<0.45		<0.45	<0.45	<0.45	20.7	1.92		<0.45	<0.45	<0.45	<0.45	
Nitrite	mg/L	<0.002	<0.002		<0.002	<0.002		<0.002	<0.002	<0.002	<0.002	<0.002		<0.002	<0.002	<0.002	<0.002	
Sulphate	mg/L	<1	3.3		37	9.52		22	<1	117	18.1	7.14		62.6	284.5	169.1	456.5	
Sept 2023																		
Ammonium	mg/L	<0.021	3.79	<0.021		<0.021		<0.021		5.27	<0.021	<0.021			7.92	7.01	5.85	
Arsenic (As)	µg/L	<0.5	11	1.64		<0.5		3.72		14.4	<0.5	<0.5			34	25	32.3	
Cadmium (Cd)	µg/L	<0.5	<0.5	<0.5		<0.5		<0.5		<0.5	<0.5	<0.5			<0.5	<0.5	<0.5	
Chloride (Cl-)	mg/L	<1	43.2	16.7		42		37.4		2059	32	56			3749	2849	4249	
Conductivity @ 25°C	µS/cm	0	876	605		701		856		5730	836	921			11290	9060	12610	
Lead (Pb)	µg/L	<0.5	<0.5	<0.5		<0.5		<0.5		<0.5	<0.5	<0.5			<0.5	<0.5	<0.5	
Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001		<0.0001		<0.0001		<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	
Nitrate	mg/L	<0.45	<0.45	<0.45		<0.45		<0.45		<0.45	18.06	2.57			<0.45	<0.45	<0.45	
Nitrite	mg/L	<0.002	<0.002	<0.002		<0.002		0.33		<0.002	<0.002	<0.002			<0.002	0.01	0.01	
Sulphate	mg/L	<1	<1	15.5		7.9		21.4		312	19.7	12.4			242	101	369	
Oct 2023																		
Ammonium	mg/L	<0.021	4.3	0.1		<0.021			3.01					4.6	4.9	5.62	1.03	5
Arsenic (As)	µg/L	<0.5	4.6	1.15		<0.5			1.92					5.59	8.38	13.7	20.7	18.8
Cadmium (Cd)	µg/L	<0.5	<0.5	<0.5		<0.5			<0.5					<0.5	<0.5	<0.5	<0.5	<0.5
Chloride (Cl-)	mg/L	<1	94.2	19.6		46.6			40.9					1442	1450	2499	4149	3949
Conductivity @ 25°C	µS/cm	0	845	598		717			726					4250	11200	8895	11850	10560
Lead (Pb)	µg/L	<0.5	<0.5	<0.5		<0.5			<0.5					<0.5	<0.5	<0.5	<0.5	<0.5
Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001		<0.0001			<0.0001					<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nitrate	mg/L	<0.45	<0.45	<0.45		<0.45			<0.45					<0.45	<0.45	<0.45	<0.45	1.4
Nitrite	mg/L	<0.002	<0.002	<0.002		<0.002			<0.002					<0.002	14.3	17.5	0.015	7.82
Sulphate	mg/L	<1	1.34	15.5		7.45			<1					60.8	271	141	467	428
Nov 2023																		
Ammonium	mg/L	<0.021	2.73	<0.021		<0.021		<0.021	2.12	2.98	<0.021	<0.021		5.12	5.72	5.82	1.78	<0.021
Arsenic (As)	µg/L	<0.5	7	<0.5		<0.5		<0.5	1.96	1.8	<0.5	<0.5		4.7	13.6	10	6.6	1.6
Cadmium (Cd)	µg/L	<0.5	<0.5	<0.5		<0.5		<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5
Chloride (Cl-)	mg/L	<1	162	47.2		48.5		48	39.4	214	39	74		844	2071	1621	1074	61.1
Conductivity @ 25°C	µS/cm	0	990	636		634		635	717	1095	755	851		2480	4880	3980	2990	1059
Lead (Pb)	µg/L	<0.5	<0.5	<0.5		<0.5		<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5
Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001		<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nitrate	mg/L	<0.45	<0.45	<0.45		<0.45		<0.45	<0.45	<0.45	20.9	2.18		<0.45	<0.45	<0.45	<0.45	<0.45
Nitrite	mg/L	<0.002	<0.002	<0.002		<0.002		<0.002	<0.002	<0.002	<0.002	<0.002		<0.002	<0.002	<0.002	<0.002	<0.002
Sulphate	mg/L	<1	4.4	7.3		9.6		7.2	<1	10.2	19.6	6.6		31	115	56	142	135
Dec 2023																		
Ammonium	mg/L	<0.021	3.12	<0.021	<0.021	<0.021		<0.021	2.78	3.11	<0.021	<0.021		7.21	7.84			<0.021
Arsenic (As)	µg/L	<0.5	5.5	<0.5	<0.5	<0.5		3	8.34	7.3	<0.5	<0.5		7.4	26.6			1.58

Term	Unit	LoQ	BACK-UP	Ç-01	Ç-02	Ç-03	SK-01	SK-04	WaterWell-1	WaterWell-2	WaterWell-3	WaterWell-4	WaterWell-5	WEL-01	WEL-02	WEL-03	WEL-04	WEL-05
Cadmium (Cd)	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5			<0.5
Chloride (Cl-)	mg/L	<1	178	21.9	26.1	48.6		34.6	56	518	38.7	78.6		1051	3799			57.2
Conductivity @ 25°C	µS/cm	0	1027	378	766	628		498	779	1695	740	855		2930	10160			919
Lead (Pb)	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5			<0.5
Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001	<0.0001			<0.0001
Nitrate	mg/L	<0.45	<0.45	0.504	17.8	0.545		<0.45	<0.45	<0.45	20.8	2.73		<0.45	<0.45			<0.45
Nitrite	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002		<0.002	<0.002	<0.002	<0.002	<0.002		<0.002	0.01			<0.002
Sulphate	mg/L	<1	8.67	17.6	38.3	8.62		22.2	5.4	26.5	21.3	6.7		96.4	253			165
Jan 2024																		
Ammonium	mg/L	<0.021	5.02	<0.021	<0.021	<0.021		<0.021	3.65	2.46	<0.021	<0.021		3.89	0.552	7.79	0.662	<0.021
Arsenic (As)	µg/L	<0.5	8.9	1.8	<0.5	<0.5		3.5	7.93	5.7	<0.5	<0.5		3.85	3.28	20.6	4.3	1.7
Cadmium (Cd)	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5
Chloride (Cl-)	mg/L	<1	793	84.3	28	36.4		24.4	241	355	45.3	63		418	233	3799	382	41.8
Conductivity @ 25°C	µS/cm	0	2760	379	855	522		498	1299	1602	739	864		1991	1382	8630	1214	887
Lead (Pb)	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5
Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nitrate	mg/L	<0.45	<0.45	<0.45	20.1	<0.45		<0.45	<0.45	1.05	18.7	3.35		<0.45	<0.45	1.07	<0.45	3.57
Nitrite	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002		<0.002	<0.002	<0.002	<0.002	<0.002		<0.002	<0.002	0.099	<0.002	<0.002
Pesticides	µg/L	<0.005						<0.005		<0.005	<0.005	<0.005						
Sulphate	mg/L	<1	56.3	20	45	12.8		30.3	11.1	20.7	22.3	7.8		101	85	197.8	55.4	163
Tetrachloroethylene	µg/L	<0.1						<0.1		<0.1	<0.1	<0.1						
Trichloroethylene	µg/L	<0.1						<0.1		<0.1	<0.1	<0.1						
Feb 2024																		
Ammonium	mg/L	<0.021		<0.021	<0.021	<0.021		<0.021	4.41	4.42	<0.021	<0.021		4.78	5.23	5.28	0.411	<0.021
Arsenic (As)	µg/L	<0.5		1.2	<0.5	<0.5		4.5	6.7	4.9	<0.5	<0.5		1.8	2.8	21	1.8	6.3
Cadmium (Cd)	µg/L	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5
Chloride (Cl-)	mg/L	<1		18	25.8	38.4		48.1	438	481	23.7	63.6		243	258	3549	141	431
Conductivity @ 25°C	µS/cm	0		419	884	684		559	1944	2025	781	923		1654	1639	8460	1291	1938
Lead (Pb)	µg/L	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5
Mercury (Hg)	mg/L	<0.0001		<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nitrate	mg/L	<0.45		<0.45	22	0.87		<0.45	<0.45	<0.45	18.3	2.4		<0.45	<0.45	<0.45	<0.45	<0.45
Nitrite	mg/L	<0.002		<0.002	<0.002	<0.002		<0.002	<0.002	<0.002	<0.002	<0.002		<0.002	<0.002	0.015	<0.002	<0.002
Sulphate	mg/L	<1		17	40.1	8.6		25.2	25.8	24.5	17.9	8.4		87.1	96.6	149	50.7	25.3

Drinking Water Standards

In addition to protecting groundwater from deterioration, the drinking water legislation has taken into consideration for groundwater sampling points that are used for domestic purposes. The drinking water standards for the Project are set by taking into consideration the legislation listed below.

- Regulation on Water for Human Consumption (RWHC), published on the Official Gazette No. 25730 – Date: 17.02.2005 (Amended: Official Gazette No. 12.05.2023 – Date: 32188).
- Guidelines for Drinking-Water Quality: Fourth Edition, published by World Health Organization (WHO) (Date: 21.03.2022).

According to the analysis, Ammonium, Chromium, Lead, Mercury, Nitrite and Selenium are the most frequent exceeding parameters. While Clostridia (Searching and Counting of Sulphite Reducing Spores), Clostridium Perfringens, Escherichia Coli, Pathogen Staphylococcus and Pseudomonas Aeruginosa were observed at SK-04, WaterWell-2, WaterWell-3, WaterWell-4 and WEL-04 multiple times, Total and Fecal Coliform Bacteria were observed at nearly all sampling locations at least once (Figure 6-43, Table 6-35).

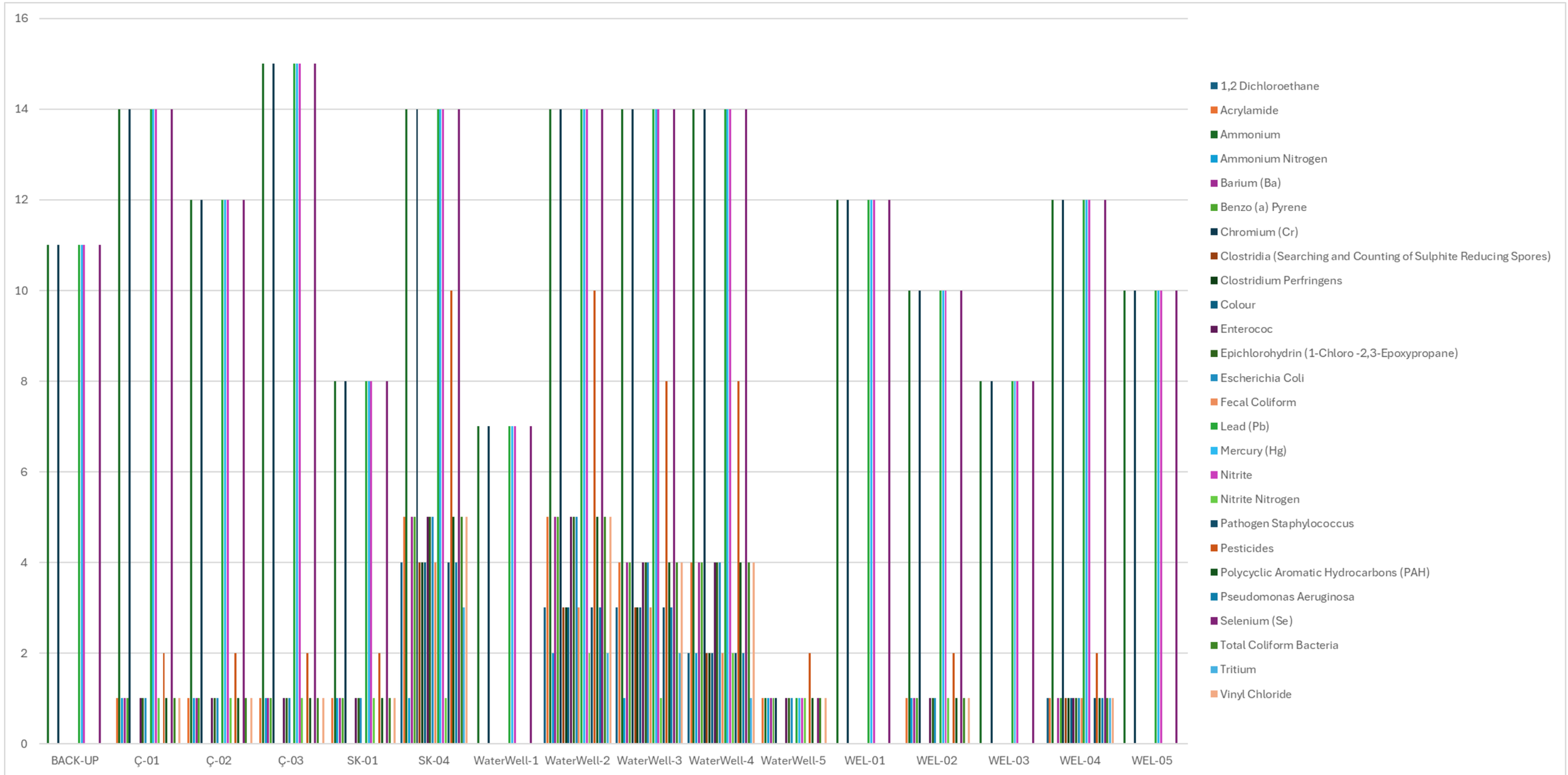


Figure 6-43: Frequency of the Exceeding Drinking Water Parameters

Table 6-35: Drinking Water Quality Assessment

Parameters	Unit	Drinking Water Limit	LoQ	BACK-UP	Ç-01	Ç-02	Ç-03	SK-01	SK-04	WaterWell-1	WaterWell-2	WaterWell-3	WaterWell-4	WaterWell-5	WEL-01	WEL-02	WEL-03	WEL-04	WEL-05
March 2022																			
Acrylamide	µg/L	0.100	<0.1																
Aluminium (Al)	mg/L	200.000	<0.02		0.06066	0.06066	0.09159	0.46678			0.12098	0.02032	0.02032	0.02032					
Ammonium	mg/L	0.500	<0.021								7.17	7.17	7.17	7.17					
Ammonium Nitrogen	mg/L	0.388	<0.016								5.56	5.56	5.56	5.56					
Antimony (Sb)	µg/L	5.000	<0.5																
Arsenic (As)	µg/L	10.000	<0.5					3.95142			13.84007	13.84007	13.84007	13.84007					
Barium (Ba)	mg/L	0.700	<0.005			0.10226	0.01536	0.01141			0.23659	0.13718	0.076	0.08526					
Benzene	µg/L	1.000	<0.1																
Benzo (a) Pyrene	µg/L	0.010	<0.005																
Boron (B)	mg/L	1.000	<0.02			0.02369	0.02369	0.07121			0.26852	0.26852	0.26852	0.26852					
Cadmium (Cd)	µg/L	3.000	<0.5																
Chloride (Cl-)	mg/L	250.000	<1		42.4	34.7	24.3	13.6			53.7	27.9	24.3	26.9					
Chromium (Cr)	mg/L	0.025	<0.001																
Conductivity @ 25°C	µS/cm	2750.000	0		365	815	595	569			1026	678	768	682					
Copper (Cu)	mg/L	2.000	<0.001																
Enterococ	CFU/100 mL	0.000	0			2	2	160											
Epichlorohydrin (1-Chloro -2,3-Epoxypropane)	µg/L	0.100	<0.1																
Escherichia Coli	CFU/250 mL	0.000	0			2	2	200											
Fluoride	mg/L	1.500	<0.1		0.164	0.191	0.191	0.152				0.189	0.189	0.411					
Iron (Fe)	µg/L	200.000	<5		32.06863	32.06863	53.073 2	745.1251 7			1250.34966	25.26474	12.23882	25.62363					
Lead (Pb)	µg/L	0.005	<0.5																
Manganese (Mn)	µg/L	50.000	<0.5		0.85692	0.85692	0.95007	23.33794			232.32106	1.76082	31.69242	1026.67264					
Mercury (Hg)	mg/L	0.001	<0.000 1																
Nickel (Ni)	µg/L	20.000	<5																
Nitrate	mg/L	50.000	<0.45		0.822	34.2	0.538	7.49				13.9	6.34	0.751					
Nitrate Nitrogen	mg/L	11.295	<0.1		0.186	7.72	0.121	1.69				3.14	1.43	0.17					
Nitrite	mg/L	0.500	<0.002								0.019	0.019	0.019	0.055					
Nitrite Nitrogen	mg/L	0.152	<0.002								0.006	0.006	0.006	0.017					
Pesticides	µg/L	0.500	<0.005																
Polycyclic Aromatic Hydrocarbons (PAH)	µg/L	0.000	<0.005																
Selenium (Se)	µg/L	0.010	<0.5					0.60729											
Sodium (Na)	mg/L	200.000	<0.05		22.2351	19.7024 6	21.2178	42.45972			72.16451	13.49467	30.42694	18.58402					
Sulphate	mg/L	250.000	<1		46.5	57.2	6.13	21.4			9.87	20.5	4.31	5.33					
Tetrachloroethylene	µg/L	10.000	<0.1																
Total Coliform Bacteria	CFU/100ml	0.000	0		60	340	50	600			2100	2100	140	140					
Trichloroethylene	µg/L	10.000	<0.1																
Trihalomethane	µg/L	100.000	<0.1																
Vinyl Chloride	µg/L	0.300	<0.1																

Parameters	Unit	Drinking Water Limit	LoQ	BACK-UP	Ç-01	Ç-02	Ç-03	SK-01	SK-04	WaterWell-1	WaterWell-2	WaterWell-3	WaterWell-4	WaterWell-5	WEL-01	WEL-02	WEL-03	WEL-04	WEL-05
April 2022																			
Acrylamide	µg/L	0.100	<0.1																
Aluminium (Al)	mg/L	200.000	<0.02						0.09473										
Ammonium	mg/L	0.500	<0.021																
Ammonium Nitrogen	mg/L	0.388	<0.016																
Antimony (Sb)	µg/L	5.000	<0.5																
Arsenic (As)	µg/L	10.000	<0.5						2.34256										
Barium (Ba)	mg/L	0.700	<0.005						0.02207										
Benzene	µg/L	1.000	<0.1																
Benzo (a) Pyrene	µg/L	0.010	<0.005																
Boron (B)	mg/L	1.000	<0.02						0.59378										
Cadmium (Cd)	µg/L	3.000	<0.5																
Chloride (Cl-)	mg/L	250.000	<1						50.9										
Chromium (Cr)	mg/L	0.025	<0.001																
Conductivity @ 25°C	µS/cm	2750.000	0						442										
Copper (Cu)	mg/L	2.000	<0.001						0.00217										
Enterococ	CFU/100 mL	0.000	0																
Epichlorohydrin (1-Chloro -2,3-Epoxypropane)	µg/L	0.100	<0.1																
Escherichia Coli	CFU/250 mL	0.000	0																
Fluoride	mg/L	1.500	<0.1						0.613										
Iron (Fe)	µg/L	200.000	<5						211.00083										
Lead (Pb)	µg/L	0.005	<0.5						3.62967										
Manganese (Mn)	µg/L	50.000	<0.5						31.20031										
Mercury (Hg)	mg/L	0.001	<0.0001																
Nickel (Ni)	µg/L	20.000	<5																
Nitrate	mg/L	50.000	<0.45																
Nitrate Nitrogen	mg/L	11.295	<0.1																
Nitrite	mg/L	0.500	<0.002																
Nitrite Nitrogen	mg/L	0.152	<0.002																
Pesticides	µg/L	0.500	<0.005																
pH	-	9.500	0						7.83										
Polycyclic Aromatic Hydrocarbons (PAH)	µg/L	0.000	<0.005																
Selenium (Se)	µg/L	0.010	<0.5																
Sodium (Na)	mg/L	200.000	<0.05						122.02559										
Sulphate	mg/L	250.000	<1						31.5										
Tetrachloroethylene	µg/L	10.000	<0.1																
Total Coliform Bacteria	CFU/100ml	0.000	0						700										
Trichloroethylene	µg/L	10.000	<0.1																
Trihalomethane	µg/L	100.000	<0.1																
Vinyl Chloride	µg/L	0.300	<0.1																

Parameters	Unit	Drinking Water Limit	LoQ	BACK-UP	Ç-01	Ç-02	Ç-03	SK-01	SK-04	WaterWell-1	WaterWell-2	WaterWell-3	WaterWell-4	WaterWell-5	WEL-01	WEL-02	WEL-03	WEL-04	WEL-05
June 2022																			
Acrylamide	µg/L	0.100	<0.1																
Aluminium (Al)	mg/L	200.000	<0.02								0.54494					0.08999			
Ammonium	mg/L	0.500	<0.021								2.28					10.6			
Ammonium Nitrogen	mg/L	0.388	<0.016								1.84					8.27			
Antimony (Sb)	µg/L	5.000	<0.5													1.87361			
Arsenic (As)	µg/L	10.000	<0.5								4.63228					1.92486			
Barium (Ba)	mg/L	0.700	<0.005								0.15975		0.06833			0.5779			
Benzene	µg/L	1.000	<0.1																
Benzo (a) Pyrene	µg/L	0.010	<0.005																
Boron (B)	mg/L	1.000	<0.02								0.20884					0.38547			
Cadmium (Cd)	µg/L	3.000	<0.5																
Chloride (Cl-)	mg/L	250.000	<1								328		46.2			5026			
Chromium (Cr)	mg/L	0.025	<0.001																
Conductivity @ 25°C	µS/cm	2750.000	0								1294		744			11440			
Copper (Cu)	mg/L	2.000	<0.001								0.43938		0.00174			0.00494			
Enterococ	CFU/100 mL	0.000	0								18								
Epichlorohydrin (1-Chloro -2,3-Epoxypropane)	µg/L	0.100	<0.1																
Escherichia Coli	CFU/250 mL	0.000	0								20								
Fluoride	mg/L	1.500	<0.1								0.182		0.262						
Iron (Fe)	µg/L	200.000	<5								3319.13376		26.14858			21566.82137			
Lead (Pb)	µg/L	0.005	<0.5								13.61229		1.15635			1.10776			
Manganese (Mn)	µg/L	50.000	<0.5								409.56831		34.07854			1376.9631			
Mercury (Hg)	mg/L	0.001	<0.0001																
Nickel (Ni)	µg/L	20.000	<5								21.63716					18.77133			
Nitrate	mg/L	50.000	<0.45								0.64		8.12			5.16			
Nitrate Nitrogen	mg/L	11.295	<0.1								0.145		1.83			1.16			
Nitrite	mg/L	0.500	<0.002																
Nitrite Nitrogen	mg/L	0.152	<0.002																
Pesticides	µg/L	0.500	<0.005																
pH	-	9.500	0								6.76		7.41			6.28			
Polycyclic Aromatic Hydrocarbons (PAH)	µg/L	0.000	<0.005																
Selenium (Se)	µg/L	0.010	<0.5																
Sodium (Na)	mg/L	200.000	<0.05								130.60035		31.08514			1475.93009			
Sulphate	mg/L	250.000	<1								72.1		8.27			371			
Tetrachloroethylene	µg/L	10.000	<0.1																
Total Coliform Bacteria	CFU/100ml	0.000	0								5400					30000			
Trichloroethylene	µg/L	10.000	<0.1																
Trihalomethane	µg/L	100.000	<0.1																
Vinyl Chloride	µg/L	0.300	<0.1																

Parameters	Unit	Drinking Water Limit	LoQ	BACK-UP	Ç-01	Ç-02	Ç-03	SK-01	SK-04	WaterWell-1	WaterWell-2	WaterWell-3	WaterWell-4	WaterWell-5	WEL-01	WEL-02	WEL-03	WEL-04	WEL-05
Jan 2023																			
1,2 Dichloroethane	µg/L	0.003	<0.1																
Acrylamide	µg/L	0.100	<0.1																
Aluminium (Al)	mg/L	200.000	<0.02	<0.02	<0.02	<0.02	<0.02												
Ammonium	mg/L	0.500	<0.021	0.113	0.113	0.113	0.113	7.07	0.049		5.04	5.04			5.59			0.0195	0.0195
Antimony (Sb)	µg/L	5.000	<0.5	<0.5	<0.5	<0.5	<0.5	2.36	2.36										
Arsenic (As)	µg/L	10.000	<0.5	3.4	3.4	3.4	3.4	19.8	2.55		3.6	3.6			15.7			0.55	0.55
Barium (Ba)	mg/L	0.700	<0.005								0.216	0.14						0.072	
Benzene	µg/L	1.000	<0.1																
Benzo (a) Pyrene	µg/L	0.010	<0.005																
Boron (B)	mg/L	1.000	<0.02	365	365	37.6	37.6	155	0.455		0.133	0.133			155			110.5125	401
Cadmium (Cd)	µg/L	3.000	<0.5	<0.5	<0.5	<0.5	<0.5												
Chloride (Cl-)	mg/L	250.000	<1	84	19.1	33	49.4	2125	46.17		523	40.14			1893			87.1	63.2
Chromium (Cr)	mg/L	0.025	<0.001	44	23	45.6	49.4	45.5	23		48.7	41.3			46			52.9	60
Clostridia (Searching and Counting of Sulphite Reducing Spores)	CFU/500ml	0.000	0						59										
Clostridium Perfringens	CFU/100ml	0.000	0						2										
Colony Count at 22°C	CFU/ml	20.000	0						3										
Colony Count at 37°C	CFU/ml	5.000	0																
Colour	Pt-Co	0.000	<5																
Conductivity @ 25°C	µS/cm	2750.000	0	1003	419	859	700	5700	526		2131	548			5250			930.5	1182
Copper (Cu)	mg/L	2.000	<0.001	<0.001	2.2	2.2	2.2	2.4	2.4			0.0035			1.88				1.2
Enterococ	CFU/100 mL	0.000	0																
Epichlorohydrin (1-Chloro -2,3-Epoxypropane)	µg/L	0.100	<0.1																
Escherichia Coli	CFU/250 mL	0.000	0																
Fecal Coliform	CFU/100 mL	0.000	<1.8																
Fluoride	mg/L	1.500	<0.1	<0.1	<0.1	<0.1	<0.1		0.525			0.122						0.1415	0.14
Iron (Fe)	µg/L	200.000	<5	247	181	560	289	1218	30.9		547	483			1226			435.75	410
Lead (Pb)	µg/L	0.005	<0.5	<0.5	<0.5	<0.5	<0.5												
Manganese (Mn)	µg/L	50.000	<0.5	248	248	248	248	506	506		265.5	265.5			449			434.715	569
Mercury (Hg)	mg/L	0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001												
Nickel (Ni)	µg/L	20.000	<5	2.6	2.6	4.1	4.1	8.7	8.7		3.94	8.3			8.8			4.56	5
Nitrate	mg/L	50.000	<0.45	<0.45	<0.45	20.2	0.567					24.2						1.81	1.52
Nitrite	mg/L	0.500	<0.002	<0.002	<0.002	<0.002	<0.002												
Pathogen Staphylococcus	CFU/100ml	0.000	0																
Pesticides	µg/L	0.500	<0.005																
pH	-	9.500	0	6.98	6.86	6.86	6.72	6.63	7.76		7.6	7.14			6.64			6.57	6.83
Polycyclic Aromatic Hydrocarbons (PAH)	µg/L	0.000	<0.005						0.054		0.075	0.085						0.056	
Pseudomonas Aeruginosa	CFU/100ml	0.000	0						44			3							
Radioactivity (alpha-beta)	Bq/L	1.000	0						#DIV/0!		#DIV/0!	#DIV/0!						#DIV/0!	
Selenium (Se)	µg/L	0.010	<0.5	1.3	1.3	1.3	1.3	1.02	1.02		2.3	2.3			1.4				

Parameters	Unit	Drinking Water Limit	LoQ	BACK-UP	Ç-01	Ç-02	Ç-03	SK-01	SK-04	WaterWell-1	WaterWell-2	WaterWell-3	WaterWell-4	WaterWell-5	WEL-01	WEL-02	WEL-03	WEL-04	WEL-05
Sodium (Na)	mg/L	200.000	<0.05	126	25.3	25.5	25.75	721	109.3		219	24.07			678			79.05	143.7
Sulphate	mg/L	250.000	<1	62.6	15.9	39.4	7.92	103	20.41		24.1	29.4			89.6			40.035	116.6
Tetrachloroethylene	µg/L	10.000	<0.1																
Total Coliform Bacteria	CFU/100ml	0.000	0																
Trichloroethylene	µg/L	10.000	<0.1																
Trihalomethane	µg/L	100.000	<0.1																
Tritium	Bq/L	0.000	0						#DIV/0!		#DIV/0!	#DIV/0!						#DIV/0!	
Uranium	µg/L	15.000	0																
Vinyl Chloride	µg/L	0.300	<0.1																
Feb 2023																			
Aluminium (Al)	mg/L	200.000	<0.02	<0.02	<0.02	<0.02	<0.02												
Ammonium	mg/L	0.500	<0.021	0.14	0.14	0.14	0.14				5.54	5.54	5.54		6.85				
Arsenic (As)	µg/L	10.000	<0.5	4.2	1.22	1.22	1.003		5.46		8.4	8.4	8.4		23			1.6	1.3
Boron (B)	mg/L	1.000	<0.02	322	322	30.4	30.4		440		138	138	138		168			243	320
Cadmium (Cd)	µg/L	3.000	<0.5	<0.5	<0.5	<0.5	<0.5								0.42				0.3
Chloride (Cl-)	mg/L	250.000	<1	86	19	30	48.2	31.7	48.6		1166	32	53.7		2116			275	60
Chromium (Cr)	mg/L	0.025	<0.001	50	32.5	71	58.3	55	34.5		54.1	56	55		59			48.4	71
Conductivity @ 25°C	µS/cm	2750.000	0	895	427	864	703	798	572		3690	796	878		6180			1592	1242
Copper (Cu)	mg/L	2.000	<0.001	1.7	2.15	2.15	2.15		1.38		2.2	2.58	2.58		3.76			3.1	1.87
Fluoride	mg/L	1.500	<0.1	<0.1	<0.1	<0.1	<0.1		0.59										
Iron (Fe)	µg/L	200.000	<5	220	129	413	228	434	434		775	433	392		1363			473	432
Lead (Pb)	µg/L	0.005	<0.5	<0.5	<0.5	<0.5	<0.5												
Manganese (Mn)	µg/L	50.000	<0.5	2.03	2.03	2.03	2.03				375	375	29.2		632			194	618
Mercury (Hg)	mg/L	0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001												
Nickel (Ni)	µg/L	20.000	<5	2.53	2.53	5.4	2.44	2.7	2.7		5.1	2.75	2.6		10.2			4.8	5.5
Nitrate	mg/L	50.000	<0.45	<0.45	0.488	19.92	0.559	22.63	22.63			22.71	3.45					9.71	4.67
Nitrite	mg/L	0.500	<0.002	<0.002	<0.002	<0.002	<0.002												
pH	-	9.500	0	8.25	7.91	8.06	7.69	7.11	8.17		7.62	7.97	7.2		7.51			7.78	7.76
Selenium (Se)	µg/L	0.010	<0.5	12.4	2.76	2.76	6	1.7	1.39		1.7	2.5	2.5		11.6			1.3	7
Sodium (Na)	mg/L	200.000	<0.05	103	24.5	22.8	23.2	19.2	133		275	19	35.1		511			143	99.4
Sulphate	mg/L	250.000	<1	65	16.8	44.8	7.2	28.6	25.4		52.5	29	6.5		105			190	155
Mar.23																			
Aluminium (Al)	mg/L	200.000	<0.02	<0.02	<0.02	<0.02	<0.02												
Ammonium	mg/L	0.500	<0.021	0.133	0.133	0.133	0.133				4.68	4.68	4.68		3.99				
Antimony (Sb)	µg/L	5.000	<0.5	<0.5	<0.5	<0.5	<0.5												
Arsenic (As)	µg/L	10.000	<0.5	2.3	1.3	1.3	1.3		3.7		9.64	9.64	9		12.4			1.7	1.7
Boron (B)	mg/L	1.000	<0.02	213	213	32	32		279		123	123	123		135			170	265
Cadmium (Cd)	µg/L	3.000	<0.5	<0.5	<0.5	<0.5	<0.5												
Chloride (Cl-)	mg/L	250.000	<1	72.2	15.1	22	36.6	25	26		1141	22.4	40		1652			227	46
Chromium (Cr)	mg/L	0.025	<0.001	40	24	63	45	50	27		51	54	51		49			41	63
Conductivity @ 25°C	µS/cm	2750.000	0	964	426	887	694	796	536		4430	794	850		6180			1591	1240

Parameters	Unit	Drinking Water Limit	LoQ	BACK-UP	Ç-01	Ç-02	Ç-03	SK-01	SK-04	WaterWell-1	WaterWell-2	WaterWell-3	WaterWell-4	WaterWell-5	WEL-01	WEL-02	WEL-03	WEL-04	WEL-05
Copper (Cu)	mg/L	2.000	<0.001	2.3	1.8	2.1	2.1		1.9		5.4	4.23	1.14		8.5			3.8	2.9
Fluoride	mg/L	1.500	<0.1	<0.1	<0.1	<0.1	<0.1		0.261										
Iron (Fe)	µg/L	200.000	<5	162	141	479	252	380	380		798	432	316		1159			398	359
Lead (Pb)	µg/L	0.005	<0.5	<0.5	<0.5	<0.5	<0.5												
Manganese (Mn)	µg/L	50.000	<0.5	<0.5	<0.5	<0.5	<0.5				536	536	131		793			12.4	804
Mercury (Hg)	mg/L	0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001												
Nickel (Ni)	µg/L	20.000	<5	<5	<5	3.6	3.6	2.8	2.8		6.1	3.36	2.4		12			4.3	4.9
Nitrate	mg/L	50.000	<0.45	<0.45	<0.45	19.8	0.725	24.2	24.2			22.4	4.61					8.75	2.26
Nitrite	mg/L	0.500	<0.002	<0.002	<0.002	<0.002	<0.002												
pH	-	9.500	0	7.52	7.34	6.67	6.86	6.84	7.38		7.55	7.12	7.69		7.21			7.6	7.04
Selenium (Se)	µg/L	0.010	<0.5	<0.5	1.6	2.97	2.7					1.9	1.68						
Sodium (Na)	mg/L	200.000	<0.05	93.5	21.1	20	22	15.8	92.3		358	16.05	49		455.4			129	101
Sulphate	mg/L	250.000	<1	73.2	17.6	44.5	7.84	27	23		73.2	23.7	11		114			179	156
Apr 2023																			
1,2 Dichloroethane	µg/L	0.003	<0.1																
Acrylamide	µg/L	0.100	<0.1																
Aluminium (Al)	mg/L	200.000	<0.02	<0.02	<0.02	<0.02	<0.02												
Ammonium	mg/L	0.500	<0.021	0.17	0.17	0.17	0.17				4.79	4.79	4.79		9.23			0.087	0.087
Antimony (Sb)	µg/L	5.000	<0.5	<0.5	<0.5	<0.5	<0.5												
Arsenic (As)	µg/L	10.000	<0.5	2	1.2	1.2	1.2		3.38		10	10	1.2		8.9			2.4	1.04
Barium (Ba)	mg/L	0.700	<0.005								0.297	0.141	0.077						
Benzene	µg/L	1.000	<0.1																
Benzo (a) Pyrene	µg/L	0.010	<0.005																
Boron (B)	mg/L	1.000	<0.02	314	314	29.2	29.2		0.406		0.16	0.16	0.03		176			221	373
Cadmium (Cd)	µg/L	3.000	<0.5	<0.5	<0.5	<0.5	<0.5												
Chloride (Cl-)	mg/L	250.000	<1	72.1	16.3	21.3	35.2	20.6	29.2		1145	20.9	43.5		1448			214	44.3
Chromium (Cr)	mg/L	0.025	<0.001	41	17	43.4	33.3	41.5	19.1		38	39	40.4		37			37	55
Clostridia (Searching and Counting of Sulphite Reducing Spores)	CFU/500ml	0.000	0						80		16	4	4						
Clostridium Perfringens	CFU/100ml	0.000	0																
Colony Count at 22°C	CFU/ml	20.000	0						300		12	77	19						
Colony Count at 37°C	CFU/ml	5.000	0						10		4	17	12						
Colour	Pt-Co	0.000	<5																
Conductivity @ 25°C	µS/cm	2750.000	0	1179	421	878	687	798	527		4150	759	846		5210			1665	1240
Copper (Cu)	mg/L	2.000	<0.001	2.2	5	1.6	1.6		0.0011		0.0039	0.003	0.003		4.6			2.9	1.8
Enterococ	CFU/100 mL	0.000	0						4										
Epichlorohydrin (1-Chloro -2,3-Epoxypropane)	µg/L	0.100	<0.1																
Escherichia Coli	CFU/250 mL	0.000	0																
Fecal Coliform	CFU/100 mL	0.000	<1.8																
Fluoride	mg/L	1.500	<0.1	0.26	0.26	2.4	0.46		0.55										
Iron (Fe)	µg/L	200.000	<5	341	203	620	331	545	78		1160	611	616		1387			599	543

Parameters	Unit	Drinking Water Limit	LoQ	BACK-UP	Ç-01	Ç-02	Ç-03	SK-01	SK-04	WaterWell-1	WaterWell-2	WaterWell-3	WaterWell-4	WaterWell-5	WEL-01	WEL-02	WEL-03	WEL-04	WEL-05
Lead (Pb)	µg/L	0.005	<0.5	<0.5	<0.5	<0.5	<0.5												
Manganese (Mn)	µg/L	50.000	<0.5	1.2	1.2	1.2	1.2				438	438	35.6		710			6.6	842
Mercury (Hg)	mg/L	0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001												
Nickel (Ni)	µg/L	20.000	<5	3	3	4.3	2.13	3.8	3.8		7.7	4.4	4.2		13			4.5	5.65
Nitrate	mg/L	50.000	<0.45	<0.45	<0.45	18.43	18.43	19.8	19.8			20.1	3.05					13.11	0.55
Nitrite	mg/L	0.500	<0.002	<0.002	<0.002	<0.002	<0.002												
Pathogen Staphylococcus	CFU/100ml	0.000	0																
Pesticides	µg/L	0.500	<0.005																
pH	-	9.500	0	7.35	7.59	7.31	7.43	7.41	7.83		7.35	7.06	7.55		7.07			7.4	7.3
Polycyclic Aromatic Hydrocarbons (PAH)	µg/L	0.000	<0.005																
Pseudomonas Aeruginosa	CFU/100ml	0.000	0						12										
Radioactivity (alpha-beta)	Bq/L	1.000	0						#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!						
Selenium (Se)	µg/L	0.010	<0.5	<0.5	<0.5	<0.5	<0.5		1.7		2.24	2.5	1.24		6.3			4.4	3.7
Sodium (Na)	mg/L	200.000	<0.05	95.6	18.7	17	17.8	15.2	107		450	18.5	37.3		471			124	91.7
Sulphate	mg/L	250.000	<1	70	17	40	6.8	20.8	21.8		75	30.7	6.54		91.8			177	131
Tetrachloroethylene	µg/L	10.000	<0.1																
Total Coliform Bacteria	CFU/100ml	0.000	0						22										
Trichloroethylene	µg/L	10.000	<0.1																
Trihalomethane	µg/L	100.000	<0.1																
Tritium	Bq/L	0.000	0																
Uranium	µg/L	15.000	0																
Vinyl Chloride	µg/L	0.300	<0.1																
May.23																			
Aluminium (Al)	mg/L	200.000	<0.02																
Ammonium	mg/L	0.500	<0.021																
Antimony (Sb)	µg/L	5.000	<0.5																
Arsenic (As)	µg/L	10.000	<0.5		1.2	1.2	1.2		3.1										
Boron (B)	mg/L	1.000	<0.02		47	56	56	28	596				36						495
Cadmium (Cd)	µg/L	3.000	<0.5																
Chloride (Cl-)	mg/L	250.000	<1		16.4	43.4	41.3	25.3	31.6			25.3	49.6						51
Chromium (Cr)	mg/L	0.025	<0.001		19	48	34.3	45.4	21.3			44	51.6						58
Conductivity @ 25°C	µS/cm	2750.000	0		413	839	623	774	526			758	893						1236
Copper (Cu)	mg/L	2.000	<0.001		5.5	1.7	1.7		1.1			12.8	12.8						3.6
Fluoride	mg/L	1.500	<0.1						0.48										
Iron (Fe)	µg/L	200.000	<5		96	354	162	271	34.4			275	282						235
Lead (Pb)	µg/L	0.005	<0.5																
Manganese (Mn)	µg/L	50.000	<0.5			1.5	1.5						41.4						354
Mercury (Hg)	mg/L	0.001	<0.0001																
Nickel (Ni)	µg/L	20.000	<5			3.1	3.1												
Nitrate	mg/L	50.000	<0.45			32.8	32.8	20.9	20.9			20.3	3.29						3.25
Nitrite	mg/L	0.500	<0.002																

Parameters	Unit	Drinking Water Limit	LoQ	BACK-UP	Ç-01	Ç-02	Ç-03	SK-01	SK-04	WaterWell-1	WaterWell-2	WaterWell-3	WaterWell-4	WaterWell-5	WEL-01	WEL-02	WEL-03	WEL-04	WEL-05
pH	-	9.500	0		7.55	7.4	7.62	7.4	8.5			7.45	7.25						7.61
Selenium (Se)	µg/L	0.010	<0.5			1.8	2	1.94	3.3			1.8	1.29						1.25
Sodium (Na)	mg/L	200.000	<0.05		29	28	27.6	20.6	143			19	41.5						155
Sulphate	mg/L	250.000	<1		15.8	70.1	7.3	22.2	21.2			22.52	6.45						139
June 2023																			
Aluminium (Al)	mg/L	200.000	<0.02			2.8	38.7											4.1	
Ammonium	mg/L	0.500	<0.021							2.89	5.91	5.91	5.91		4.5	7.457	2.18	0.657	
Antimony (Sb)	µg/L	5.000	<0.5																
Arsenic (As)	µg/L	10.000	<0.5		1.1	1.1	1.1		3.2	8.2	12	9.1	9.1		7.7	19.4	17.1	1.1	
Boron (B)	mg/L	1.000	<0.02			30.4	30.4		437	111	161	26	26		141	247	218	204	
Cadmium (Cd)	µg/L	3.000	<0.5				0.326				0.367	0.367	0.367						
Chloride (Cl-)	mg/L	250.000	<1		17.6	28.1	37.3	29.8	43.1	34	2325	29.7	52		1444	3124	3606	256	
Chromium (Cr)	mg/L	0.025	<0.001		4	9.1	19	8.26	4.6	25.4	25	9.9	7.9		28	24	6.8	24	
Conductivity @ 25°C	µS/cm	2750.000	0		459	942	670	746	605	918	6840	769	857		4690	10850	3470	1741	
Copper (Cu)	mg/L	2.000	<0.001		5.6	5.6	5.4			1.01	3.8	3.8	3.8		3.9	7.94	7.2	1.65	
Fluoride	mg/L	1.500	<0.1						0.82	0.82	0.82	0.82	0.29			0.217	0.217	0.217	
Iron (Fe)	µg/L	200.000	<5		122	357	147	264	264	158	685	325	274		513	916	865	219	
Lead (Pb)	µg/L	0.005	<0.5				3.2												
Manganese (Mn)	µg/L	50.000	<0.5				70.4	7.4	7.4	117	615	24.2	26.4		456	778	674	343	
Mercury (Hg)	mg/L	0.001	<0.0001																
Nickel (Ni)	µg/L	20.000	<5			80.7	80.7	3.8	3.8	9.3	5.6	2.2	2.2		4.12	7	8	4.5	
Nitrate	mg/L	50.000	<0.45			18.6	18.6	20.7	20.7	20.7	20.7	20.4	3					3.99	
Nitrite	mg/L	0.500	<0.002													0.07	26.4	3.46	
pH	-	9.500	0		7.75	7.8	7.43	6.4	8.51	7.67	6.95	7.02	6.66		6.98	6.86	7.35	7.2	
Selenium (Se)	µg/L	0.010	<0.5				1.2	2.8	2.8	2.8	2.3	2.3	1.75		1.72	3.3	3.3	3.3	
Sodium (Na)	mg/L	200.000	<0.05		19.3	16.7	35	38.8	98.6	48.1	600	98.5	30		389	1205	928	175	
Sulphate	mg/L	250.000	<1		15.4	38.8	6.75	22.5	22.4	2.3	135	22.6	6.05		79.1	340.7	156	158	
July 2023																			
1,2 Dichloroethane	µg/L	0.003	<0.1																
Acrylamide	µg/L	0.100	<0.1																
Aluminium (Al)	mg/L	200.000	<0.02	<0.02	<0.02	<0.02	3.9	3.85	3.85								3.2		
Ammonium	mg/L	0.500	<0.021	5.63	5.63	5.63	5.63				3.65	3.65	3.65		4.12	2.84	5.64		
Antimony (Sb)	µg/L	5.000	<0.5	<0.5	<0.5	<0.5	<0.5												
Arsenic (As)	µg/L	10.000	<0.5	9.3	1.56	1.56	1.56		3.02		11	11	1.04		7	8.8	15.6		
Barium (Ba)	mg/L	0.700	<0.005																
Benzene	µg/L	1.000	<0.1																
Benzo (a) Pyrene	µg/L	0.010	<0.005																
Boron (B)	mg/L	1.000	<0.02	186	186	27	27		0.351		167	167	167		144	136	193		
Cadmium (Cd)	µg/L	3.000	<0.5	<0.5	<0.5	<0.5	<0.5												
Chloride (Cl-)	mg/L	250.000	<1	0.63	18.3	25.5	41.5	38	37.2		2000	37.5	56		1141	2449	2935		
Chromium (Cr)	mg/L	0.025	<0.001	39	18	35.2	32	32.7	16.3		34	34	36.2		35.2	30.2	33.7		

Parameters	Unit	Drinking Water Limit	LoQ	BACK-UP	Ç-01	Ç-02	Ç-03	SK-01	SK-04	WaterWell-1	WaterWell-2	WaterWell-3	WaterWell-4	WaterWell-5	WEL-01	WEL-02	WEL-03	WEL-04	WEL-05
Clostridia (Searching and Counting of Sulphite Reducing Spores)	CFU/500ml	0.000	0						40										
Clostridium Perfringens	CFU/100ml	0.000	0						5										
Colony Count at 22°C	CFU/ml	20.000	0						293										
Colony Count at 37°C	CFU/ml	5.000	0						300										
Colour	Pt-Co	0.000	<5																
Conductivity @ 25°C	µS/cm	2750.000	0	1128	425	866	692	853	566		6100	837	897		3680	8430	6350		
Copper (Cu)	mg/L	2.000	<0.001	<0.001	<0.001	4	4		0.0011		5.1	2.4	2.4		2.72	3.2	6.1		
Enterococ	CFU/100 mL	0.000	0						9										
Epichlorohydrin (1-Chloro -2,3-Epoxypropane)	µg/L	0.100	<0.1																
Escherichia Coli	CFU/250 mL	0.000	0						5										
Fecal Coliform	CFU/100 mL	0.000	<1.8						3										
Fluoride	mg/L	1.500	<0.1	0.325	0.325	0.479	0.479	0.478	0.671		1.6	0.41	0.41		0.33	0.33	1.57		
Iron (Fe)	µg/L	200.000	<5	212	120	328	203	301	21.1		665	293	270		501	499	833		
Lead (Pb)	µg/L	0.005	<0.5	<0.5	<0.5	<0.5	<0.5												
Manganese (Mn)	µg/L	50.000	<0.5	418	418	418	418				612	612	34		520	516	706		
Mercury (Hg)	mg/L	0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001												
Nickel (Ni)	µg/L	20.000	<5	2.4	2.4	2.4	2.4				4.2	2.2	2.2		3.6	3.2	5.6		
Nitrate	mg/L	50.000	<0.45	0.558	0.558	17	17	20.2	20.2		1.07	19.9	3.05		0.642	0.642	1.9		
Nitrite	mg/L	0.500	<0.002	<0.002	<0.002	<0.002	<0.002												
Pathogen Staphylococcus	CFU/100ml	0.000	0																
Pesticides	µg/L	0.500	<0.005																
pH	-	9.500	0	7.02	7.17	7.17	6.88	7.17	7.99		7.56	7.46	7.33		7.18	7.23	7.02		
Polycyclic Aromatic Hydrocarbons (PAH)	µg/L	0.000	<0.005																
Pseudomonas Aeruginosa	CFU/100ml	0.000	0						26										
Radioactivity (alpha-beta)	Bq/L	1.000	0						#DIV/0!										
Selenium (Se)	µg/L	0.010	<0.5	3.4	3.4	4.6	2.7	2.86	2.86			1.4	2.2			1.4	4.9		
Sodium (Na)	mg/L	200.000	<0.05	70.2	16.6	15.5	16.4	14	83		467	15.3	26.2		256	320	669		
Sulphate	mg/L	250.000	<1	0.184	16.8	43.4	7.9	23.3	24.1		119	22.9	6.61		71.3	293	139		
Tetrachloroethylene	µg/L	10.000	<0.1																
Total Coliform Bacteria	CFU/100ml	0.000	0						16										
Trichloroethylene	µg/L	10.000	<0.1																
Trihalomethane	µg/L	100.000	<0.1																
Tritium	Bq/L	0.000	0						#DIV/0!										
Uranium	µg/L	15.000	0																
Vinyl Chloride	µg/L	0.300	<0.1																
August 2023																			
Aluminium (Al)	mg/L	200.000	<0.02	<0.02							3	3	3						
Ammonium	mg/L	0.500	<0.021	2.65		0.031	0.031			2.19	4.596	4.596	4.596		4.288	6.075	5.779	4.397	
Antimony (Sb)	µg/L	5.000	<0.5	<0.5															
Arsenic (As)	µg/L	10.000	<0.5	3.73		1.16	1.16		3.8	5.2	14.3	14.3	14.3		8.5	27	20.7	22.6	

Parameters	Unit	Drinking Water Limit	LoQ	BACK-UP	Ç-01	Ç-02	Ç-03	SK-01	SK-04	WaterWell-1	WaterWell-2	WaterWell-3	WaterWell-4	WaterWell-5	WEL-01	WEL-02	WEL-03	WEL-04	WEL-05
Boron (B)	mg/L	1.000	<0.02	130					568	116	208	208	29		170	347	287	562	
Cadmium (Cd)	µg/L	3.000	<0.5	<0.5															
Chloride (Cl-)	mg/L	250.000	<1	54.4		27.6	40.1		41.4	20.3	2069	37.5	60.2		1279	704	2849	3599	
Chromium (Cr)	mg/L	0.025	<0.001	7.8		11.2	18.6		12	12.3	11.4	15.3	15.4		11.6	12.4	13.1	12	
Conductivity @ 25°C	µS/cm	2750.000	0	925		570	665		574	785	6090	841	922		4210	10890	9450	11860	
Copper (Cu)	mg/L	2.000	<0.001	1.64		2.7	2.7				2.4	2.85	2.85		1.3	5.1	4.2	7.5	
Fluoride	mg/L	1.500	<0.1	<0.1					0.59	0.59	0.59	0.59	0.59			0.464	0.332	0.437	
Iron (Fe)	µg/L	200.000	<5	81		99.5	105			108	444	182	179		325	704	604	610	
Lead (Pb)	µg/L	0.005	<0.5	<0.5															
Manganese (Mn)	µg/L	50.000	<0.5	286						181	640	640	37.1		483	957	799	1174	
Mercury (Hg)	mg/L	0.001	<0.0001	<0.0001															
Nickel (Ni)	µg/L	20.000	<5	<5							3.1	2.5	2.5		2.05	5.2	4.3	5.3	
Nitrate	mg/L	50.000	<0.45	<0.45		12.45	12.45					20.7	1.92						
Nitrite	mg/L	0.500	<0.002	<0.002															
pH	-	9.500	0	7.36		6.93	6.65		7.91	7.46	7.15	7.31	7.49		7.17	6.99	7.06	7.15	
Selenium (Se)	µg/L	0.010	<0.5	<0.5						5.5	5.5	3.8	5.1			5.4	7.4	6.1	
Sodium (Na)	mg/L	200.000	<0.05	61.4		23.4	26.4		123	48	685	19.7	38		418	1391	1182	1772	
Sulphate	mg/L	250.000	<1	3.3		37	9.52		22	22	117	18.1	7.14		62.6	284.5	169.1	456.5	
Sept 2023																			
Aluminium (Al)	mg/L	200.000	<0.02	<0.02	<0.02														
Ammonium	mg/L	0.500	<0.021	3.79	3.79						5.27	5.27	5.27			7.92	7.01	5.85	
Antimony (Sb)	µg/L	5.000	<0.5	<0.5	<0.5														
Arsenic (As)	µg/L	10.000	<0.5	11	1.64				3.72		14.4	14.4	14.4			34	25	32.3	
Boron (B)	mg/L	1.000	<0.02	114	114				520		195	195	25.4			344	270	522	
Cadmium (Cd)	µg/L	3.000	<0.5	<0.5	<0.5														
Chloride (Cl-)	mg/L	250.000	<1	43.2	16.7		42		37.4		2059	32	56			3749	2849	4249	
Chromium (Cr)	mg/L	0.025	<0.001	32.5	16		28.4		15		32.3	36	37.5			31	29	25.4	
Conductivity @ 25°C	µS/cm	2750.000	0	876	605		701		856		5730	836	921			11290	9060	12610	
Copper (Cu)	mg/L	2.000	<0.001	<0.001	1.1		1.1		1.44		2.6	3.1	3.1			6.2	4.3	7.8	
Fluoride	mg/L	1.500	<0.1	<0.1	<0.1												0.18	0.363	
Iron (Fe)	µg/L	200.000	<5	104	61		90				407	171	157			807	703	566	
Lead (Pb)	µg/L	0.005	<0.5	<0.5	<0.5														
Manganese (Mn)	µg/L	50.000	<0.5	254	17		2.3		1.15		568	568	37.6			895	740	975	
Mercury (Hg)	mg/L	0.001	<0.0001	<0.0001	<0.0001														
Nickel (Ni)	µg/L	20.000	<5	<5	<5						3.4	3.4	3.4			6.7	5.1	5.9	
Nitrate	mg/L	50.000	<0.45	<0.45	<0.45							18.06	2.57						
Nitrite	mg/L	0.500	<0.002	<0.002	<0.002				0.33								0.01	0.01	
pH	-	9.500	0	7.46	7.16		6.91		7.74		7.3	7.34	7.54			7.11	7.12	7.19	
Selenium (Se)	µg/L	0.010	<0.5	<0.5	<0.5		1.75				2.1	2.2	2.2			7.8	4.5	6.7	
Sodium (Na)	mg/L	200.000	<0.05	51.6	28.3		23.2		127		574	24.1	36			1378	888	1745	
Sulphate	mg/L	250.000	<1	<1	15.5		7.9		21.4		312	19.7	12.4			242	101	369	

Parameters	Unit	Drinking Water Limit	LoQ	BACK-UP	Ç-01	Ç-02	Ç-03	SK-01	SK-04	WaterWell-1	WaterWell-2	WaterWell-3	WaterWell-4	WaterWell-5	WEL-01	WEL-02	WEL-03	WEL-04	WEL-05
Oct 2023																			
Aluminium (Al)	mg/L	200.000	<0.02	4.31	6.12		2.87												
Ammonium	mg/L	0.500	<0.021	4.3	0.1					3.01					4.6	4.9	5.62	1.03	5
Antimony (Sb)	µg/L	5.000	<0.5	<0.5	<0.5														
Arsenic (As)	µg/L	10.000	<0.5	4.6	1.15					1.92					5.59	8.38	13.7	20.7	18.8
Boron (B)	mg/L	1.000	<0.02	143	143					121					171	178	248	507	495
Cadmium (Cd)	µg/L	3.000	<0.5	<0.5	<0.5														
Chloride (Cl-)	mg/L	250.000	<1	94.2	19.6		46.6			40.9					1442	1450	2499	4149	3949
Chromium (Cr)	mg/L	0.025	<0.001	31.7	11.6		17.7			22.7					26.9	23.6	25.7	24.04	21.7
Conductivity @ 25°C	µS/cm	2750.000	0	845	598		717			726					4250	11200	8895	11850	10560
Copper (Cu)	mg/L	2.000	<0.001	2.12	6.08					1.48					2.33	2.36	5.04	6.48	6.28
Fluoride	mg/L	1.500	<0.1	<0.1	<0.1													0.255	0.252
Iron (Fe)	µg/L	200.000	<5	<5	<5										20.2	46.6	54.8	161	187
Lead (Pb)	µg/L	0.005	<0.5	<0.5	<0.5														
Manganese (Mn)	µg/L	50.000	<0.5	347	5.36		5.63			224					538	576	779	1027	1015
Mercury (Hg)	mg/L	0.001	<0.0001	<0.0001	<0.0001														
Nickel (Ni)	µg/L	20.000	<5	4.03	4.03										3.26	3.73	6.84	6.23	6.18
Nitrate	mg/L	50.000	<0.45	<0.45	<0.45														1.4
Nitrite	mg/L	0.500	<0.002	<0.002	<0.002											14.3	17.5	0.015	7.82
pH	-	9.500	0	7.31	7.2		6.95			7.55					7.11	7.21	7.18	7.22	7.8
Selenium (Se)	µg/L	0.010	<0.5	1.48	1.48										3.06	3.8	3.09	5.24	2.83
Sodium (Na)	mg/L	200.000	<0.05	61.1	21.9		20.5			43.6					331	430	819	1646	1546
Sulphate	mg/L	250.000	<1	1.34	15.5		7.45								60.8	271	141	467	428
Nov 2023																			
Aluminium (Al)	mg/L	200.000	<0.02	<0.02	<0.02														
Ammonium	mg/L	0.500	<0.021	2.73	2.73					2.12	2.98	2.98	2.98		5.12	5.72	5.82	1.78	1.78
Antimony (Sb)	µg/L	5.000	<0.5	<0.5	<0.5														
Arsenic (As)	µg/L	10.000	<0.5	7	7					1.96	1.8	1.8	1.8		4.7	13.6	10	6.6	1.6
Boron (B)	mg/L	1.000	<0.02	155	155					130	135	135	27.3		202	295	223	298	470
Cadmium (Cd)	µg/L	3.000	<0.5	<0.5	<0.5														
Chloride (Cl-)	mg/L	250.000	<1	162	47.2		48.5		48	39.4	214	39	74		844	2071	1621	1074	61.1
Chromium (Cr)	mg/L	0.025	<0.001	27	15		19.1		21.6	20	20.3	22	23.7		27.6	23.4	23	24	27
Conductivity @ 25°C	µS/cm	2750.000	0	990	636		634		635	717	1095	755	851		2480	4880	3980	2990	1059
Copper (Cu)	mg/L	2.000	<0.001	1.2	1.2						1.04	3.5	3.5		1.25	1.76	1.85	1.8	2
Fluoride	mg/L	1.500	<0.1	<0.1	<0.1														
Iron (Fe)	µg/L	200.000	<5	<5	<5														
Lead (Pb)	µg/L	0.005	<0.5	<0.5	<0.5														
Manganese (Mn)	µg/L	50.000	<0.5	262	262					182	200	200	42		494	652	479	605	605
Mercury (Hg)	mg/L	0.001	<0.0001	<0.0001	<0.0001														
Nickel (Ni)	µg/L	20.000	<5	<5	<5											2.3	4.5	2.7	2.8
Nitrate	mg/L	50.000	<0.45	<0.45	<0.45							20.9	2.18						

Parameters	Unit	Drinking Water Limit	LoQ	BACK-UP	Ç-01	Ç-02	Ç-03	SK-01	SK-04	WaterWell-1	WaterWell-2	WaterWell-3	WaterWell-4	WaterWell-5	WEL-01	WEL-02	WEL-03	WEL-04	WEL-05
Nitrite	mg/L	0.500	<0.002	<0.002	<0.002														
pH	-	9.500	0	7.46	7.33		7.34		7.17	7.56	7.48	7.37	7.4		7.37	7.3	7.35	7.38	7.71
Selenium (Se)	µg/L	0.010	<0.5	6	6		5.7		4.1	4.1	4.1	4.1	4.1		4.1	1.6	3.4	3.6	2.73
Sodium (Na)	mg/L	200.000	<0.05	60	19.5		21.3		21	46.9	76	16.04	36.2		207	476	411	310	100
Sulphate	mg/L	250.000	<1	4.4	7.3		9.6		7.2	7.2	10.2	19.6	6.6		31	115	56	142	135
Dec 2023																			
Aluminium (Al)	mg/L	200.000	<0.02	<0.02	<0.02	16.1	16.1												
Ammonium	mg/L	0.500	<0.021	3.12	3.12	3.12	3.12			2.78	3.11	3.11	3.11		7.21	7.84			
Antimony (Sb)	µg/L	5.000	<0.5	<0.5	<0.5	<0.5	<0.5												
Arsenic (As)	µg/L	10.000	<0.5	5.5	5.5	5.5	5.5		3	8.34	7.3	7.3	7.3		7.4	26.6			1.58
Boron (B)	mg/L	1.000	<0.02	136	136	41.4	41.4		368	171	185	185	31.5		292	355			413
Cadmium (Cd)	µg/L	3.000	<0.5	<0.5	<0.5	<0.5	<0.5												
Chloride (Cl-)	mg/L	250.000	<1	178	21.9	26.1	48.6		34.6	56	518	38.7	78.6		1051	3799			57.2
Chromium (Cr)	mg/L	0.025	<0.001	29.3	9.1	32.7	27.4		17.4	33	32.2	32.1	35.6		42.3	31.2			28.5
Conductivity @ 25°C	µS/cm	2750.000	0	1027	378	766	628		498	779	1695	740	855		2930	10160			919
Copper (Cu)	mg/L	2.000	<0.001	1.34	19	1.7	1.12		1.4	1.36	1.88	3.6	1.12		2.5	7.1			2.3
Fluoride	mg/L	1.500	<0.1	<0.1	<0.1	<0.1	<0.1												
Iron (Fe)	µg/L	200.000	<5	<5	<5	<5	<5									0.175			
Lead (Pb)	µg/L	0.005	<0.5	<0.5	<0.5	<0.5	<0.5												
Manganese (Mn)	µg/L	50.000	<0.5	234	234	234	234			202	281	281	45		598	952			
Mercury (Hg)	mg/L	0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001												
Nickel (Ni)	µg/L	20.000	<5	<5	<5	<5	<5					2.1	2.1		2.2	4.6			
Nitrate	mg/L	50.000	<0.45	<0.45	0.504	17.8	0.545					20.8	2.73						
Nitrite	mg/L	0.500	<0.002	<0.002	<0.002	<0.002	<0.002									0.01			
pH	-	9.500	0	7.5	7.51	7.08	7.03		7.56	7.4	7.41	7.35	7.33		7.16	6.99			7.68
Selenium (Se)	µg/L	0.010	<0.5	<0.5	<0.5	2.6	3.3		2.6	2.4	1.45	3.6	3.4		2.84	12			7.54
Sodium (Na)	mg/L	200.000	<0.05	44.7	19.8	15.4	16.1		54.1	10.4	116	12.2	27.6		202	754			69.5
Sulphate	mg/L	250.000	<1	8.67	17.6	38.3	8.62		22.2	5.4	26.5	21.3	6.7		96.4	253			165
Jan 2024																			
1,2 Dichloroethane	µg/L	0.003	<0.1																
Acrylamide	µg/L	0.100	<0.1																
Aluminium (Al)	mg/L	200.000	<0.02	<0.02	<0.02	<0.02	<0.02												
Ammonium	mg/L	0.500	<0.021	5.02	5.02	5.02	5.02			3.65	2.46	2.46	2.46		3.89	0.552	7.79	0.662	0.662
Antimony (Sb)	µg/L	5.000	<0.5	<0.5	<0.5	<0.5	<0.5												
Arsenic (As)	µg/L	10.000	<0.5	8.9	1.8	1.8	1.8		3.5	7.93	5.7	5.7	5.7		3.85	3.28	20.6	4.3	1.7
Barium (Ba)	mg/L	0.700	<0.005						0.009		0.383	0.138	0.08						
Benzene	µg/L	1.000	<0.1																
Benzo (a) Pyrene	µg/L	0.010	<0.005																
Boron (B)	mg/L	1.000	<0.02	181	27.5	55	55		0.327	162	0.167	0.167	0.041		331	334	343	261	429
Cadmium (Cd)	µg/L	3.000	<0.5	<0.5	<0.5	<0.5	<0.5												
Chloride (Cl-)	mg/L	250.000	<1	793	84.3	28	36.4		24.4	241	355	45.3	63		418	233	3799	382	41.8

Parameters	Unit	Drinking Water Limit	LoQ	BACK-UP	Ç-01	Ç-02	Ç-03	SK-01	SK-04	WaterWell-1	WaterWell-2	WaterWell-3	WaterWell-4	WaterWell-5	WEL-01	WEL-02	WEL-03	WEL-04	WEL-05
Chromium (Cr)	mg/L	0.025	<0.001	39	18.5	40.4	24		18.8	33	34.5	36.8	39.5		45.1	43.6	34.1	41	28.2
Clostridia (Searching and Counting of Sulphite Reducing Spores)	CFU/500ml	0.000	0						1										
Clostridium Perfringens	CFU/100ml	0.000	0																
Colony Count at 22°C	CFU/ml	20.000	0								206	300	70						
Colony Count at 37°C	CFU/ml	5.000	0						9		86	93	13						
Colour	Pt-Co	0.000	<5																
Conductivity @ 25°C	µS/cm	2750.000	0	2760	379	855	522		498	1299	1602	739	864		1991	1382	8630	1214	887
Copper (Cu)	mg/L	2.000	<0.001	2.5	5	1.6	1.6		0.0015	1.57	0.0018	0.003	0.0014		2.5	2	8.1	2.3	2.31
Enterococ	CFU/100 mL	0.000	0																
Epichlorohydrin (1-Chloro -2,3-Epoxypropane)	µg/L	0.100	<0.1																
Escherichia Coli	CFU/250 mL	0.000	0																
Fecal Coliform	CFU/100 mL	0.000	<1.8																
Fluoride	mg/L	1.500	<0.1	<0.1	<0.1	<0.1	<0.1										0.155	0.155	0.155
Iron (Fe)	µg/L	200.000	<5	40.4	40.4	40.4	40.4				10	10	10		20	10.65	53.9	53.9	53.9
Lead (Pb)	µg/L	0.005	<0.5	<0.5	<0.5	<0.5	<0.5												
Manganese (Mn)	µg/L	50.000	<0.5	621	1.03	1.03	1.03			267	288	288	49.7		602	645	776	1037	1037
Mercury (Hg)	mg/L	0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001												
Nickel (Ni)	µg/L	20.000	<5	3.6	3.6	2.4	2.4					2.62	2.62		2.4	2.4	6.4	3.7	3.7
Nitrate	mg/L	50.000	<0.45	<0.45	<0.45	20.1	20.1				1.05	18.7	3.35				1.07	1.07	3.57
Nitrite	mg/L	0.500	<0.002	<0.002	<0.002	<0.002	<0.002										0.099	0.099	0.099
Pathogen Staphylococcus	CFU/100ml	0.000	0																
Pesticides	µg/L	0.500	<0.005																
pH	-	9.500	0	7.31	7.6	7.11	7.06		7.81	7.49	7.46	7.42	7.37		7.27	7.34	6.98	7.36	7.87
Polycyclic Aromatic Hydrocarbons (PAH)	µg/L	0.000	<0.005																
Pseudomonas Aeruginosa	CFU/100ml	0.000	0						8			80	2						
Selenium (Se)	µg/L	0.010	<0.5	5.4	2.9	2.83	2.3			1.5	1.5	2.15	4.1		5.01	4.2	4.2	4.2	3.84
Sodium (Na)	mg/L	200.000	<0.05	202	25.1	26	22.2		73.5	80	119	#DIV/0!	#DIV/0!		188	132	1014	126	111
Sulphate	mg/L	250.000	<1	56.3	20	45	12.8		30.3	11.1	20.7	22.3	7.8		101	85	197.8	55.4	163
Tetrachloroethylene	µg/L	10.000	<0.1																
Total Coliform Bacteria	CFU/100ml	0.000	0																
Trichloroethylene	µg/L	10.000	<0.1																
Trihalomethane	µg/L	100.000	<0.1																
Uranium	µg/L	15.000	0																
Vinyl Chloride	µg/L	0.300	<0.1																
Feb 2024																			
Aluminium (Al)	mg/L	200.000	<0.02						3.62	3.62	3.62	3.62	3.62						
Ammonium	mg/L	0.500	<0.021							4.41	4.42	4.42	4.42		4.78	5.23	5.28	0.411	0.411
Antimony (Sb)	µg/L	5.000	<0.5																
Arsenic (As)	µg/L	10.000	<0.5		1.2	1.2	1.2		4.5	6.7	4.9	4.9	4.9		1.8	2.8	21	1.8	6.3
Boron (B)	mg/L	1.000	<0.02			31	31		397	137	143	143	29		291	278	288	217	142

Parameters	Unit	Drinking Water Limit	LoQ	BACK-UP	Ç-01	Ç-02	Ç-03	SK-01	SK-04	WaterWell-1	WaterWell-2	WaterWell-3	WaterWell-4	WaterWell-5	WEL-01	WEL-02	WEL-03	WEL-04	WEL-05
Cadmium (Cd)	µg/L	3.000	<0.5																
Chloride (Cl-)	mg/L	250.000	<1		18	25.8	38.4		48.1	438	481	23.7	63.6		243	258	3549	141	431
Chromium (Cr)	mg/L	0.025	<0.001		18.9	42.3	35		24	44	47.4	49.1	48.3		49.4	49.1	38.4	42.5	39.5
Conductivity @ 25°C	µS/cm	2750.000	0		419	884	684		559	1944	2025	781	923		1654	1639	8460	1291	1938
Copper (Cu)	mg/L	2.000	<0.001		1.92	1.4	1.4			2.25	2.4	2.6	1.3		2.2	2.4	7.05	2.54	2.2
Fluoride	mg/L	1.500	<0.1						0.34	0.34	0.34	0.34	0.34						
Iron (Fe)	µg/L	200.000	<5							50	45.3	26	26		40	59	197	197	54.5
Lead (Pb)	µg/L	0.005	<0.5																
Manganese (Mn)	µg/L	50.000	<0.5		7.61	1.9	4.5			309	325	7.4	50		501	509	592	795	292
Mercury (Hg)	mg/L	0.001	<0.0001																
Nickel (Ni)	µg/L	20.000	<5		2.31	4	4		2.4	5.9	3.6	10	4.5		6	3.6	8.4	4.1	3.82
Nitrate	mg/L	50.000	<0.45			22	0.87					18.3	2.4						
Nitrite	mg/L	0.500	<0.002														0.015	0.015	0.015
pH	-	9.500	0		7.61	7.09	7.17		8.09	7.42	7.47	7.23	7.37		7.37	7.39	7.15	7.44	7.4
Selenium (Se)	µg/L	0.010	<0.5				4.5		4.65	4.65	4.5	4.5	4.5				4.3	2.4	2.3
Sodium (Na)	mg/L	200.000	<0.05		23.2	20.2	22.1		87.5	155	143	16.5	36		139	136	791	126	124
Sulphate	mg/L	250.000	<1		17	40.1	8.6		25.2	25.8	24.5	17.9	8.4		87.1	96.6	149	50.7	25.3

Irrigation Water Standards

The groundwater in the Project Area also has been used as irrigation water by the surrounding villages. Therefore, its quality for use as irrigation water should also be considered. As in surface water, the U.S. Salinity Diagram was used, as in surface waters.

According to this assessment, Samples of Ç-01, Ç-03, SK-01, WaterWell-3 and WaterWell-5 collected in March 2022, sample of SK-04 collected in April 2022, and sample of WaterWell-4 collected in June 2022 are C2-S1 (Medium Salinity-Low Sodium) waters. On the other hand, samples of Ç-02, WaterWell-2 and WaterWell-4 collected in March 2022 and sample of WaterWell-2 collected in June 2022 are C3-S1 (High Salinity-Low Sodium) WATERS, which are not preferrable for irrigation. The sample collected from WEL-02 in June 2022 is C4-S4 (Very High Salinity – Very High Sodium) water, which is the least suitable water for irrigation (Figure 6-44).

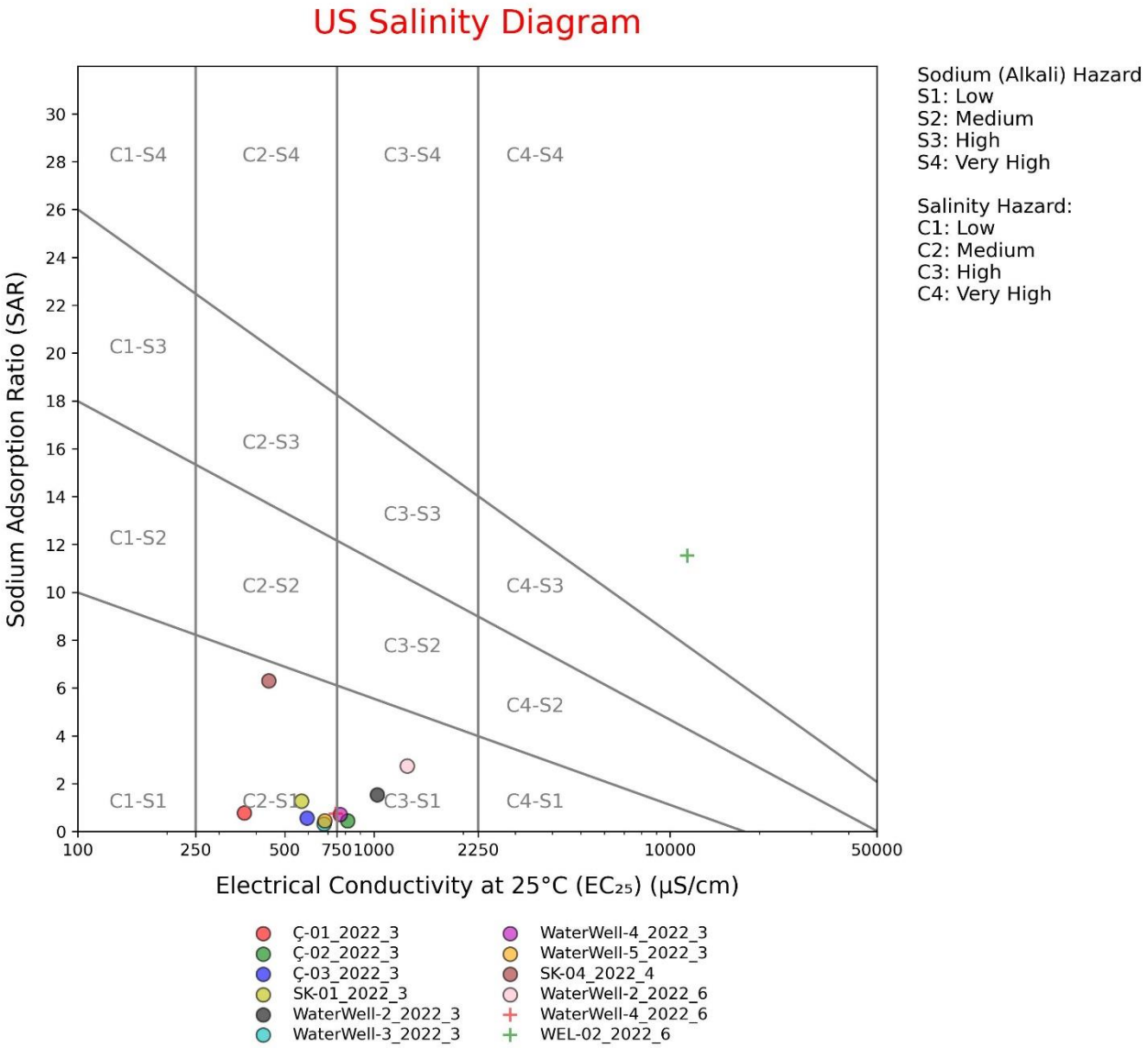


Figure 6-44: U.S. Salinity Diagram of Groundwater Samples

Sensitivity Assessment

Sensitivity features	Supported by	Sensitivity value
Presence of shallow aquifer in AoI. Presence of exploited aquifer. Presence of groundwater exploitation in AoI. Presence of high rock permeability in AoI. Presence of aquifer vulnerability in AoI.	Primary data and secondary data	High