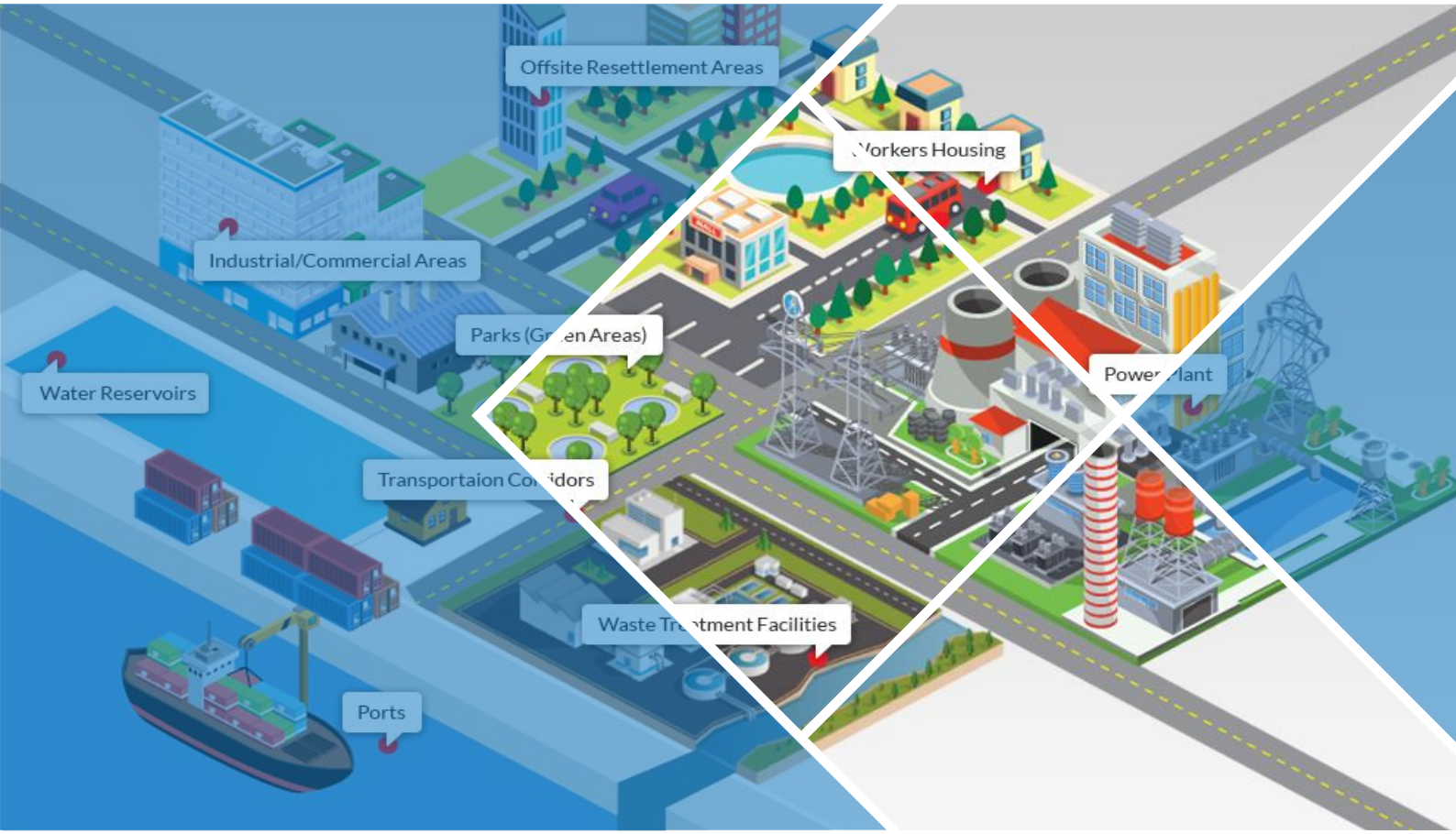
Government of the People's Republic of Bangladesh

Bangladesh Economic Zones Authority

REGIONAL ENVIRONMENTAL AND SOCIAL ASSESSMENT FOR NATIONAL SPECIAL ECONOMIC ZONE



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REGIONAL ENVIRONMENTAL AND SOCIAL ASSESSMENT FOR NATIONAL SPECIAL ECONOMIC ZONE

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APPENDIX A

Appendix A: Environmental Quality

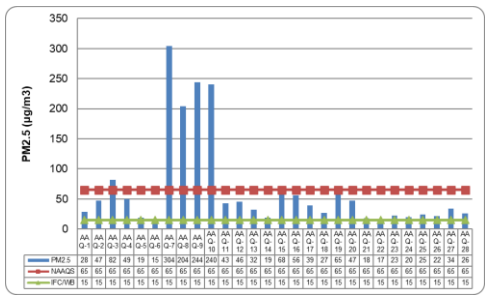
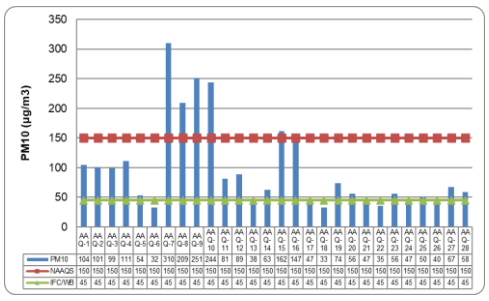
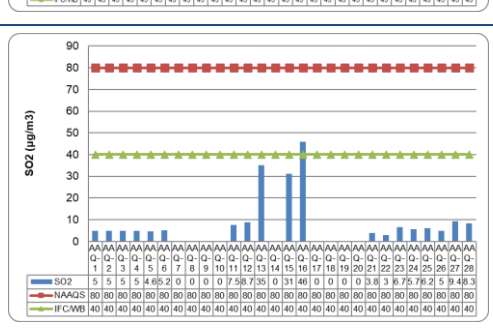
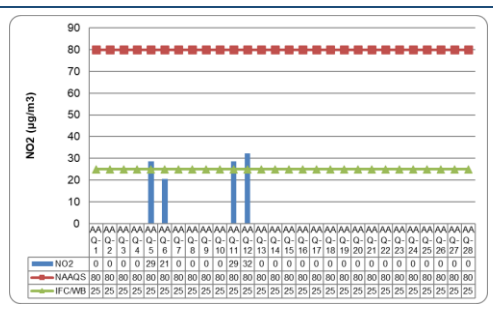
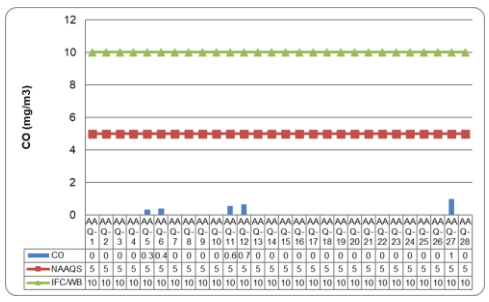
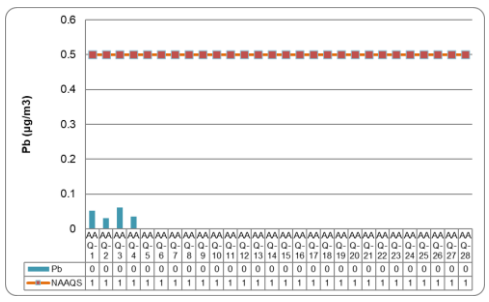
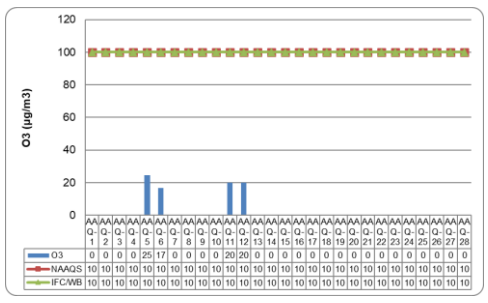
Appendix A-1: Ambient Air Quality - Secondary

From the secondary literature review, a total of 28 ambient air quality monitoring results have been identified in the study area and summarized in Table A-1.

Table A-1: Ambient Air Quality Monitoring at the Study Area

Monitoring Code	Geographical Coordinates	Location Details	Parameters							Date of Monitoring	Data Sources
			$PM_{2.5}$	PM_{10}	SO_2	NO_2	CO	Pb	O_3		
AAQ-1	22°45'8.72" N & 91°29'8.79" E	Barotakia Bazar, Mirsharai, Chattogram	28.25	104.17	5.0	-	Nil	0.052	-	24-27/12/2018	BEZA, 2018
AAQ-2	22°42'22.54" N & 91°32'25.55"E	Dakhin Magadia, Mirsharai, Chattogram	47.09	101.19	5.0	-	Nil	0.0313	-		
AAQ-3	22°48'29.19" N & 91°28'2.69" E	Moddho Moghadia, Mirsharai, Chattogram	81.74	98.92	5.0	-	Nil	0.0616	-		
AAQ-4	22°48'30.63" N & 91°23'13.99"E	CP More, Mirsharai, Chattogram	49.42	111.11	5.0	-	Nil	0.0347	-		
AAQ-5	-	Mirsharai Site 1	19.15	53.66	4.6	28.5	0.34	-	24.5	4-5/06/2018	GTCL, 2021
AAQ-6	-	Mirsharai Site 2	14.8	32.4	5.2	20.5	0.41	-	16.6		
AAQ-7	22°43'24.3" N & 91°30'44.3" E	11 No. South Mougadia Union, Mirsharai	304.0	310.0	-	-	-	-	-	22-23/11/2021	PGCB, 2023
AAQ-8	22°40'45.7" N & 91°32'26.4" E	5 No. Jetty, Dhomkhali Sea Beach Mirsharai	204.0	209.0	-	-	-	-	-		
AAQ-9	22°43'27" N & 91°27'25" E	1 No. Jetty, Helipad, Mirsharai	244.0	251.0	-	-	-	-	-		
AAQ-10	22°48'14.2" N & 91°26'48.8" E	Cyclone Shed, Mirsharai	240.0	244.0	-	-	-	-	-		
AAQ-11	22°51'21.60"N & 91°28'16.07'E	Feni River, Osmanpur Union	42.7	81.4	7.5	28.6	0.58	-	20	18-19/3/2021	BEZA, 2022
AAQ-12	22°47'30.89"N & 91°27'16.28"E	Poshchim Ichakhali	45.7	88.5	8.7	32.2	0.67	-	20		
AAQ-13	22 45.704 N & 91 28.243E	Mirsharai 2 Economic Zone	32.3	38.3	35.0	-	<0.3	-	-	16/07/2016	BEZA, 2016a
AAQ-14	22°44'37.52"N & 91°32'37.85"E	Moghadia Nurul Absar Chowdhury High School	18.9	62.96	LOO	-	Nil	-	-	November 2019	BEZA, 2020c
AAQ-15	22°44'31.5"N & 91°26'55.9"E	Within 2A & 2B Zones	68.17	161.9	31.22	-	Nil	-	-		
AAQ-16	22°44'1.74"N & 91°30'12.24"E	Near Bamon Sundar Khal	55.74	147.29	45.98	-	Nil	-	-		
AAQ-17	22.77720 N & 91.57079 E	Beside Foot Over Bridge, Mirsharai	39	47	-	-	-	-	-	June 2017	UDD, 2019
AAQ-18	22.77711 N & 91.56985 E	In front of the Municipal Office, Mirsharai	27	33	-	-	-	-	-		
AAQ-19	22.74806 N & 91.55727 E	Abu Torab Bazaar (Bazar Mor)	65	74	-	-	-	-	-		
AAQ-20	22.74888 N & 91.55535 E	Abu Torab Bazaar (In front of Moghadiya UP Bhaban)	47	56	-	-	-	-	-		
AAQ-21	22°47'27.42" N & 91°21'56.19"E	Project Area (Dry)	18.3	47.4	3.8	-	<1	-	-	October 2018	EGCB, 2018
AAQ-22	22°47'27.42" N & 91°21'56.19"E	Project Area (Wet)	16.8	35.4	3.0	-	<1	-	-		
AAQ-23	22°48'09.5" N & 91°22'55.4" E	Adarsha Village (Dry)	22.5	56.2	6.7	-	<1	-	-		
AAQ-24	22°48'09.5" N & 91°22'55.4" E	Adarsha Village (Wet)	19.5	46.8	5.7	-	<1	-	-		
AAQ-25	22°47'50.5" N & 91°21'43.4" E	Purbo Barodhuli Village (Dry)	24.5	50.1	6.2	-	<1	-	-		
AAQ-26	22°47'50.5" N & 91°21'43.4" E	Purbo Barodhuli Village (Wet)	21.6	40.1	5.0	-	<1	-	-		
AAQ-27	22°46'24.0" N & 91°21'07.3" E	Musapur Civic (Dry)	34.1	66.8	9.4	-	1	-	-		
AAQ-28	22°46'24.0" N & 91°21'07.3" E	Musapur Civic (Wet)	25.8	58.4	8.3	-	<1	-	-		

Table A-2: Summary of Analysis of the Ambient Air Quality (Secondary)

Parameters	Observation and Interference	Graphical Representation
Particulate Matter ($PM_{2.5}$)	$PM_{2.5}$ concentration in ambient air in the study region was recorded in the range of 14.8 - 304.0 µg/m^3. The concentration of $PM_{2.5}$ was observed to be a minimum (14.8 µg/m^3) at Mirsharai Site 2 (AAQ-6) and a maximum (304.0 µg/m^3) at 11 No. South Mougadia Union, Mirsharai (AAQ-7). Observed values at AAQ-7, AAQ-8, AAQ-9, and AAQ-10 exceeded the Air Pollution (Control) Rules 2022 standard (65 µg/m^3) for 24 hours. All observed values except AAQ-6 exceed the IFC/WB standard (15 µg/m^3) for 24 hours.	
Particulate Matter (PM_{10})	PM_{10} concentration in ambient air in the study region was recorded in the range of 32.4 - 310.0 µg/m^3. The concentration of PM_{10} was observed to be a minimum (32.4 µg/m^3) at Mirsharai Site 2 (AAQ-6) and a maximum (310.0 µg/m^3) at 11 No. South Mougadia Union, Mirsharai (AAQ-7). Observed values at AAQ-7, AAQ-8, AAQ-9, AAQ-10, and AAQ-15 exceeded the Air Pollution (Control) Rules 2022 standard (150 µg/m^3) for 24 hours. All observed values except AAQ-6, AAQ-13, AAQ-18, AAQ-22, and AAQ-26 exceed the IFC/WB standard (45 µg/m^3) for 24 hours.	
Sulphur Dioxide (SO_2)	SO_2 concentration in ambient air in the study region was recorded in the range of 3.0 - 45.98 µg/m^3. The concentration of SO_2 was observed to be a minimum (3.0 µg/m^3) at NSEZ Area (Wet) (AAQ-22) and a maximum (45.98 µg/m^3) at Near Bamon Sundar Khal (AAQ-16). All the observed values were within the Air Pollution (Control) Rules 2022 standard (80 µg/m^3) for 24 hours. However, observed values at AAQ-16 exceed the IFC/WB standard (40 µg/m^3) for 24 hours.	
Oxides of Nitrogen (NO_2)	NO_2 concentration in ambient air in the study region was recorded in the range of 20.5 - 32.2 µg/m^3. The concentration of NO_2 was observed to be a minimum (20.5 µg/m^3) at Mirsharai Site 2 (AAQ-6) and a maximum (32.2 µg/m^3) at Poshchim Ichakhali (AAQ-12). All the observed values were within the Air Pollution (Control) Rules 2022 standard (80 µg/m^3) for 24 hours. However, observed values at AAQ-5, AAQ-11, and AAQ-12 exceed the IFC/WB standard (25 µg/m^3) for 24 hours.	
Carbon Monoxide (CO)	CO concentration in ambient air in the study region was recorded in the range of <0.3 - 1 mg/m^3. The concentration of CO was observed to be minimum (<0.3 mg/m^3) at Mirsharai 2 Economic Zone (AAQ-13) and maximum (1 mg/m^3) at Musapur Civic (Dry) (AAQ-27). All the observed values were within the Air Pollution (Control) Rules 2022 standard (5 mg/m^3) and IFC/WB (10 mg/m^3) for 8 hours.	
Lead (Pb)	Pb concentration in ambient air in the study region was recorded in the range of 0.0313 - 0.0616 µg/m^3. The concentration of SO2 was observed to be minimum (0.0313 µg/m^3) at Dakhin Maghadia, Mirsharai, Chattogram (AAQ-2) and maximum (0.0616 µg/m^3) at Moddho Moghadia, Mirsharai, Chattogram (AAQ-3). All the observed values were within the Air Pollution (Control) Rules 2022 standard (0.05 µg/m^3) for 24 hours and IFC/WB have no standards.	
Ozone (O_3)	O_3 concentration in ambient air in the study region was recorded in the range of 16.6 - 24.5 µg/m^3. The concentration of O_3 was observed to be a minimum (16.6 µg/m^3) at Mirsharai Site 2 (AAQ-6) and a maximum (24.5 µg/m^3) at Mirsharai Site 1 (AAQ-5). All the observed values were within the Air Pollution (Control) Rules 2022 standard (100 µg/m^3) and IFC/WB (100 µg/m^3) for 8 hours.	

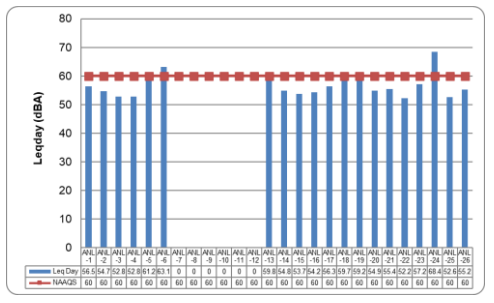
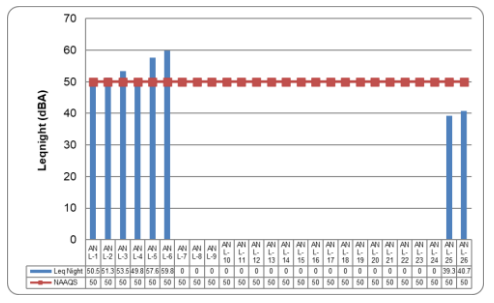
Appendix A-2: Ambient Noise Level – Secondary

From the secondary literature review, a total of 26 ambient noise level monitoring results have been identified and summarized in Table A-3.

Table A-3: Ambient Noise Level Monitoring at the Study Area

Monitoring Code	Geographical Coordinates	Location Details	Parameters								Date of Monitoring	Data Sources
			Day Time (6 AM-9 PM)				Nighttime (9 PM-6 AM)					
			Mean	Leq	Maximum	Minimum	Mean	Leq	Maximum	Minimum		
ANL-1	22°45’8.72” N & 91°29’8.79” E	Barotakia Bazar	56.07	56.46	59.6	53.1	50.02	50.48	53.2	47.6	24-27/12/2018	BEZA, 2018
ANL-2	22°42’22.54” N & 91°32’25.55” E	Dakhin Magadia	53.46	54.67	58.7	45.9	49.04	51.31	59.4	41.6		
ANL-3	22°48’29.19” N & 91°28’2.69” E	Moddho Moghadia	50.72	52.81	57.9	41.3	51.03	53.45	59.8	40.5		
ANL-4	22°48’30.63” N & 91°23’13.99” E	CP More	50.88	52.83	58.2	43.9	48.54	49.77	53.2	42.1		
ANL-5	22°48´28.9"N & 91°28´03"E	Uttar Ishakhali	59.93	61.2	66.2	52.6	55.65	57.56	62.3	46.7		
ANL-6	22°48´30.8"N & 91°23´14.7"E	Purbo Moghadia	60.21	63.1	68.6	48	59.28	59.81	64.8	57.3		
ANL-7	22°45´39.3"N & 91°28´12"E	DRS -1 (Mirsharai Upazila)	71.4	-	-	-	-	-	-	-	21-24/5/2018	GTCL, 2021
ANL-8	22°44´37"N & 91°29´24"E	DRS -2 (Mirsharai Upazila)	59.4	-	-	-	-	-	-	-		
ANL-9	22°43'24.8"N & 91°30'43.6"E	Substation	40.5	-	46.9	34.1	-	-	-	-	22-23/11/2021	PGCB, 2023
ANL-10	22°43'28"N & 91°27'26"E	Economic Zone Helipad	-	-	58.2	40.2	-	-	-	-		
ANL-11	22°40'45.5"N & 91° 32'26.2"E	Jetty 5	-	-	49.1	40.5	-	-	-	-		
ANL-12	24° 48'14.1"N & 91° 26'48.7"E	Cyclone Shelter	-	-	43.4	33.3	-	-	-	-		
ANL-13	22°43'40.14"N & 91°27'36.76"E	Embankment of Zone 2A	-	59.8	68.7	55.2	-	-	-	-	November 2019	BEZA, 2020c
ANL-14	22°44'5.69"N & 91°28'4.83"E	Embankment of Zone 2A	-	54.8	65.5	51.2	-	-	-	-		
ANL-15	22°44'29.84"N & 91°27'10.52"E	Within the EZ (Beside stake yard)	-	53.7	57.2	51.1	-	-	-	-		
ANL-16	22°44'45.27"N & 91°27'19.17"E	Zone 2A (Beside Ichakhali khal)	-	54.2	58.4	52..5	-	-	-	-		
ANL-17	22°45'40.16"N & 91°28'15.56"E	Starting point of Economic Zone Embankment from CDSP embankment	-	56.3	66.2	50.2	-	-	-	-		
ANL-18	22°44'21.16"N & 91°29'42.15"E	BWDB Embankment	-	59.7	77.2	52.9	-	-	-	-		
ANL-19	22°43'52.07"N & 91°30'19.04"E	CP Mor	-	59.2	71.2	55.3	-	-	-	-		
ANL-20	22°44'20.21"N & 91°30'55.75"E	NSEZ Saroni	-	54.9	62.2	51.4	-	-	-	-		
ANL-21	22°44'23.52"N & 91°31'44.67"E	NSEZ Saroni	-	55.4	65.3	52.7	-	-	-	-		
ANL-22	22°44'48.12"N & 91°33'7.52"E	NSEZ Saroni	-	52.2	61.4	49.7	-	-	-	-		
ANL-23	22°44'55.39"N & 91°33'20.57"E	NSEZ Saroni	-	57.2	68.3	55.7	-	-	-	-		
ANL-24	22°45'15.78"N & 91°35'4.63"E	Starting of NSEZ Saroni (Dhaka Cht. Highway to EZ Road)	-	68.4	73.5	66.2	-	-	-	-		
ANL-25	22°51'21.60"N & 91°28'16.07'E	Feni River, Osmanpur Union	-	52.6	56.7	47.3	-	39.3	37.3	34.2	18-19/3/2021	BEZA, 2022
ANL-26	22°47'30.89"N & 91°27'16.28"E	Poshchim Ichakhali	-	55.2	58.9	48.2	-	40.7	50.4	35.5		

Table A-4: Summary of Analysis of the Ambient Air Quality (Secondary)

Parameters	Observation and Interference	Graphical Representation
Daytime Noise Levels (Leqday)	The daytime noise levels at all the locations range between 52.2 dB(A) to 68.4 dB(A). The maximum value of 68.4 dB(A) was recorded at the starting of NSEZ Saroni (Dhaka Chattogram Highway to EZ Road) (ANL-24) and the minimum value of 52.2 dB(A) was recorded at NSEZ Saroni (ANL-22). All the observed values except ANL-5, ANL-6, and ANL-24 were within the Noise Pollution (Control) Rules 2006 daytime standard (60 dBA of mixed area). IFC/WB has no standard for mixed areas.	
Nighttime Noise Levels (Leqnight)	The night-time noise levels at all the locations ranged between 39.3 dB(A) to 59.81 dB(A). The maximum value of 59.81 dB(A) was recorded at Purbo Moghadia (ANL-6) and the minimum value of 39.3 dB(A) was recorded at Feni River, Osmanpur Union (ANL-25). All the observed values except ANL-1, ANL-2, ANL-3, ANL-5, and ANL-6 were within the Noise Pollution (Control) Rules 2006 nighttime standard (50 dBA of mixed area). IFC/WB has no standard for mixed areas.	

Appendix A-3: Surface Water Quality (inland and Marine) – Secondary

From the secondary literature review, a total of 33 inland surface water quality analysis results have been identified and summarized in **Error! Reference source not found.**.

Table A-5: Inland Surface Water Sampling at the Study Area

Sampling Code	Geographical Coordinates	Location Details	Parameters											Sampling Date	Data Source
			pH	TDS	DO	BOD	COD	Nitrate	Phosphate	Total Cr	Lead (Pb)	Total Coliform	Ammonia		
SWQ-1	22.75°67’74” N & 91.45°18’61” E	Bamonsundar khal	7.6	13704	6.3	12	116	-	-	-	-	-	-	24-27/12/2018	BEZA, 2018
SWQ-2	22.70°45’13” N & 91.48°93’16” E	Govania Chhara khal	7.9	13644	6	13.2	122	-	-	-	-	-	-		
SWQ-3	22.63°42’23” N & 91.55°87’58” E	Shaherkhali khal	7.9	20844	5.9	7.2	96	-	-	-	-	-	-		
SWQ-4	22.75°90’88” N & 91.47°79’87” E	Ichhakhali Khal	8.5	3508	7.6	1.8	64	-	-	-	-	-	-		
SWQ-5	22° 45'40.78"N & 91° 28' 23.41"E	Ichhakhali Khal	6.97	0.402	9.5	-	-	-	-	-	-	-	-	24/5/2018	GTCL, 2021
SWQ-6	-	Shonagazi, Feni	-	-	-	-	-	4.22	0.0253	-	-	-	-	10/12/2019	PGCB, 2023
SWQ-7	22°45'36.0"N & 91°28'00.3"E	Ichakhali Khal U/S (Near BWDB Rest house gate)	-	3150	-	1	4	-	-	0.02	0.015	-	0.18	5/11/2019	BEZA, 2020c
SWQ-8	22°50'16.0"N & 91°27'11.7"E	Muhuri Sluice Gate	-	92	-	1	8	-	-	0.04	0.025	-	0.29		
SWQ-9	22.856446N & 91.470924E	Intake Point Osmanpur	7.32	1056	7.1	7	24	-	4.3	-	-	-	0.26	3/3/2021	BEZA, 2022
SWQ-10	22.7916667N & 91.4547222E	Method WTP Site NSEZ	6.8	698	4.8	12	48	-	6.2	-	-	-	0.25		
SWQ-11	22° 45.087 N & 91° 27.548E	Ishakhali Channel Point	-	296	6.42	3	-	-	-	-	-	-	-	16/7/2016	BEZA, 2016a
SWQ-12	22° 43.976 N & 91° 30.286E	Bumonsundor Channel Point	-	5381	5.45	23	-	-	-	-	-	-	-		
SWQ-13	22°51'27.50"N & 91°28'11.10"E	Azampur, Feni River (Wet Season)	7.35	78	6.32	0.8	7	-	-	-	-	8600	0.4	17-18/7/2018	BEZA, 2020b
SWQ-14	22°51'27.50"N & 91°28'11.10"E	Azampur, Feni River (Wet Season)	7.62	88	6.32	3	7	-	-	-	-	TNTC	0.45	1-2/9/2018	
SWQ-15	22°51'27.50"N & 91°28'11.10"E	Azampur, Feni River (Wet Season)	7.18	118	5.44	3.2	12	-	-	-	-	TNTC	0.26	10-11/10/2018	
SWQ-16	22°51'27.50"N & 91°28'11.10"E	Azampur, Feni River (Dry Season)	7.19	119	6.51	0.4	2	-	-	-	-	38	0.41	28-29/1/2019	
SWQ-17	22°51'27.50"N & 91°28'11.10"E	Azampur, Feni River (Dry Season)	7.42	160	6.19	1	5	-	-	-	-	380	0.53	25-26/2/2019	
SWQ-18	22°51'27.50"N & 91°28'11.10"E	Azampur, Feni River (Dry Season)	7.59	132	5.48	2.6	6	-	-	-	-	1050	0.38	13-14/3/2019	
SWQ-19	22°48'45.56"N & 91°29'31.55"E	Jhulonpul Bazar (Ichakhali Khal) _Wet Season	7.14	75	5.95	2.8	10	-	-	-	-	26000	0.55	17-18/7/2018	
SWQ-20	22°48'45.56"N & 91°29'31.55"E	Jhulonpul Bazar (Ichakhali Khal) _Wet Season	7.07	71	5.31	2.8	11	-	-	-	-	TNTC	0.8	1-2/9/2018	
SWQ-21	22°48'45.56"N & 91°29'31.55"E	Jhulonpul Bazar (Ichakhali Khal) _Wet Season	7.34	133	5.48	3.6	13	-	-	-	-	TNTC	1.48	10-11/10/2018	
SWQ-22	22°48'45.56"N & 91°29'31.55"E	Jhulonpul Bazar (Ichakhali Khal) _Dry Season	-	-	-	-	-	-	-	-	-	-	-	-	
SWQ-23	22°48'45.56"N & 91°29'31.55"E	Jhulonpul Bazar (Ichakhali Khal) _Dry Season	7.26	129	4.44	1	7	-	-	-	-	TNTC	0.38	25-26/2/2019	
SWQ-24	22°48'45.56"N & 91°29'31.55"E	Jhulonpul Bazar (Ichakhali Khal) _Dry Season	7.49	136	4.18	1.6	5	-	-	-	-	TNTC	0.35	13-14/3/2019	
SWQ-25	NA	Moliyai Khal	7.44	232	6.03	125.4	-	-	-	-	-	-	-	Jun-19	UDD, 2019
SWQ-26	NA	Ichakhali Khal	7.67	2164	8.09	122.4	-	-	-	-	-	-	-		
SWQ-27	NA	Baromashi Khal near BSRM	7.8	224	8.56	129.6	-	-	-	-	-	-	-		
SWQ-28	NA	Baromashi Khal beside Dhaka Chattogram Highway	7.86	100	8.29	101.7	-	-	-	-	-	-	-		
SWQ-29	NA	Baromashi Khal near Zorarganj	7.53	172	8.28	114	-	-	-	-	-	-	-		
SWQ-30	22°47'06.0"N & 91°21'53.4"E	Project Area (dry)	7.8	4400	5.2	4	9.5	0.04	2.93	-	-	-	-	Oct-18	EGCB, 2018
SWQ-31	22°47'06.0"N & 91°21'53.4"E	Project Area (wet)	7.4	2400	5.4	3	6.4	0.08	6.45	-	-	-	-		
SWQ-32	22°49'23.1"N & 91°24'47.7"E	Feni River (Near Char khandakar Jele para) (dry)	7.7	6500	6.3	7	5.6	0.12	0.714	-	-	-	-		

Sampling Code	Geographical Coordinates	Location Details	Parameters											Sampling Date	Data Source
			pH	TDS	DO	BOD	COD	Nitrate	Phosphate	Total Cr	Lead (Pb)	Total Coliform	Ammonia		
SWQ-33	22°49'23.1"N & 91°24'47.7"E	Feni River (Near Char khandakar Jele para) (wet)	6.8	5200	6.7	5	2.6	0.09	6.48	-	-	-	-		

Table A-6: Marine Water Sampling at the Study Area

From the secondary literature review, a total of 8 marine water quality analysis results have been identified and summarized in **Error! Reference source not found.**.

Sampling Code	Geographical Coordinates	Location Details	Parameters											Sampling Date	Data Source
			pH	TDS	DO	BOD	COD	Nitrate	Phosphate	Total Cr	Lead (Pb)	Total Coliform	Ammonia		
SWQ-1	Sea water near the EZ site	Site 1- Coastal Water	6.7	-	-	-	-	-	-	-	-	-	-	2008-2009	BEZA, 2016b
SWQ-2		Site 2- Coastal Water	7.2	-	-	-	-	-	-	-	-	-	-		
SWQ-3		Site 3- Coastal Water	6.9	-	-	-	-	-	-	-	-	-	-		
SWQ-4		Feni River	7.47	6854.95	7.45	1.97	2.94	1	1.77	0.012	0.07	-	-		
SWQ-5		Muhuri River	7.16	32.7	4.88	2.61	2.87	0.03	0.86	0.019	0.012	-	-		
SWQ-6	22°42'29.0"N & 91°27'22.6"E	Sea Shore	-	6580	-	2	8	-	-	0.03	0.02	-	0.26	5/11/2019	BEZA, 2020c
SWQ-7	22°43'57.7"N & 91°30'13.5"E	Bamun Sundar Khal D/S	-	10100	-	17	72	-	-	0.01	-	-	0.68	27/11/2019	BEZA, 2020c
SWQ-8	22°44'40.4"N & 91°26'51.5"E	Ichakhali Khal D/S	-	3610	-	1	4	-	-	0.03	0.012	-	0.13	5/11/2019	BEZA, 2020c

Appendix A-4: Groundwater Water Quality - Secondary

From the secondary literature review, a total of 30 groundwater quality analysis results have been identified and summarized in Table A-7.

Table A-7: Groundwater Sampling at the Study Area

Sampling Code	Geographical Coordinates	Location Details	Parameters																									Sampling Date	Data Source
			pH	TDS	TSS	Hardness	Arsenic (As)	Iron (Fe)	Lead (Pb)	Cadmium (Cd)	Chromium (Cr)	Mercury (Hg)	Turbidity	Nitrate	Sulphate	Magnesium (Mg)	Manganese (Mn)	Total Ammonia	Fluoride	Calcium (Ca)	Zinc (Zn)	Sodium (Na)	Potassium (K)	Nickel (Ni)	Total Coliform	Fecal Coliform	Copper (Cu)	Chloride	Boron		
GWQ-1	22°45'8.72" N & 91°29'8.79" E	Barotakia Bazar	7.2	385		172	<0.001	LOD	<0.001	<0.001	0.002	0.00017																		24-27/12/2018	BEZA, 2018
GWQ-2	22°42'22.54" N & 91°32'25.55" E	Dakhin Magadia	7.3	651		190	0.087	LOD	<0.001	<0.001	0.003	0.00005																			
GWQ-3	22°48'29.19" N & 91°28'2.69" E	Moddho Moghadia	7.9	322		90	<0.001	LOD	<0.001	<0.001	<0.002	0.00004																			
GWQ-4	22°48'30.63" N & 91°23'13.99" E	CP More	7.8	171		60	<0.001	LOD	<0.001	<0.001	<0.002	0.001																			
GWQ-5	22°45' 49.48"N & 91° 28' 33.32"E	Ichhakhali				190	0.001	31.02																						24/6/2018	GTCL, 2021
GWQ-6	-	Shonagazi, Feni	7.65	258				0					2.22	1.5	0															10/12/2019	PGCB, 2023

Sampling Code	Geographical Coordinates	Location Details	Parameters																									Sampling Date	Data Source
			pH	TDS	TSS	Hardness	Arsenic (As)	Iron (Fe)	Lead (Pb)	Cadmium (Cd)	Chromium (Cr)	Mercury (Hg)	Turbidity	Nitrate	Sulphate	Magnesium (Mg)	Manganese (Mn)	Total Ammonia	Fluoride	Calcium (Ca)	Zinc (Zn)	Sodium (Na)	Potassium (K)	Nickel (Ni)	Total Coliform	Fecal Coliform	Copper (Cu)	Chloride	Boron		
GWQ-7	22°45'50.8"N & 91°28'41.4"E	Near Ichakhali Sluice Gate				160	0.001	0.84	0.068							6	0.04		0.14	28	0.08								05/11/2019	BEZA, 2020c
GWQ-8	22.856292 N & 91.474350E	Intake Point Osmanpur	7.21	468		310	0.001	2.6					4												0	0		760		3/3/2021	BEZA, 2022
GWQ-9	22.789581 N & 91.454385E	Method WTP Site NSEZ	7.08	512		180	0.001	0.67					5												0	0		15			
GWQ-10	22°45.936 N & 91° 27.781E	Mirsharai 2 Economic Zone				53	0.002	0.69							3.1													16		16/7/2016	BEZA, 2016a
GWQ-11	-	Site 1- Ground Water Quality (EZ)	6.8												683.13	34				132								5150		-	BEZA, 2016b
GWQ-12	-	Site 2- Ground Water Quality (EZ)	6.9												678.91	45				87								5310			
GWQ-13	-	Site 3- Ground Water Quality (EZ)	6.8												704.7	65				56								5420			
GWQ-14	-	Sample-1_Muhuri Irrigation Project	6.45			36	0.007	3.8						0.33	1	6				9	<0.08	50.6	3.3					26	0.2		
GWQ-15	-	Sample-2_Muhuri Irrigation Project	6.86			45	0.018	4.1						0.71	<1	8				10	<0.08	87.3	4.1					69	0.2		
GWQ-16	-	Sample-3_Muhuri Irrigation Project	6.98			44	0.007	4.2						0.61	1	7				9	<0.08	53.7	4					32	0.22		
GWQ-17	-	Musapur Bridge, Litte Feni River	8.15	948	43			0.56	<0.001	<0.001	0.108	<0.001	26.3	0.8				0.26			0.128				262	128				-	BEZA, 2020b
GWQ-18	-	Musapur Bridge, Litte Feni River	7.9	22068	712	3,750		6.8	<0.001	<0.001	<0.001	<0.001	616	0.1	1340	789.6	0.12				<0.001			0.011			0.006	12275			
GWQ-19	22.76689 & 91.5197	TTW-1 (Banatoli)	7.4	339			Nil	6									Nil											11			
GWQ-20	22.6829 & 91.5622	TTW-2 (Dhumkhali)	7.53	732			Nil	1.5									Nil											11			
GWQ-21	22.7048 & 91.5416	TTW-3 (Shaherkhali)	7.76	404			Nil	2.5									Nil											250			
GWQ-22	23.7273 & 91.5073	TTW-4 (Near CP moroe)	8.11	307			Nil	0.5									Nil											50			
GWQ-23	-	TTW-5																													
GWQ-24	-	TTW-6																													
GWQ-25	22.7615 & 91.4823	TTW-7 (South Ichakhali)	7.84	281			Nil	1.5									Nil														

Sampling Code	Geographical Coordinates	Location Details	Parameters																									Sampling Date	Data Source
			pH	TDS	TSS	Hardness	Arsenic (As)	Iron (Fe)	Lead (Pb)	Cadmium (Cd)	Chromium (Cr)	Mercury (Hg)	Turbidity	Nitrate	Sulphate	Magnesium (Mg)	Manganese (Mn)	Total Ammonia	Fluoride	Calcium (Ca)	Zinc (Zn)	Sodium (Na)	Potassium (K)	Nickel (Ni)	Total Coliform	Fecal Coliform	Copper (Cu)	Chloride	Boron		
GWQ-26	22.8019 & 91.4625	TTW-8 (Chunimidhir Tek)	7	1566			0.4	>7.0									0.4											1200			
GWQ-27	22.7715 & 91.4589	TTW-9 (NW Side of Cyclone Centre)	7.48	1127			Nil	3.5									Nil											430			
GWQ-28	22.8014 & 91.3909	TTW-10 (South Char Chandia Sonagazi)	7.52	290			Nil	1									Nil											66			
GWQ-29	22.7646 & 91.4786	TTW-DPHE-01	7.47	1076			Nil	3									Nil											590			
GWQ-30	22.7672 & 91.4768	TTW-DPHE-03	7.59	297			Nil	2									Nil											55			

Appendix A-5: Soil Quality - Secondary

From the secondary literature review, a total of 10 soil quality analysis results have been identified and summarized in Table A-8.

Table A-8: Soil Sampling at the Study Area

Sampling Code	Geographical Coordinates	Location Details	Parameter																				Sampling Date	Data Source
			PH	EC	Organic Matter	Total Nitrogen	Phosphorus	Potassium	Calcium	Magnesium	Sulphur	Lead (Pb)	Cadmium (Cd)	Chromium (Cr)	Nickel (Ni)	Sulphate	Chloride	CO3-	HCO3-	Texture				
SQ-1	22°47'33.46"N 91°27'19.64"E	WTP Area-1 at NSEZ	7.5	-	2.15	31	8.2	0.51	6.2	7.5	-	-	-	-	-	-	-	-	-	-	3/3/2021	BEZA, 2022
SQ-2	22°47'30.05"N 91°27'15.68"E	WTP Area-2 at NSEZ	7.1	-	2.5	30	7.75	0.45	6.1	6.25	-	-	-	-	-	-	-	-	-	-		
SQ-3	22°51'35.64"N 91°28'22.35"E	Intake area -1 at Osmanpur	6.95	-	2.2	28	7.5	0.4	5.9	6.02	-	-	-	-	-	-	-	-	-	-		
SQ-4	22°51'32.89"N 91°28'19.56"E	Intake area -2 at Osmanpur	6.75	-	2.4	27	6.55	0.31	5.8	6.95	-	-	-	-	-	-	-	-	-	-		
SQ-5	22°44'38.4"N 91°29'22.0"E	Purba Ichhakhali	5.9	-	2.96	0.148	2.14	1.54	-	-	20.81	18.41	1.09	53.57	36.94	-	-	-	-	Silty Clay Loam	24/5/2018	GTCL, 2021
SQ-6	-	Feni	8.2	4.6	1.2	0.06	3.98	0.8	5.88	7.68	59.16	-	-	-	-	-	-	-	-	-	2020	-
SQ-7	-	Chattogram	7.9	25	0.7	0.035	1.9	0.85	2.71	6.21	76.58	-	-	-	-	-	-	-	-	-		
SQ-8	-	Site-1	6.8	-	-	-	-	-	670	121	-	-	-	-	-	276.54	440	434.65	543	-	-	BEZA, 2016b
SQ-9	-	Site-2	7.2	-	-	-	-	-	750	129	-	-	-	-	-	289.64	476	456.94	346	-		

Sampling Code	Geographical Coordinates	Location Details	Parameter																	Sampling Date	Data Source
			PH	EC	Organic Matter	Total Nitrogen	Phosphorus	Potassium	Calcium	Magnesium	Sulphur	Lead (Pb)	Cadmium (Cd)	Chromium (Cr)	Nickel (Ni)	Sulphate	Chloride	CO3-	HCO3-	Texture		
SQ-10	-	Site-3	6.8	-	-	-	-	-	640	138	-	-	-	-	-	269.78	455	398.76	367	-		

Table A-9: Tourist Spots in the Study Area

Upazila	Tourist spot	Sea Beaches	Historical places
Mirsharai	Mahamaya lake, Khoiyachara Waterfalls, Melkhum trail, Napittachora Waterfall, Bawachhora Lake[1]	Saherkhali sea beach, Mohanagor sea beach, Uttor bogar char beach	• Hinguli Court Parr (embankment) built by Arakani Moghs • Chhuti Khan Mosque (16th century) • Daulat Bibi Mosque (16th century) • Mahadia Mosque (1780) • Nai Duari Mosque (18th century) • Hamidullah Khan Mosque (19th century) • The tomb of Shah Zayed (R) (806 AH) • Tomb of Awal Kazi Moakkel (R) • The tomb of Hazrat Shah Badal (R) • tomb of Hazrat Chinki Montana (R) • Tomb of Hazrat Mia Noor Ali Shah (R) • Tomb of Sufi Noor Mohammad Nizampuri (R) • Tomb of Hazrat Mir Gaffar Khan • Jagannath Mandir (Abu Torab Bazar) • Kali Mandir (Karerhat) • Hazisharai Mandir • Newanpur Mandir.[2]
Sitakunda	Eco Park, Botanical Garden, Sohosrodhara Waterfall, Jharjhari Waterfalls, Bhatiari Lake, Komoldoho Trail	Guliakhali Sea Beach, Banshbaria Sea Beach,	• Tomb of Bara Aulia • Kalu Shah Mazar • Fakir Hat Mazar • Pasthishala Buddhist Vihara • Sitakunda Shankar Math • Labanakhya Mandir • Chandranath Mandir and Hill
Sonagazi	Muhuri project	Sonagazi national forest	-
*One of the longest sea beaches in the world is the sea beach from Mirsharai to Teknaf.			

[1] https://www.thedailystar.net/life-living/travel/news/top-5-places-visit-mirsharai-chattogram-3350356

[2] https://en.banglapedia.org/index.php/Mirsharai_Upazila

Appendix A-6: Photographs of Monitoring and Sampling

Appendix A-6.1: Ambient Air Quality Monitoring Photographs

AAQ-1: Near BADC Sluice gate, Char Chandia, Sonagazi, Feni

AAQ-2: Near 7 no. Sonagazi Union parishad, Sonagazi, Feni

AAQ-3: East side of the road, Bishumiyarhat, Zorarjong, Mirsharai

AAQ-4: Near BEZA Administrative Building, NSEZ

AAQ-5: South Maghadia, Mirsharai

AAQ-6: Beribadh Road, Infront of Unigas Plant, Barabkunda, Sitakunda

AAQ-7: Goll Chattor of Komor Ali Bazar, Mirsharai

AAQ-8: Middle Abu Turab Bazar, Mirsharai, Chattogram

AAQ-9: In front of the Government Technical School & College, Sitakunda

AAQ-10: In front of the Kazi company market, CNG station, Bamansundor, Darogarhat, Mirsharai

Appendix A-6.2: Ambient Noise Level Monitoring Photographs

ANL-1: In front of the BEZA Administrative Building, NSEZ

ANL-2: Beribadh Road, near CP Mor, NSEZ

ANL-3: In front of Olikhan Govt, Primary School, Ichakhali, Mirsharai

ANL-4: Zero Point, Sonagazi municipality, Sonagazi, Feni

ANL-5: Junction of 4 roads at Vorer Bazar, Saherkhali, Mirsharai

ANL-6: East Muradpur Deli Bazar, Muradpur Sandwip Ghatghor Road, Mirsharai

ANL-7: 3 Rastar mor, Brickfield Bazar, Sitakunda, Chattogram

ANL-8: Gol Circle of Komor Ali Bazar, Mirsharai

ANL-9: Beside Uni Gas Central Jame Mosque, Barabkunda, Sitakunda

ANL-10: Junction of 3 Road at Banatoli Vor Bazar, Mirsharai

Appendix A-6.3: Surface Water Sampling Photographs

SW-01_1(U_S): Close to Ichakhali Khal Sluice Gate in Upstream

SW-01_2(D_S): Near Ichakhali Khal Sluice gate in downstream

SW-01_3(D_S): Close to Daborkhali Khal Sluice gate in downstream

SW-02_1(U_S): Near Bamansundar Khal Sluice gate in Upstream

SW-02_2(D_S): Near Bamansundar Khal Sluice gate in downstream

SW-03_1(U_S): Near Hoania Khal Sluice gate in Upstream

SW-03_2(D_S): Near Hoania Khal Sluice gate in downstream

SW-04_1(U_S): Near Saherkhali Khal Sluice gate in upstream

SW-04_2(D_S): Near Saherkhali Khal Sluice gate in downstream

SW-05_1(U_S): Near Domkhali Khal Sluice gate in upstream

SW-05_2(D_S): Near Domkhali Khal Sluice gate in Downstream

SW-06_1(U_S): Just behind of New Muhuri Bridge, Muhuri Reservoir, Feni

SW-06_2(D_S): Feni River (Muhuri Reservoir)

SW-07_1(U_S): Sandwip Channel

SW-07_2(D_S): Sandwip Channel

Appendix A-6.4: Groundwater Sampling Photographs

GWQ-1: Inside of Assistant Engineer Office, DPHE, NSEZ

GWQ-2: In front of the cyclone center, Takerhat Bazar, Jorargong, Mirsharai, Chattogram

GWQ-3: Hamidul Hoque Mistry House, Mia Para, Maghadia, Mirsharai, Chattogram

GWQ-4: New house of Abul Khayar, North-West Saidpur, Sitakunda, Chattogram

GWQ-5: In front of Madina Supermarket, Saherkhali Bazar Circle, Mirsharai, Chattogram

Appendix A-6.5: Soil Sampling Photographs

SQ-1: Precincts A - Residential development in NSEZ

SQ-2: Precincts I - Heavy Industrial Development in NSEZ

Appendix A-6.6: Sediment Sampling Photographs

SeQ-1: Confluence of Ichakhali Khal

SeQ-2: Sandwip channel

SeQ-3: Confluence of Domkhali Khal/Sandwip channel

SeQ-4: Downstream of Fakirhat ghat, Saidpur/Sandwip Channel

SeQ-5: Char in the Sandwip Channel (near Urirchar)

SeQ-6: Confluence of Feni and Little Feni River

SeQ-7: Near Musapur Closure (Feni EZ)

SeQ-8: Feni River

Appendix A-6.7: Photographs of the Traffic Survey

Daytime traffic monitoring

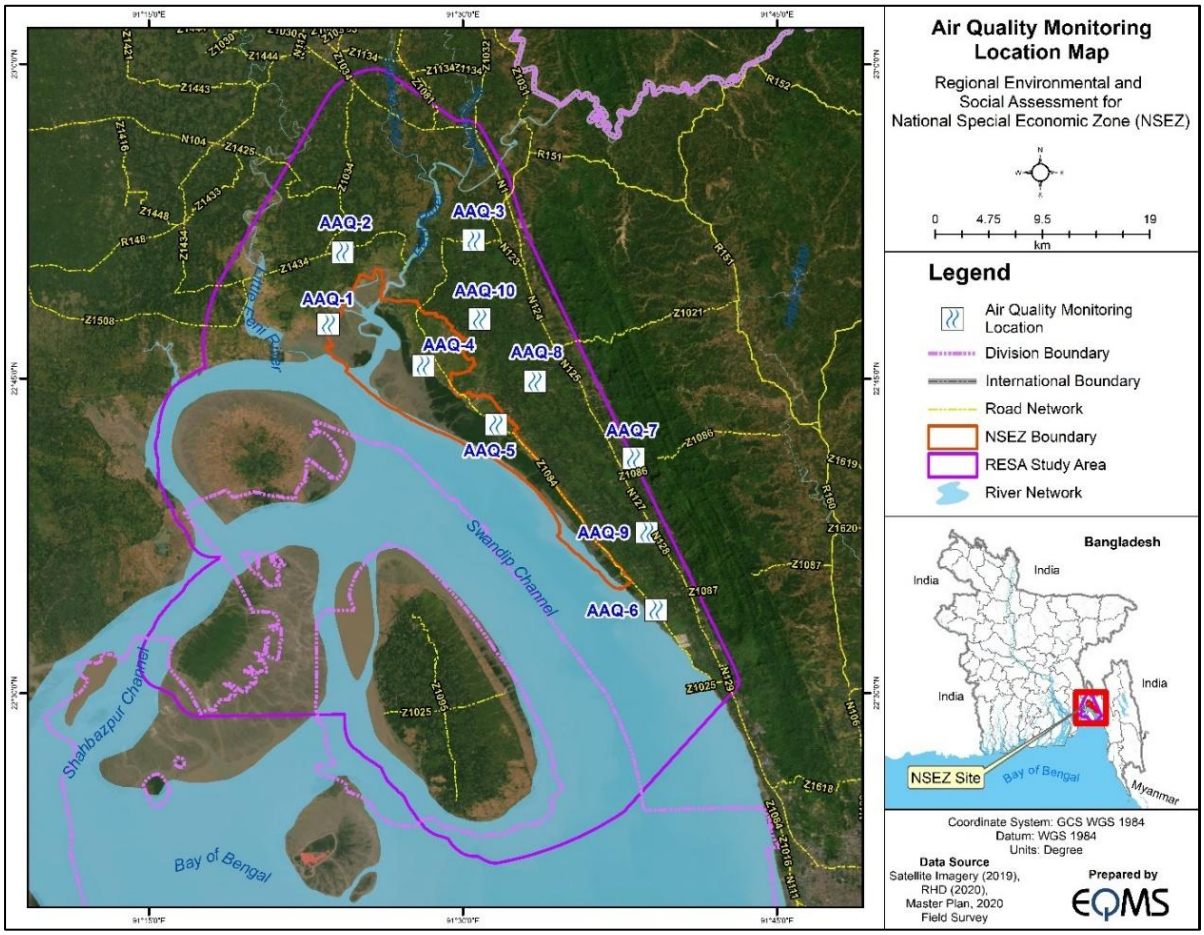
Nighttime traffic monitoring

Daytime traffic monitoring

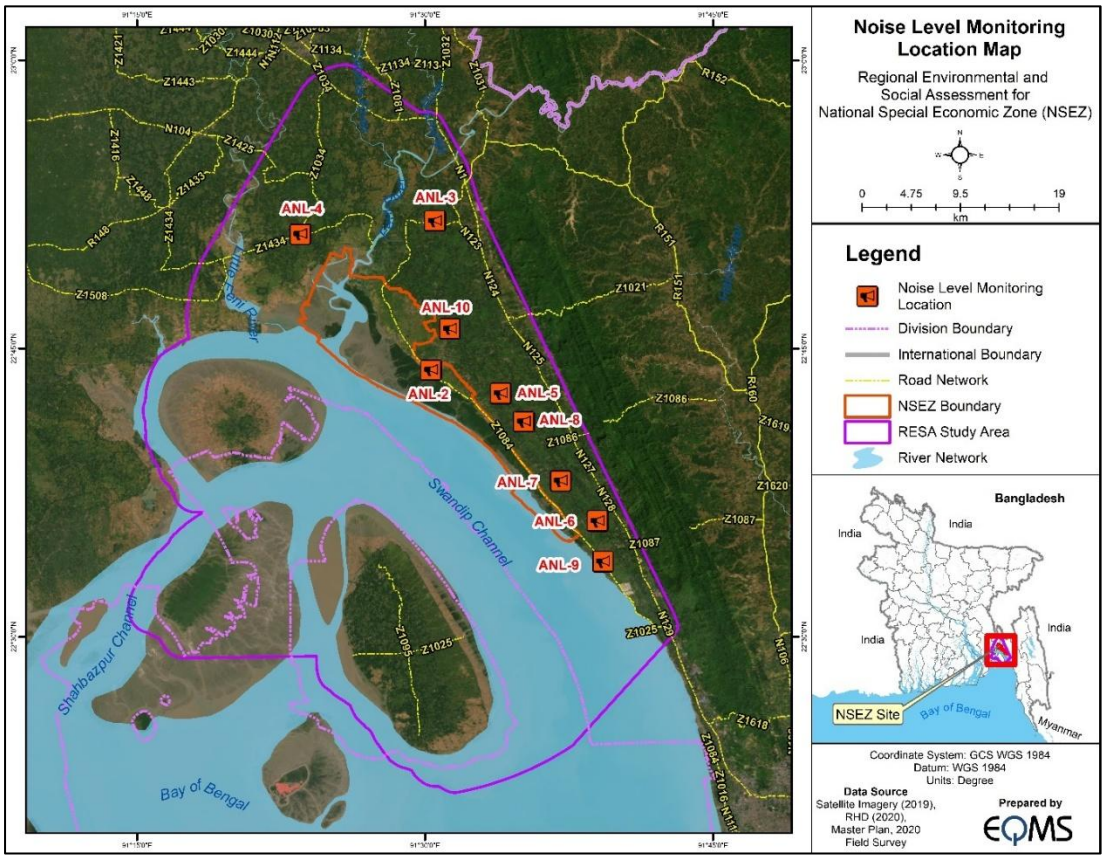
Nighttime traffic monitoring

Appendix A-7: Maps of Monitoring and Sampling

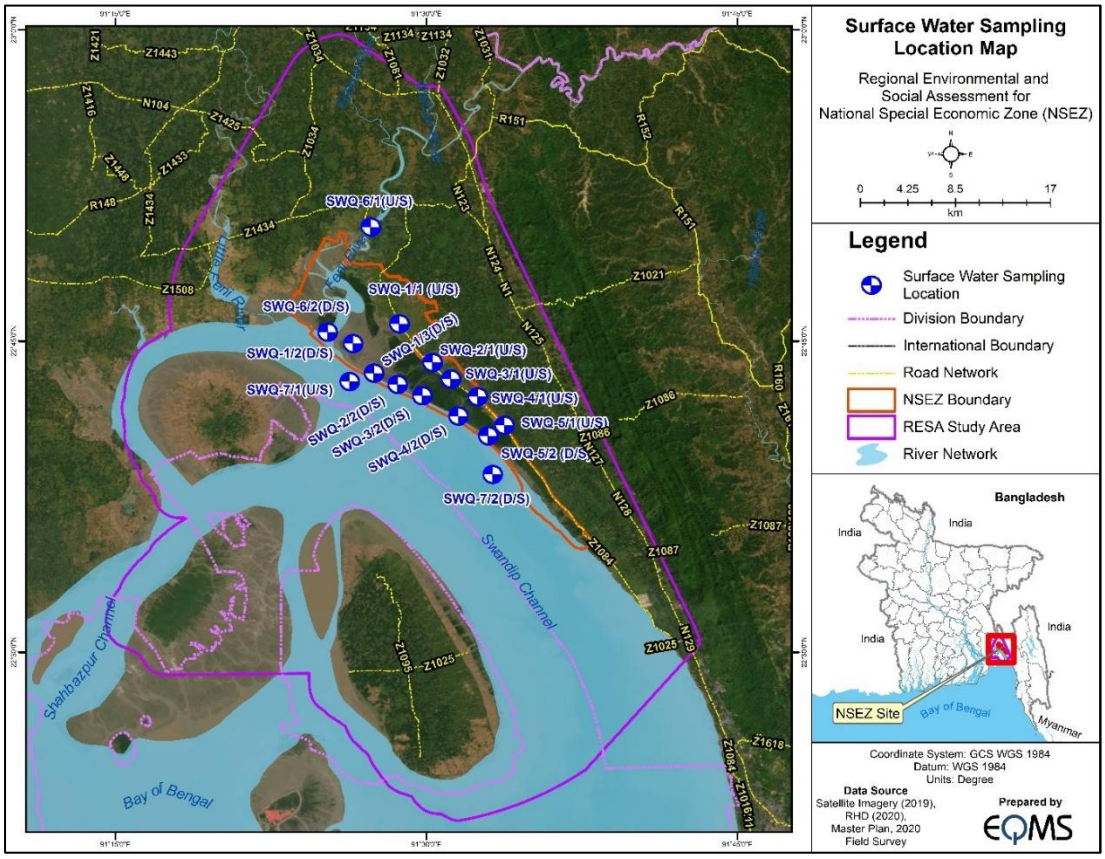
Appendix A-7.1: Ambient Air Quality Monitoring Location Map



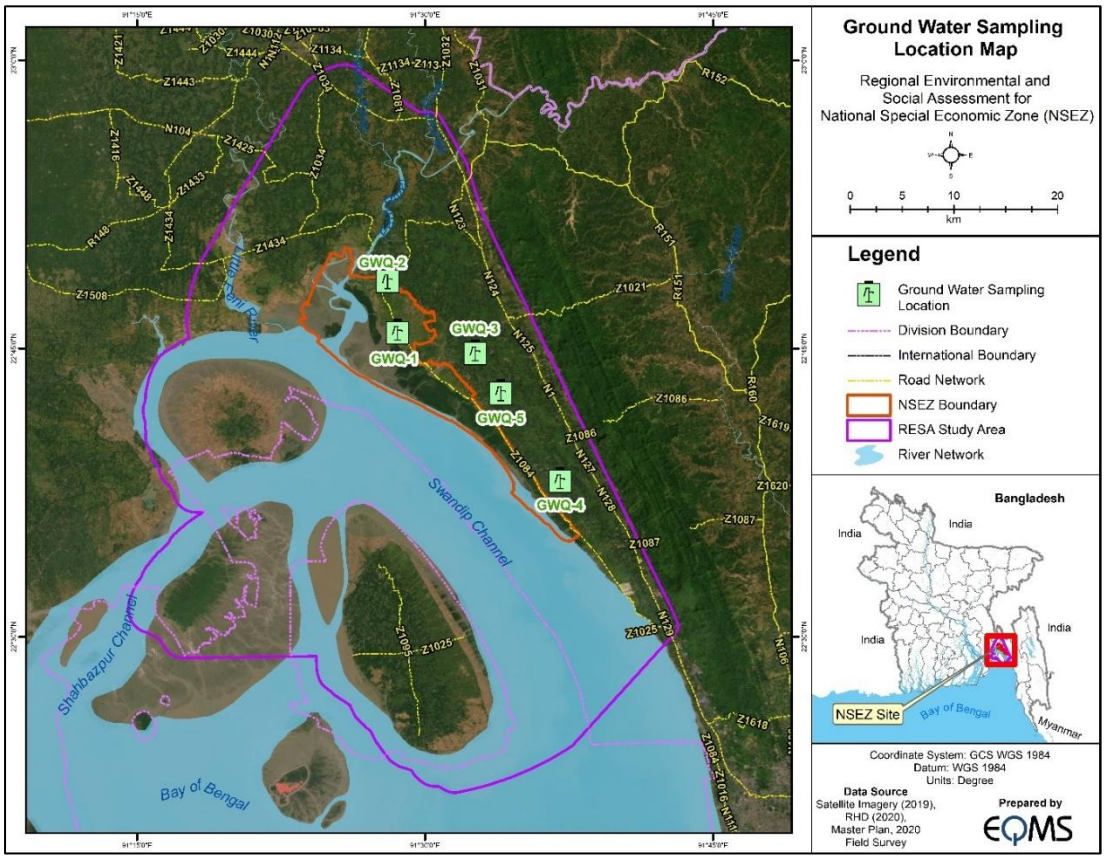
Appendix A-7.2: Ambient Noise Level Monitoring Location Map



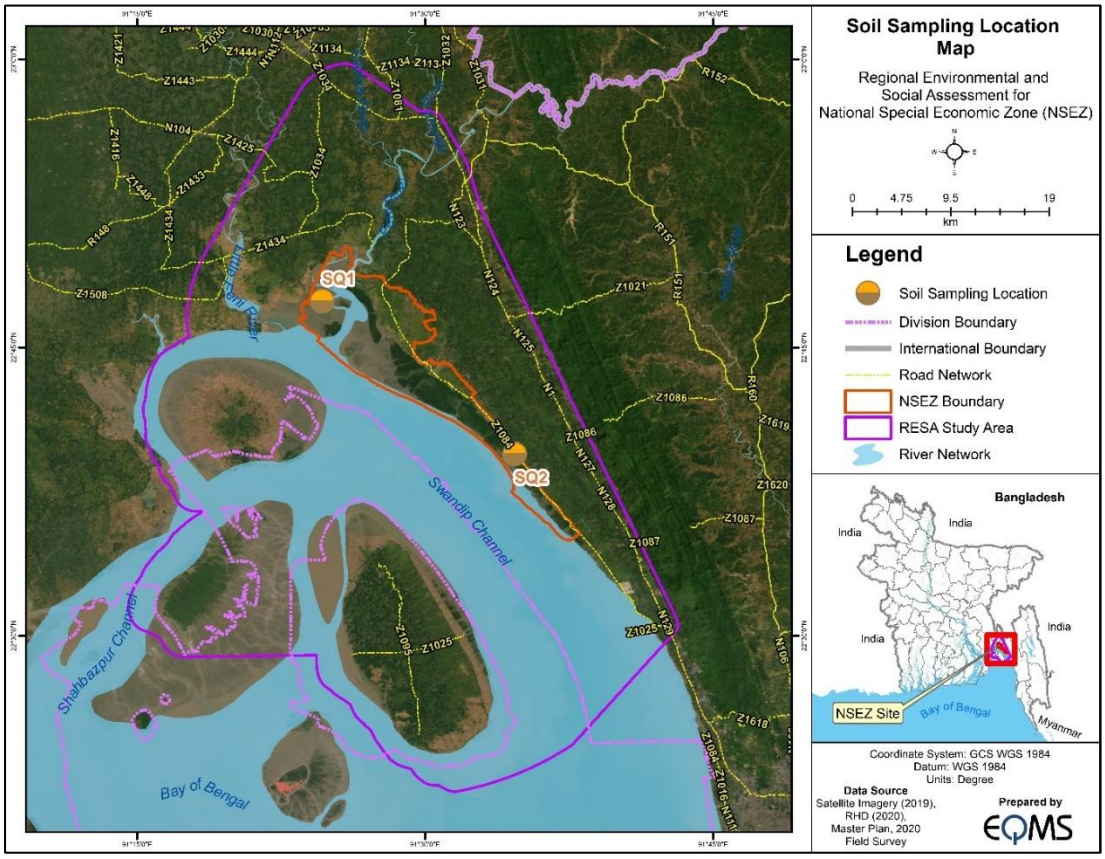
Appendix A-7.3: Surface Water Sampling Location Map



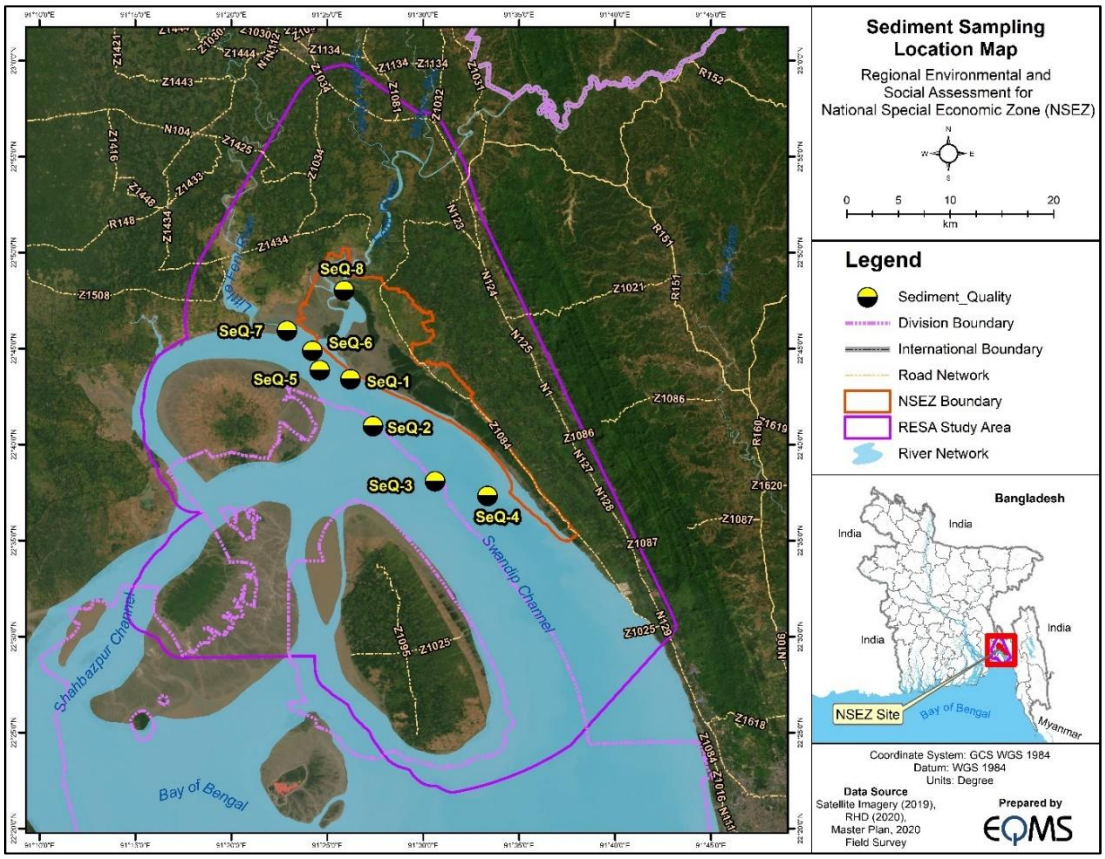
Appendix A-7.4: Groundwater Sampling Location Map



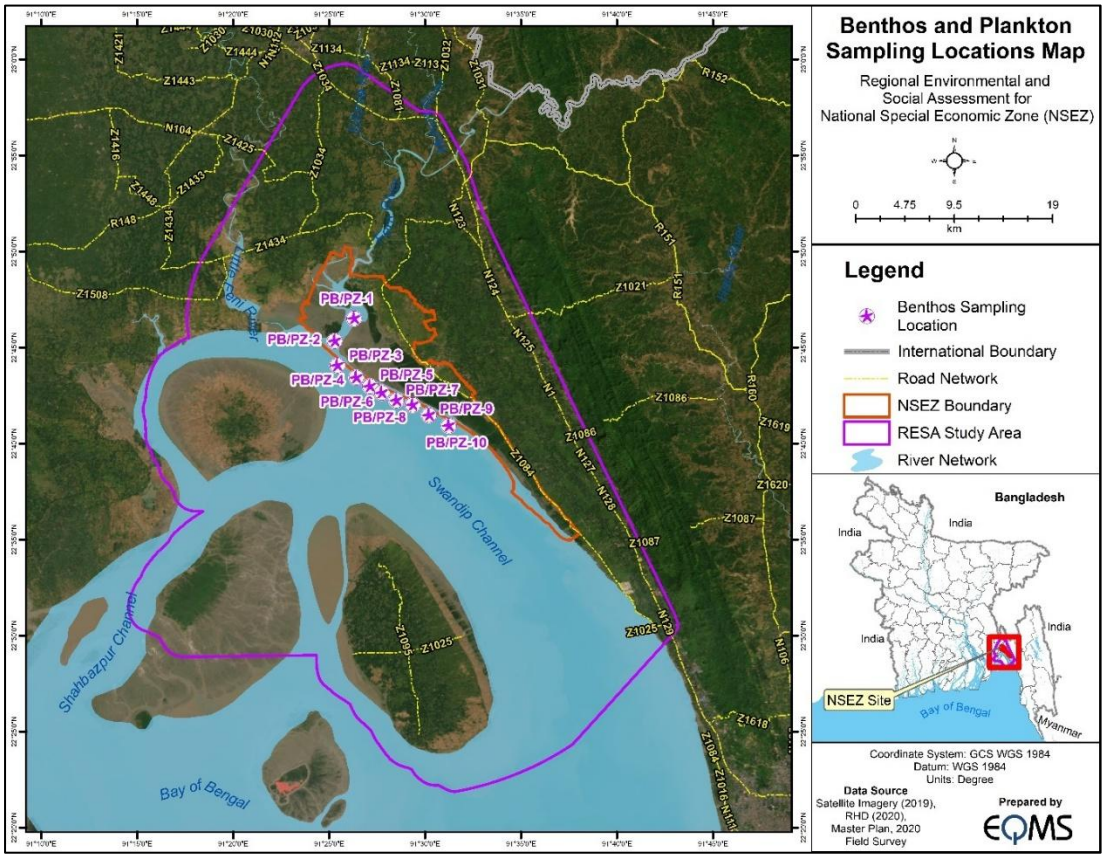
Appendix A-7.5: Soil Sampling Location Map



Appendix A-7.6: Sediment Sampling Location Map



Appendix A-7.7: Plankton and Benthos Sampling Locations Map



APPENDIX B

Appendix B: Flora and Fauna Species in the Study Region

Appendix B-1: Checklists

Appendix B-1.1: Checklist of Flora (Homestead Species) Present in the Study Region

SL#	Local Name	Scientific Name	Local Status	Area of Occurrence		Data Source	
				NSEZ Site	Study Region	Primary	Secondary
1.	Aam	*Mangifera indica*	VC	+	-	√	
2.	Jam	*Syzygium cumini*	VC	-	+	√	
3.	Kathal	*Artocarpus heterophyllus*	C	-	+	√	
4.	Boroi	*Zizyphus mauritiana*	VC	-	+	√	
5.	Aamra	*Spondias mombin*	VC	-	+	√	
6.	Kola	*Musa sapientum*	VC	+	+	√	
7.	Peyara	*Psidium guajava*	VC	+	+	√	
8.	Lichu	*Litchi chinensis*	VC	-	+	√	
9.	Pepe	*Carica papaya*	VC	+	+	√	
10.	Zambura	*Citrus maxima*	R	-	+	√	
11.	Lebu	*Citrus spp.*	VC	-	+	√	
12.	Koromcha	*Carissa carandas*	R	-	+	√	
13.	Khezur	*Phoenix dactylifera*	VC	+	+	√	
14.	Taal	*Borassus flabellifer*	C	-	+	√	
15.	Narikel	*Cocos nucifera*	C	+	+	√	
16.	Supari	*Areca catechu*	C	-	+	√	
17.	Akashmoni	*Acacia auriculiformis*	C	+	+	√	
18.	Arjun	*Terminalia arjuna*	C	-	+	√	
19.	Dumur	*Ficus racemosa*	C	+	+	√	
20.	Ashwath	*Ficus religiosa*	C	+	+	√	
21.	Eucalyptus	*Eucalyptus citriodora.*	VC	+	+	√	
22.	Hargoza	*Acanthus ilicifolius*	C	+	+	√	
23.	Debdaru	*Polyalthia longifolia*	C	-	+	√	
24.	Kath Badam	*Terminalia catappa*	R	-	+		√
25.	Chalta	*Dillenia indica*	R	-	+		√

SL#	Local Name	Scientific Name	Local Status	Area of Occurrence		Data Source	
				NSEZ Site	Study Region	Primary	Secondary
26.	Choita Boroi	*Salacia chinensis*	C	+	+	√	
27.	Nona jhaw	*Tamarix indica*	C	+	+	√	
28.	Bherenda	*Ricinus communis*	C	-	+	√	
29.	Pitali	*Trewia nudiflora*	VC	-	+	√	
30.	Sada koroi	*Albizia procera*	C	+	+	√	
31.	Koroi	*Samanea saman*	VC	+	+	√	
32.	Mehegony	*Swietenia mahagoni*	VC	+	+	√	
33.	Sonalu	*Cassia fistula*	C	-	+	√	
34.	Krishno chura	*Caesalpinia pulcherrima*	C	+	+	√	
35.	Shimul	*Bombax ceiba*	R	+	+	√	
36.	Mandar	*Erythrina ovalifolia*	C	-	+	√	
37.	Sisu	*Dalbergia sissoo*	R	-	+	√	
38.	Tetul	*Tamarindus indica*	VC	+	+	√	
39.	Neem	*Azadirachta indica*	C	+	+	√	
40.	Bot	*Ficus bengalensis*	C	+	+	√	
41.	Bash	*Bamboo spp.*	VC	+	+	√	
42.	Kodom	*Neolamarckia cadamba*	C	+	+	√	
43.	Shegun	*Tectona grandis*	VC	-	+	√	

Data Source: EQMS Field Survey 2023, ECAL 2018, CEGIS 2018

Appendix B-1.2: Checklist of Flora (Fallow Lands Species) Present in the Study Region

SL#	Common Name	Scientific Name	Local Status	Area of Occurrence		Data Source	
				NSEZ Site	Study Region	Primary	Secondary
1.	Rough cocklebur	*Xanthium indicum*	C	+	+	√	
2.	Dwarf copperleaf	*Alternanthera sesilis*	VC	+	+	√	
3.	Lemon Bush	*Lippia scaberrima*	C	+	+		√

SL#	Common Name	Scientific Name	Local Status	Area of Occurrence		Data Source	
				NSEZ Site	Study Region	Primary	Secondary
4.	Nut grass	*Cyperus rotundusl*	C	+	+	√	
5.	Spotted Knotweed	*Persicaria praetermissa*	C	+	+	√	
6.	Climbing Croton	Croton caudatus	C	+	+	√	
7.	Three-flower beggar weed	*Desmodium triflorum*	C	+	+	√	
8.	Catmint	*Anisomeles indica*	C	+	+	√	
9.	Sickle pod	*Cassia tora*	C	+	+	√	
10.	Chique chique	*Crotalaria pallida*	VC	+	+	√	

Data Source: EQMS Field Survey 2023, ECAL 2018, CEGIS 2018

Appendix B-1.3: Checklist of Flora (Mangrove Species) Present in the Study Region

SL#	Local Name	Common Name	Scientific Name	Local Status	Area of Occurrence		Data Source	
					NSEZ Site	Study Region	Primary	Secondary
1.	Sada baen	Common mangrove tree	*Avicennia alba*	C	+	+	√	
2.	Gewa	Thillai, milky mangrove	*Excoecaria agallochas*	C	+	+	√	
3.	Keora	Keora	*Sonneratia apetala*	C	+	+	√	

Data Source: EQMS Field Survey 2023

Appendix B-1.4: Checklist of Mammals Recorded in the Study Region

SL#	Common Name	Scientific Name	IUCN Red List Status	Wildlife Act, 2012	Area of Occurrence		Data Source	
					NSEZ Site	Study Region	Primary	Secondary
1.	Lesser Bandicoot Rat	*Bandicota bengalensis*	LC	SCH-III	+	+	√	
2.	Large Bandicoot Rat	*Bandicota indica*	LC	SCH-III	+	+	√	
3.	Common Indian Field Mouse	*Mus boodug*	LC	SCH-III	+	+		√
4.	House Mouse	*Mus musculus*	LC	SCH-III	+	+	√	
5.	House Shrew	*Suncus murinus*	LC	-	+		√	
6.	Common mongoose	*Herpestes edwardsii*	LC	SCH-I	-	+	√	
7.	Small Indian Mongoose	*Herpestes auropunctatus*	LC	SCH-I	+	+	√	
8.	Indo-Pacific Humpback dolphin	*Sousa chinensis*	LC	SCH-I	-	+		√
9.	Irrawaddy dolphin	*Orcaella brevirostris*	NT	SCH-I	-	+		√
10.	Irrawaddy Squirrel	*Callosciurus pygerythrus*	LC	SCH-I	-	+	√	
11.	Indian Fruit Bat	*Pteropus giganteus*	LC	SCH-I	-	+	√	
12.	Short-nosed Fruit Bat	*Cynopterus sphinx*	LC	SCH-I	-	+	√	
13.	Lesser Asiatic Yellow Bat	*Scotophilus kuhlii*	LC	SCH-I	+	+	√	
14.	Rhesus Macaque	*Macaca mulatta*	VU	SCH-I	+	+	√	
15.	Golden Jackel	*Canis aureus*	LC	SCH-I	+	+	√	
16.	Fishing Cat	*Prionailurus viverrinus*	EN	SCH-I	-	+		√
17.	Jungle Cat	*Felis chaus*	NT	SCH-I	+	+	√	
18.	Spotted Deer	*Axis axis*	LC	SCH-II	+	+	√	

Note: CR - Critically Endangered, EN - Endangered, VU - Vulnerable, LC - Least Concern, DD - Data Deficient.
Source: EQMS Field Survey 2023, IUCN Bangladesh 2015, Khan 2018, Aziz 2019, ECAL 2018, CEGIS 2018.

Appendix B-1.5: Checklist of Avifauna Recorded in the Study Region

SL #	English Name	Scientific Name	IUCN Status		Wildlife Act 2012	Area of Occurrence		Data Source	
			Local	Global		NSEZ Site	Study Region	Primary	Secondary
1.	Abbott's Babbler	*Malacocincla abbotti*	LC	LC	Schedule I	-	+		√
2.	Ashy Bulbul	*Hemixos flavala*	LC	LC	Schedule I	-	+		√
3.	Ashy Drongo	*Dicrurus leucophaeus*	LC	LC	Schedule I	-	+	√	
4.	Ashy Wood swallow	*Artamus fuscus*	LC	LC	Schedule II	-	+	√	
5.	Asian Koel	*Eudynamys scolopacea*	LC	LC	Schedule II	-	+	√	
6.	Asian Openbill	*Anastomus oscitans*	LC	LC	Schedule I	+	+	√	
7.	Asian Palm Swift	*Cypsiurus balasiensis*	LC	LC	Schedule I	+	+	√	
8.	Asian Paradise-flycatcher	*Terpsiphone paradisi*	LC	LC	Schedule I	-	+	√	
9.	Asian Pied Starling	*Sturnus contra*	LC	LC	Schedule I	+	+	√	
10.	Barn Owl	*Tyto alba*	LC	LC	Schedule I	+	+	√	
11.	Barn Swallow	*Hirundo rustica*	LC	LC	Schedule II	+	+	√	
12.	Baya Weaver	*Ploceus philippinus*	LC	LC	Schedule I	+	+	√	
13.	Bengal Bushlark	*Mirafra assamica*	LC	LC	Schedule I	+	+	√	
14.	Besra	*Accipiter virgatus*	LC	LC	Schedule I	+	+		√
15.	Black Baza	*Aviceda leuphotes*	LC	LC	Schedule I	+	+	√	
16.	Black Drongo	*Dicrurus macrocercus*	LC	LC	Schedule II	+	+	√	
17.	Black Kite	*Milvus migrans*	LC	LC	Schedule II	+	+	√	
18.	Black-crested Bulbul	*Pycnonotus melanicterus*	LC	LC	Schedule I	-	+		√
19.	Black-crowned Night Heron	*Nycticorax nycticorax*	LC	LC	Schedule I	+	+		√
20.	Black-headed Cuckooshrike	*Coracina melanoptera*	LC	LC	Schedule I	-	+	√	
21.	Black-headed gull	*Chroicocephalus ridibundus*	LC	LC	Schedule I	-	+		√

SL #	English Name	Scientific Name	IUCN Status		Wildlife Act 2012	Area of Occurrence		Data Source	
			Local	Global		NSEZ Site	Study Region	Primary	Secondary
22.	Black-headed Ibis	*Threskiornis melanocephalus*	VU	NT	Schedule I	+	+	√	
23.	Black-hooded Oriole	*Oriolus xanthornus*	LC	LC	Schedule II	+	+	√	
24.	Black-naped Monarch	*Hypothymis azurea*	LC	LC	Schedule I	-	+	√	
25.	Black-naped Oriole	*Oriolus chinensis*	LC	LC	Schedule I	-	+	√	
26.	Black-rumped Flameback	*Dinopium benghalense*	LC	LC	Schedule II	+	+	√	
27.	Black-winged Kite	*Elanus caeruleus*	LC	LC	Schedule I	+	+	√	
28.	Blue Whistling Trush	*Myophonus caeruleus*	LC	LC	Schedule I	-	+		√
29.	Blue-throated Barbet	*Megalaima asiatica*	LC	LC	Schedule I	-	+	√	
30.	Blue-throated Flycatcher	*Cyornis rubeculoides*	LC	LC	Schedule I	-	+		√
31.	Brahminy Kite	*Haliastur indus*	LC	LC	Schedule II	+	+	√	
32.	Bronzed Drongo	*Dicrurus aeneus*	LC	LC	Schedule I	-	+	√	
33.	Bronze-winged jacana	*Metopidius indicus*	LC	LC	Schedule I	+	+	√	
34.	Brown Fish Owl	*Ketupa zeylonensis*	LC	LC	Schedule I	-	+		√
35.	Brown Shrike	*Lanius cristatus*	LC	LC	Schedule II	+	+		√
36.	Brown-headed Gull	*Larus brunnicephalus*	LC	LC	Schedule I	-	+	√	
37.	Cattle Egret	*Bubulcus ibis*	LC	LC	Schedule II	+	+	√	
38.	Chestnut-tailed Starling	*Sturnus malabaricus*	LC	LC	Schedule II	+	+	√	
39.	Chrested Hawk Eagle	*Nisaetus cirrhatus*	LC	LC	Schedule I	-	+	√	
40.	Cinnamon Bittern	*Ixobrychus cinnamomeus*	LC	LC	Schedule I	+	+	√	
41.	Citrine Wagtail	*Motacilla citreola*	LC	LC	Schedule I	+	+	√	
42.	Collared Scops Owl	*Otus bakkamoena*	LC	LC	Schedule I	-	+		√
43.	Common Greenshank	*Tringa nebularia*	LC	LC	Schedule I	-	+	√	
44.	Common Hawk Cuckoo	*Hierococcyx varius*	LC	LC	Schedule II	-	+	√	

SL #	English Name	Scientific Name	IUCN Status		Wildlife Act 2012	Area of Occurrence		Data Source	
			Local	Global		NSEZ Site	Study Region	Primary	Secondary
45.	Common Hoopoe	*Upupa epops*	LC	LC	Schedule I	+	+	√	
46.	Common Iora	*Aegithina tiphia*	LC	LC	Schedule II	-	+	√	
47.	Common Kestrel	*Falco tinnunculus*	LC	LC	Schedule I	-	+	√	
48.	Common Kingfisher	*Alcedo atthis*	LC	LC	Schedule II	+	+	√	
49.	Common Myna	*Acridotheres tristis*	LC	LC	Schedule II	+	+	√	
50.	Common Sandpiper	*Actitis hypoleucos*	LC	LC	Schedule II	+	+	√	
51.	Common Shelduck	*Tadorna tadorna*	LC	LC	Schedule I	-	+	√	
52.	Common Snipe	*Gallinago gallinago*	LC	LC	Schedule I	+	+	√	
53.	Common Stonechat	*Saxicola torquatus*	LC	LC	Schedule I	+	+	√	
54.	Common Tailorbird	*Orthotomus sutorius*	LC	LC	Schedule II	+	+	√	
55.	Common Woodshrike	*Tephrodornis pondicerianus*	LC	LC	Schedule I	-	+	√	
56.	Coppersmith Barbet	*Megalaima haemacephala*	LC	LC	Schedule II	-	+	√	
57.	Crested Goshawk	*Accipiter trivirgatus*	LC	LC	Schedule I	-	+		√
58.	Crested Serpent Eagle	*Spilornis cheela*	LC	LC	Schedule I	+	+	√	
59.	Crimson Sunbird	*Aethopyga siparaja*	LC	LC	Schedule I	+	+	√	
60.	Dollar Bird	*Eurystomas orientalis*	LC	LC	Schedule I	-	+	√	
61.	Dusky Warbler	*Phylloscopus fuscatus*	LC	LC	Schedule II	+	+	√	
62.	Emerald Dove	*Chalcophaps indica*	LC	LC	Schedule I	-	+	√	
63.	Eurasian Collared Dove	*Streptopelia decaocto*	LC	LC	Schedule I	+	+	√	
64.	Eurasian Curlew	*Numenius arquata*	LC	LC	Schedule I	+	+	√	
65.	Eurasian Golden Oriole	*Oriolus oriolus*	LC	LC	Schedule I	-	+	√	
66.	Eurasian Teal	*Anas crecca*	LC	LC	Schedule I	-	+	√	
67.	Eurasian Wigeon	*Mareca penelope*	LC	LC	Schedule I	-	+	√	
68.	Eurasian Wryneck	*Jynx torquilla*	LC	LC	Schedule II	-	+	√	
69.	Forest Wagtail	*Dendronanthus indicus*	LC	LC	Schedule I	-	+	√	

SL #	English Name	Scientific Name	IUCN Status		Wildlife Act 2012	Area of Occurrence		Data Source	
			Local	Global		NSEZ Site	Study Region	Primary	Secondary
70.	Fulvous-breasted Woodpecker	*Dendrocopos macei*	LC	LC	Schedule II	-	+	√	
71.	Gadwall	*Mareca strepera*	LC	LC	Schedule I	-	+	√	
72.	Glossy Ibis	*Plegadis falcinellus*	LC	LC	Schedule I	-	+	√	
73.	Golden-fronted Leaf Bird	*Chloropsis aurifrons*	LC	LC	Schedule I	-	+	√	
74.	Golden-spectacled Warbler	*Seicercus burkii*	DD	LC	Schedule I	-	+	√	
75.	Great Egret	*Casmerodius albus*	LC	LC	Schedule II	+	+	√	
76.	Great Tit	*Parus major*	LC	LC	Schedule I	+	+	√	
77.	Greater Coucal	*Centropus sinensis*	LC	LC	Schedule I	-	+	√	
78.	Greater Flameback	*Chrysocolaptes lucidus*	LC	LC	Schedule I	-	+	√	
79.	Greater Necklaced Laughingthrush	*Garrulax pectoralis*	LC	LC	Schedule I	-	+		√
80.	Greater Painted-snipe	*Rostratula benghalensis*	LC	LC	Schedule I	+	+	√	
81.	Green Bee-eater	*Merops orientalis*	LC	LC	Schedule II	+	+	√	
82.	Green Sandpiper	*Tringa ochropus*	LC	LC	Schedule I	+	+	√	
83.	Green-billed Malkoha	*Phaenicophaeus tristis*	LC	LC	Schedule I	-	+	√	
84.	Greenish Warbler	*Phylloscopus trochiloides*	LC	LC	Schedule II	-	+	√	
85.	Grey Heron	*Ardea cinerea*	LC	LC	Schedule I	-	+	√	
86.	Grey-backed Shrike	*Lanius tephronotus*	LC	LC	Schedule I	-	+	√	
87.	Grey-capped Pygmy Woodpecker	*Dendrocopos canicapillus*	LC	LC	Schedule I	-	+	√	
88.	Grey-headed Canary Flycatcher	*Culicicapa ceylonensis*	LC	LC	Schedule I	+	+	√	
89.	Grey-headed Fish Eagle	*Ichthyophaga ichthyaetus*	NT	NT	Schedule I	-	+	√	
90.	Grey-headed Lapwing	*Vanellus cinereus*	LC	LC	Schedule I	+	+	√	
91.	House Crow	*Corvus splendens*	LC	LC	-	+	+	√	
92.	House Sparrow	*Passer domesticus*	LC	LC	Schedule II	+	+	√	

SL #	English Name	Scientific Name	IUCN Status		Wildlife Act 2012	Area of Occurrence		Data Source	
			Local	Global		NSEZ Site	Study Region	Primary	Secondary
93.	House Swift	*Apus nipalensis*	LC	LC	-	+	+	√	
94.	Indian Cuckoo	*Cuculus micropterus*	LC	LC	Schedule II	+	+	√	
95.	Indian Pond Heron	*Ardeola grayii*	LC	LC	Schedule I	+	+	√	
96.	Indian Roller	*Coracias benghalensis*	LC	LC	Schedule I	+	+	√	
97.	Indian Spot-billed Duck	*Anas poecilorhyncha*	LC	LC	Schedule I	-	+	√	
98.	Intermediate Egret	*Ardea intermedia*	LC	LC	Schedule I	+	+	√	
99.	Jerdon's Baza	*Aviceda jerdoni*	LC	LC	Schedule I	-	+		√
100.	Jungle Babbler	*Turdoides striatus*	LC	LC	Schedule II	+	+	√	
101.	Jungle Crow	*Corvus macrorhynchos*	LC	LC	-	+	+	√	
102.	Jungle Myna	*Acridotheres fuscus*	LC	LC	Schedule II	+	+	√	
103.	Large Cuckooshrike	*Coracina macei*	LC	LC	Schedule I	-	+	√	
104.	Large Hawk Cuckoo	*Hierococcyx sparverioides*	LC	LC	Schedule I	-	+	√	
105.	Large Woodshrike	*Tephrodornis gularis*	LC	LC	Schedule I	-	+		√
106.	Large-tailed Nightjar	*Caprimulgus macrurus*	LC	LC	Schedule I	-	+	√	
107.	Lesser Coucal	*Centropus bengalensis*	LC	LC	Schedule I	-	+	√	
108.	Lesser Sandplover	*Charadrius mongolus*	LC	LC	Schedule I	+	+	√	
109.	Lesser whistling duck	*Dendrocygna javanica*	LC	LC	Schedule I	+	+	√	
110.	Lineated Barbet	*Megalaima lineata*	LC	LC	Schedule I	-	+	√	
111.	Little Cormorant	*Microcarbo niger*	LC	LC	Schedule II	+	+	√	
112.	Little Egret	*Egretta garzetta*	LC	LC	Schedule II	-	+	√	
113.	Little Heron	*Butorides striata*	LC	LC	Schedule I	-	+	√	
114.	Little Ringed Plover	*Charadrius dubius*	LC	LC	Schedule I	+	+	√	
115.	Little Spiderhunter	*Arachnothera longirostra*	LC	LC	Schedule I	-	+	√	
116.	Little Tern	*Sternula albifrons*	LC	LC	Schedule I	-	+	√	

SL #	English Name	Scientific Name	IUCN Status		Wildlife Act 2012	Area of Occurrence		Data Source	
			Local	Global		NSEZ Site	Study Region	Primary	Secondary
117.	Long-tailed Shrike	*Lanius schach*	LC	LC	Schedule II	+	+	√	
118.	Mallard	*Anas platyrhynchos*	LC	LC	Schedule I	-	+	√	
119.	Marsh Sandpiper	*Tringa stagnatilis*	LC	LC	Schedule I	-	+	√	
120.	Nepal Fulvetta	*Alcippe nipalensis*	LC	LC	Schedule I	-	+	√	
121.	Northern Pintail	*Anas acuta*	LC	LC	Schedule I	-	+	√	
122.	Northern Shoveller	*Anas clypeata*	LC	LC	Schedule I	-	+	√	
123.	Olive-backed Pipit	*Anthus hodgsoni*	LC	LC	Schedule I	-	+		√
124.	Orange-breasted Green Pigeon	*Treron bicinctus*	LC	LC	Schedule I	-	+		√
125.	Orange-headed Thrush	*Zoothera citrina*	LC	LC	Schedule I	-	+	√	
126.	Oriental Magpie Robin	*Copsychus saularis*	LC	LC	Schedule II	-	+	√	
127.	Oriental Turtle Dove	*Streptopelia orientalis*	LC	LC	Schedule I	-	+	√	
128.	Oriental White-eye	*Zosterops palpebrosus*	LC	LC	Schedule I	-	+	√	
129.	Paddyfield Pipit	*Anthus rufulus*	LC	LC	Schedule II	+	+	√	
130.	Pale-billed Flowerpecker	*Dicaeum erythrorhynchos*	LC	LC	Schedule I	-	+	√	
131.	Pale-chinned Flycatcher	*Cyornis poliogenys*	LC	LC	Schedule I	-	+	√	
132.	Pied Avocet	*Recurvirostra avosetta*	LC	LC	Schedule I	+	+	√	
133.	Pied Cuckoo	*Clamator jacobinus*	LC	LC	Schedule I	-	+	√	
134.	Pied Harrier	*Circus melanoleucos*	LC	LC	Schedule I	+	+	√	
135.	Pied Kingfisher	*Ceryle rudis*	LC	LC	Schedule II	+	+	√	
136.	Pintail Snipe	*Gallinago stenura*	LC	LC	Schedule I	+	+	√	
137.	Plain Prinia	*Prinia inornata*	LC	LC	Schedule II	+	+	√	
138.	Plaintive Cuckoo	*Cacomantis merulinus*	LC	LC	Schedule II	-	+	√	
139.	Puff-throated Babbler	*Pellorneum ruficeps*	LC	LC	Schedule I	+	+		√
140.	Purple Sunbird	*Nectarinia asiaticus*	LC	LC	Schedule I	+	+	√	

SL #	English Name	Scientific Name	IUCN Status		Wildlife Act 2012	Area of Occurrence		Data Source	
			Local	Global		NSEZ Site	Study Region	Primary	Secondary
141.	Purple-rumped Sunbird	*Nectarinia zeylonica*	LC	LC	Schedule I	+	+	√	
142.	Purple-throated Sunbird	*Leptocoma sperata*	LC	LC	Schedule I	+	+	√	
143.	Red Collared Dove	*Streptopelia tranquebarica*	LC	LC	Schedule I	+	+	√	
144.	Red-breasted Parakeet	*Psittacula alexandri*	LC	LC	Schedule I	-	+	√	
145.	Red-necked Stint	*Calidris ruficollis*	LC	NT	Schedule I	-	+	√	
146.	Red-throated/ Taiga Flycatcher	*Ficedula albicilla*	LC	LC	Schedule I	+	+	√	
147.	Red-vented Bulbul	*Pycnonotus cafer*	LC	LC	Schedule II	+	+	√	
148.	Red-wattled Lapwing	*Vanellus indicus*	LC	LC	Schedule I	+	+	√	
149.	Red-whiskered Bulbul	*Pycnonotus jocosus*	LC	LC	Schedule I	-	+		√
150.	Rock Pigeon	*Columba livia*	LC	LC	Schedule I	+	+	√	
151.	Rose-ringed Parakeet	*Psittacula krameri*	LC	LC	Schedule II	-	+	√	
152.	Rosy Minivet	*Pericrocotus roseus*	LC	LC	Schedule I	-	+	√	
153.	Ruddy shelduck	*Tadorna ferruginea*	LC	LC	Schedule I	-	+	√	
154.	Rufescent Prinia	*Prinia rufescens*	LC	LC	Schedule I	+	+	√	
155.	Rufous Treepie	*Dendrocitta vagabunda*	LC	LC	Schedule II	+	+	√	
156.	Rufous Woodpecker	*Celeus brachyurus*	LC	LC	Schedule I	+	+	√	
157.	Rufous-necked Laughingthrush	*Garrulax ruficollis*	LC	LC	Schedule I	-	+		√
158.	Scaly Thrush	*Zoothera dauma*	LC	LC	Schedule I	-	+	√	
159.	Scaly-breasted Munia	*Lonchura punctulata*	LC	LC	Schedule I	+	+	√	
160.	Scarlet Minivet	*Pericrocotus flammeus*	LC	LC	Schedule I	-	+	√	
161.	Scarlet-backed Flowerpecker	*Dicaeum cruentatum*	LC	LC	Schedule I	-	+	√	
162.	Shikra	*Accipiter badius*	LC	LC	Schedule II	-	+	√	

SL #	English Name	Scientific Name	IUCN Status		Wildlife Act 2012	Area of Occurrence		Data Source	
			Local	Global		NSEZ Site	Study Region	Primary	Secondary
163.	Small Minivet	*Pericrocotus cinnamomeus*	LC	LC	Schedule I	-	+	√	
164.	Spangled Drongo	*Dicrurus hottentottus*	LC	LC	Schedule I	-	+	√	
165.	Spotted Dove	*Streptopelia chinensis*	LC	LC	Schedule I	+	+	√	
166.	Spotted Owlet	*Athene brama*	LC	LC	Schedule I	+	+	√	
167.	Spotted Redshank	*Tringa erythropus*	LC	LC	Schedule I	+	+	√	
168.	Streaked Spiderhunter	*Arachnothera magna*	LC	LC	Schedule I	-	+	√	
169.	Streak-Throated Woodpecker	*Picus xanthopygaeus*	LC	LC	Schedule I	-	+	√	
170.	Striated Babbler	*Turdoides earlei*	LC	LC	Schedule I	+	+	√	
171.	Thick-billed Flowerpecker	*Dicaeum agile*	LC	LC	Schedule I	-	+	√	
172.	Tricoloured Munia	*Lonchura malacca*	LC	LC	Schedule I	+	+	√	
173.	Whimbrel	*Numenius phaeopus*	LC	LC	Schedule I	-	+	√	
174.	Whiskered Tern	*Chlidonias hybrida*	LC	LC	Schedule I	-	+	√	
175.	White Wagtail	*Motacilla alba*	LC	LC	Schedule II	+	+	√	
176.	White-breasted Waterhen	*Amaurornis phoenicurus*	LC	LC	Schedule I	+	+	√	
177.	White-browed Wagtail	*Motacilla maderaspatensis*	LC	LC	Schedule I	+	+	√	
178.	White-rumped Munia	*Lonchura striata*	LC	LC	Schedule I	-	+	√	
179.	White-tailed Stonechat	*Saxicola leucurus*	LC	LC	Schedule I	+	+	√	
180.	White-throated Fantail	*Rhipidura albicollis*	LC	LC	Schedule I	-	+	√	
181.	White-throated Kingfisher	*Halcyon smyrnensis*	LC	LC	Schedule II	+	+	√	
182.	White-throated Munia	*Lonchura malabarica*	LC	LC	Schedule I	+	+	√	
183.	Wood Sandpiper	*Tringa glareola*	LC	LC	Schedule II	+	+	√	
184.	Yellow-footed Green Pigeon	*Treron phoenicoptera*	LC	LC	Schedule I	-	+	√	

SL #	English Name	Scientific Name	IUCN Status		Wildlife Act 2012	Area of Occurrence		Data Source	
			Local	Global		NSEZ Site	Study Region	Primary	Secondary
185.	Zitting Cisticola	*Cisticola juncidis*	LC	LC	Schedule I	+	+	√	

Note: CR - Critically Endangered, EN - Endangered, VU - Vulnerable, LC - Least Concern, DD - Data Deficient

Source: EQMS Field Survey 2023, IUCN Bangladesh 2015, Khan 2018, ECAL 2018, CEGIS 2018, eBird 2023

Appendix B-1.6: Checklist of Herpetofauna Recorded in the Study Region

SL#	Common Name	Scientific Name	IUCN Red List Status	Wildlife Act, 2012	Area of Occurrence		Data Source	
					NSEZ Site	Study Region	Primary	Secondary
Reptiles								
1.	Asian water monitor	Varanus salvator	VU	SCH-I	+	+		√
2.	Banded Krait	*Bungarus fasciatus*	LC	SCH-II	-	+		√
3.	Bengal Monitor	*Varanus bengalensis*	NT	SCH-II	+	+	√	
4.	Bowring's House Gecko	*Hemidactylus bowringii*	LC	SCH-II	-	+	√	
5.	Bowring's Supple Skink	*Lygosoma bowringii*	LC	-	+	+	√	
6.	Bronze Grass Skink	*Eutropis macularia*	LC	SCH-II	+	+	√	
7.	Checkered Keelback	*Xenochrophis piscator*	LC	SCH-I	+	+	√	
8.	Common Blind Snake	*Ramphotyphlops braminus*	LC	SCH-II	+	+		√
9.	Common Bronzeback Tree Snake	*Dendrelaphis tristis*	LC	SCH-I	-	+		√
10.	Common Garden Lizard	*Calotes versicolor*	LC	SCH-II	+	+	√	
11.	Common House Gecko	*Hemidactylus frenatus*	LC	SCH-II	+	+	√	
12.	Common Smooth Water Snake	*Enhydris enhydris*	LC	SCH-II	+	+	√	

SL#	Common Name	Scientific Name	IUCN Red List Status	Wildlife Act, 2012	Area of Occurrence		Data Source	
					NSEZ Site	Study Region	Primary	Secondary
13.	Common Trinket Snake	*Coelognathus Helena*	LC	SCH-II	-	+		√
14.	Common Vine Snake	*Ahaetulla nasuta*	LC	SCH-I	-	+		√
15.	Common Wolf Snake	*Lycodon aulicus*	LC	SCH-I	-	+		√
16.	Dog-faced Water Snake	*Cerberus rynchops*	LC	SCH-I	-	+	√	
17.	Emma Gray's Forest Lizard	*Calotes emma*	LC	SCH-II	-	+		√
18.	Glossy Marsh Snake	*Gerada prevostiana*	LC	-	-	+	√	
19.	Indian Rat Snake	*Coluber mucosus*	LC	SCH-I	-	+	√	
20.	Many-lined Grass Skink	*Mabuya multifasciata*	LC	-	-	+	√	
21.	Monocled Cobra	*Naja kaouthia*	NT	SCH-II	-	+	√	
22.	Red-necked Keelback	*Rhabdophis subminiatus*	NT	SCH-I	-	+		√
23.	Spectacled Cobra	*Naja naja*	NT	SCH-II	-	+	√	
24.	Spotted Flap Shell Turtle	*Lissemys punctata*	LC	SCH-I	-	+	√	
25.	Spotted Litter Skink	*Sphenomorphus maculatus*	LC	SCH-II	+	+		√
26.	Striped Keelback	*Amphiesma stolatum*	LC	SCH-I	+	+	√	
27.	Tokay Gecko	*Gekko gecko*	LC	SCH-II	-	+	√	
28.	Yellow Monitor	*Varanus flavescens*	NT	SCH-I	+	+	√	
Amphibians								
1.	Berdmore's Microhylid Frog	*Microhyla berdmorei*	LC	SCH-II	-	+	√	
2.	Cascade Frog	*Amolops marmoratus*	VU	SCH-I	-	+		√
3.	Common Toad	*Duttaphrynus melanostictus*	LC		+	+	√	

SL#	Common Name	Scientific Name	IUCN Red List Status	Wildlife Act, 2012	Area of Occurrence		Data Source	
					NSEZ Site	Study Region	Primary	Secondary
4.	Cricket Frog	*Fejervarya asmati*	LC	SCH-II	+	+	√	
5.	Indian Bull Frog	*Hoplobatrachus tigerinus*	LC	SCH-I	+	+	√	
6.	Jerdon's bullfrog	*Hoplobatrachus crassus*	LC	SCH-I	+	+	√	
7.	Ornate Microhylid Frog	*Microhyla ornata*	LC	SCH-II	-	+	√	
8.	Skipper Frog	*Euphlyctis cyanophlyctis*	LC	SCH-II	+	+	√	
9.	Smith's Litter Frog	*Leptobrachium smithi*	LC	SCH-I	-	+		√

Note: CR - Critically Endangered, EN - Endangered, VU - Vulnerable, LC - Least Concern, DD - Data Deficient

Source: EQMS Field Survey 2023, IUCN Bangladesh 2015, Hasan et al. 2014, Khan 2018, ECAL 2018, CEGIS 2018, eBird 2023

Appendix B-1.7: Checklist of Coastal Fisheries Recorded in the Study Region

SL#	Local name	Scientific name	Order	Data Source	
				Primary	Secondary
1.	Ayre	*Sperata aor*	Siluriformes	√	
2.	Bacha	*Eutropiichthys vacha*	Siluriformes	√	
3.	Bagda chingri	*Penaeus monodon*	Decapoda	√	
4.	Baila mach, Bela	*Glossogobius giuris*	Perciformes	√	
5.	Bata mach	*Mugil corsula*	Mugiliformes	√	
6.	Chapda chingri,	*Penaeus indicus*	Decapoda	√	
7.	Churi	*Lepturacanthus savala*	Perciformes	√	
8.	Foli chanda	*Pampus argenteus*	Perciformes	√	
9.	Futki datina	*Pomadasys hasta*	Perciformes	√	
10.	Giant mud crab	*Scylla serrata*	Decapoda	√	
11.	Golda chingri	*Macrobrachium rosenbergii*	Decapoda	√	
12.	Gura echa	*Acetes indicus*	Decapoda	√	

SL#	Local name	Scientific name	Order	Data Source	
				Primary	Secondary
13.	Harina chingri	*Metapenaeus monoceros*	Decapoda		√
14.	Hundra	*Sillago domina*	Perciformes	√	
15.	Ilish	*Tenualosa ilisha*	Clupeiformes	√	
16.	Karati alua	*Coilia dussumieri*	Clupeiformes	√	
17.	Kata mach	*Arius spp*	Suiluriformes	√	
18.	Koral	*Lates calcarifer*	Perciformes	√	
19.	Kukr jib	*Cynoglossus cynoglossus*	Pleuronectiformes		√
20.	Lal chewa	*Trypauchen vagina*	Perciformes	√	
21.	Loilla echa	*Metapenaeus brevicornis*	Decapoda	√	
22.	Lotia	*Harpodon nehereus*	Scopeliformes	√	
23.	Maittya	*Scomberomorus guttatus*	Perciformes	√	
24.	Nuna-tengra, Guilla	*Mystus guilo*	Suiluriformes		√
25.	Pangas	*Pangasius pangasius*	Siluriformes	√	
26.	Phaisya, Pati	*Thryssa dussumieri*	Clupeiformes	√	
27.	Poa, Kala poa	*Johnius dussumieri*	Perciformes	√	
28.	Smooth Shelled swimming crab	*Charybdis rostrata*	Decapoda	√	
29.	Tailla	*Eleutheronema tetradactylum*	Polynemiformes	√	
30.	Tapshi, Rishsha	*Polynemus paradiseus*	Polynemiformes	√	

Source: EQMS Field Survey 2023, Miah et al. 2015

Appendix B-1.8: Checklist of Culture Fish and Crustacean Species Recorded in the Study Region

SL#	Local Name	English Name	Scientific Name	IUCN Status	
				Local	Global
1.	Bighead carp	Bighead carp	*Hypophthalmichthys nobilis*	NE	DD
2.	Grass Carp	Grass Carp	*Ctenopharyngodon idella*	NE	LC
3.	Gulsha Tengra	Gulio Catfish	*Mystus gulio*	NT	LC
4.	Kalibaus	Orangefin labeo	*Labeo calbasu*	LC	LC
5.	Katol	Catla	*Labeo catla*	LC	NE

SL#	Local Name	English Name	Scientific Name	IUCN Status	
				Local	Global
6.	Koi	Climbing Perch	*Anabas testudineus*	LC	LC
7.	Mrigal	Mrigal carp	*Cirrhinus cirrhosus*	NT	VU
8.	Pabda	Pabda Catfish	*Ompok pabda*	EN	NT
9.	Rui	Rohu	*Labeo rohita*	LC	LC
10.	Shing	Stinging Catfish	*Heteropneustes fossilis*	LC	LC
11.	Silver Carp	Silver Carp	*Hypopthalmicthys molitrix*	NE	NT
12.	Thai Pangus	Striped catfish	*Pangasianodon hypophthalmus*	NE	EN
13.	Thai sharputi	Silver barb	*Barbonymus gonionotus*	NE	LC
14.	Tilapia	Nile Tilapia	*Oreochromis niloticus*	NE	LC
15.	Bagda chingri	Giant Tiger Shrimp	*Penaeus monodon*	LC	NE
16.	Golda chingri	Giant river prawn	*Macrobrachium rosenbergii*	LC	LC

Note: LC=Least Concern, NT=Near Threatened; VU=Vulnerable, EN= Endangered; NE=Not Evaluated, DD=Data Deficient
Source: EQMS Field Survey 2023

Appendix B-1.9: Phytoplankton Profile in the Study Region

Class	Genus	Number (cells/L)									
		PZ 1	PZ 2	PZ 3	PZ 4	PZ 5	PZ 6	PZ 7	PZ 8	PZ 9	PZ 10
Bacillariophyceae	*Melosira sp.*	135	50	0	0	0	32	53	0	0	0
	Amphora sp.	0	23	0	0	0	34	0	2	0	0
	Chaetoceros sp.	12	23	0	0	29	27	0	0	55	13
	Cyclotella sp.	0	0	0	42	0	0	0	3	0	23
	Nitzschia sp.	32	0	41	65	0	0	0	0	0	0
	Odontella sp.	0	0	0	0	0	22	0	0	17	0
	Fragilaria sp.	0	0	0	0	0	0	18	0	37	0
Chlorophyceae	*Oocystis sp.*	0	0	14	0	19	29	0	0	0	23

Class	Genus	Number (cells/L)									
		PZ 1	PZ 2	PZ 3	PZ 4	PZ 5	PZ 6	PZ 7	PZ 8	PZ 9	PZ 10
Coscinodiscaceae	*Coscinodiscus sp.*	37	0	0	0	0	12	0	20	0	0
Cyanophyceae	*Anabaena sp.*	21	0	0	0	0	0	0	0	12	0
	Raphidiopsis sp.	0	0	43	0	0	0	0	0	0	0
Cymbellaceae	*Cymbella sp.*	0	0	0	0	0	0	3	0	0	0
Chrysophyceae	*Dictyocha sp.*	45	0	0	0	44	0	0	0	35	0
Dinophyceae	*Ceraatium sp.*	0	0	0	33	0	27	0	0	0	13
Lachnospiraceae	*Clostridium sp.*	0	0	0	0	0	0	0	17	0	0
Ulotrichaceae	*Ulothrix sp.*	0	0	21	0	0	0	0	0	0	38
Cryptophceae	*Rhodommas sp.*	0	19	0	27	0	0	0	0	0	0
Euglenophyceae	*Euglena sp.*	76	0	84	0	24	35	0	0	0	0
Zygnemataceae	*Zygnema sp.*	0	0	0	0	0	0	0	14	0	12

Source: Laboratory Analysis, December 2023

Appendix B-1.10: PhytoplanktonZooplankton Profile in the Study Region

Class	Species	Number (individuals/L)									
		PZ 1	PZ 2	PZ 3	PZ 4	PZ 5	PZ 6	PZ 7	PZ 8	PZ 9	PZ 10
Copepoda	*Diaptomus* sp.	18	37	0	25	80	0	0	0	22	0
	Cyclops sp.	0	26	0	24	0	0	21	13	0	0
Monogononta	*Brachionus* sp.	0	2	2	0	3	0	0	2	0	0
	Felinia sp.	0	0	0	0	0	0	0	0	0	22
	Lecane sp.	0	0	36	0	0	13	0	0	0	0

Class	Species	Number (individuals/L)									
		PZ 1	PZ 2	PZ 3	PZ 4	PZ 5	PZ 6	PZ 7	PZ 8	PZ 9	PZ 10
Branchiopoda	*Daphnia* sp.	42	0	0	0	0	0	20	0	0	0
	Polyphemus sp.	0	0	0	0	12	0	0	0	0	0
	Moina sp.	56	0	49	11	0	0	0	0	0	17
	Bosmina sp.	46	0	28	0	0	0	12	0	0	0
	Cladocera	0	0	17	0	0	0	0	0	0	13
Eurotatoria	*Asplanchna* sp.	0	0	0	0	13	0	0	0	0	0
Hexanauplia	*Calanus sp.*	0	0	0	0	0	15	0	10	0	0
	Cyclops sp.	12	9	0	0	0	0	7	0	0	0
Mysidae	*Mysis sp.*	0	0	0	0	0	0	43	0	23	0

Source: Laboratory Analysis, December 2023

Appendix B-1.11: PhytoplanktonBenthos Profile in the Study Region

Groups	Species	Number (N) [Individuals/m^2]									
		PB 1	PB 2	PB 3	PB 4	PB 5	PB 6	PB 7	PB 8	PB 9	PB 10
Polychaeta	*Nereis lamellosa*	755	0	222	0	0	0	177	0	0	89
	Namalycastis indica	0	0	89	0	0	44	0	0	44	0
	Lumbrineris sp.	0	89	0	0	177	0	0	0	0	0
Gastropoda	*Bellamya sp.*	89	0	0	33	0	0	0	89	44	0
	Architectonica laevigata	0	0	44	0	0	0	0	44	0	44
	Anachis miser	33	88	0	0	89	33	0	44	89	0

Groups	Species	Number (N) [Individuals/m^2]									
		PB 1	PB 2	PB 3	PB 4	PB 5	PB 6	PB 7	PB 8	PB 9	PB 10
	Indoplanorbis exustus	88	0	0	0	0	44	44	0	0	0
	Melanoides sp.	0	89	0	0	0	134	0	88	177	0
	Cerithidea sp.	0	89	0	0	89	0	0	0	89	0
Bivalvia	*Anadara sp.*	222	0	133	0	0	0	133	0	44	0
	Trachycardium sp.	0	0	88	134	0	0	88	0	0	44
	Parreysia corrugata	0	177	0	0	0	0	0	0	134	0
	Mactra sp.	89	0	0	177	0	44	0	0	0	0
	Donax sp.	0	0	0	0	0	0	89	0	0	0
Insecta	*Chironomus* sp.	222	177	0	0		0	0	134	0	0
Crustacea	*Shrimp larvae*	0	0	448	0	133	0	0	0	266	89

Note: Grab area for single sample = 0.0225 m^2; N = Number of individuals/m^2

Source: Laboratory Analysis, December 2023

Appendix B-2: Photographs

Appendix B-2.1: Field Activities Conducted for Vegetation Study

Quadrate TQ1

Quadrate TQ2

Quadrate SQ1

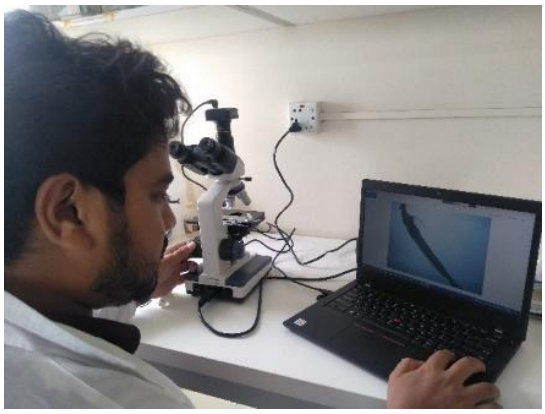
Quadrate HQ1

Appendix B-2.2: Photographs of Plankton Sample Collection and Microscopic Identification

Dragging of Planktonic net

Collection of samples in a sample bottle

Addition of preservatives in the sample bottle



Identification of Plankton number and species in the laboratory

Appendix B-2.3: Photographs of Benthos Sample Collection and Microscopic Identification

Sample Collection using Ekman Grab Sampler	Sample was Transferred to a Bucket	Sieving by 0.5 mm mesh-sized Hand Sieve
Collection of samples from sediment	Adding 10% buffered formalin in a sample jar	Identification of benthos in the laboratory

Appendix B-2.4: Common Vegetation Observed in the Study Region

Tamarix or Jhau (*Tamarix* sp.)	Akashmani (*Acacia auriculiformis*)	Hargoza (*Acanthus* sp.)
Bet (*Calamus tenuis*)	Neem (*Azadirachta indica*)	Coconut (*Cocos nucifera*)
Goniary (*Premna serratifolia*)	Kak Dumur (*Ficus* sp.)	Brittlewood (*Nuxia congesta*)

Date palm (*Phoenix dactylifera*)

Willow-leaved justicia (*Justicia gendarussa*)

Banana (*Musa* sp.)

Appendix B-2.5: Mammalian Species Found in the Study Region

Golden jackal (*Canis aureus*)

Irrawaddy Squirrel (*Callosciurus pygerythrus*)

Lesser bandicoot rat or Bengal rat (*Bandicota bengalensis*)

Indian fruit bat or Indian flying fox (*Pteropus giganteus*)

Appendix B-2.6: Avifauna Species Found in the Study Region

Chestnut-tailed starling (*Sturnia malabarica*)

Eurasian curlew (*Numenius arquata*)

Black-headed gull (*Chroicocephalus ridibundus*)

Black-headed Ibis (*Threskiornis melanocephalus*)

Grey heron (*Ardea cinerea*)

Asian openbill stork (*Anastomus oscitans*)

Ruddy shelduck (*Tadorna ferruginea*)

Common redshank or redshank *(Tringa totanus)*

Little ringed plover (*Charadrius dubius*)

Black-tailed Godwit (*Limosa limosa*)

Pied avocet (*Recurvirostra avosetta*)

Collared kingfisher (*Todiramphus chloris*)

Great egret (*Ardea alba*)

Little egret (*Egretta garzetta*)

Bronze-winged jacana (*Metopidius indicus*)

Brahminy kite (*Haliastur indus*) | Grey-headed fish eagle (*Icthyophaga ichthyaetus*) | Osprey (*Pandion haliaetus*)

Appendix B-2.7: Herpetofaunal Species Found in the Study Region

Indian rat snake (*Ptyas mucosa*)

A dead specimen of Dog-faced Water Snake (*Cerberus rynchops*)

Indian skipper frog (*Euphlyctis cyanophlyctis*)

Indian Bullfrog (*Hoplobatrachus tigerinus*)

APPENDIX C

Appendix C: Stakeholder Consultation

Appendix C-1: Photographs of Stakeholder Consultation

Consultation with the Department of Agriculture Extension, Sonagazi, Feni

Consultation with Fishermen of Shaherkhali, Mirsharai, Chattogram

Consultation with Upazila Fisheries Officer, Sonagazi, Feni

Consultation with Fishermen (Youth), Shaherkhali, Mirsharai, Chattogram

Consultation with Local Communities at Fakirhat Ghat, Saidpur, Sitakunda

Consultation with Upazila Women Affairs Officer, Sonagazi, Feni

Consultation with Fishermen at Saidpur, Sitakunda

Consultation with Upazila Education Officer, Sonagazi, Feni

Consultation with Jaldash Community (Female Participants) at Domkhali, Mirsharai

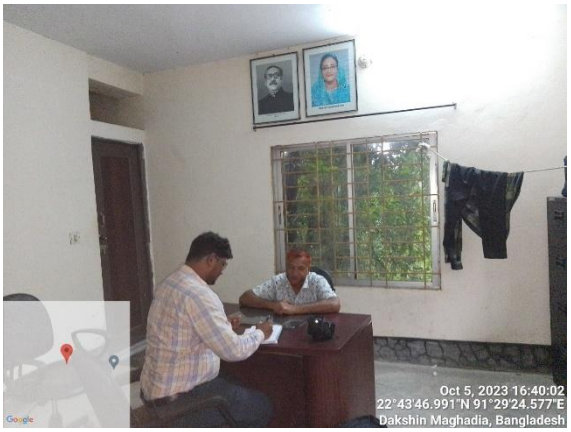
Consultation with UNO, Mirsharai, Chattogram

Consultation with UNO, Sitakunda, Chattogram

Consultation with DAE, Mirsharai, Chattogram

Consultation with UEO, Sitakunda, Chattogram

Consultation with LGED, Mirsharai, Chattogram

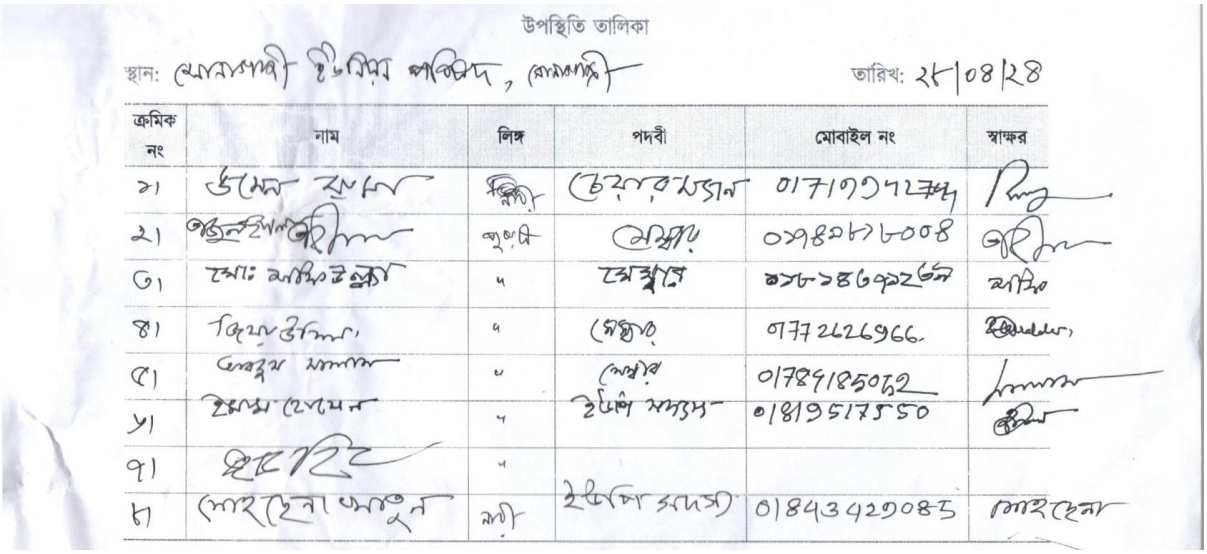


Consultation with Forest Department - Coastal Afforestation Division, Mirsharai Range, Chattogram

Consultation with Forest Department - Coastal Afforestation Division, Sitakunda Range, Chattogram

Appendix C-2: Attendance List of the Participants in Stakeholder Consultation

Appendix C-2.1: Attendance List for the validation workshop at Sonagazi Union



উপস্থিতি তালিকা

স্থান: সোনাগাজী ইউনিয়ন পরিষদ, সোনাগাজী তারিখ: ২৮/০৪/২৪

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং	স্বাক্ষর
১।	[illegible]	[illegible]	চেয়ারম্যান	01710[illegible]	
২।	[illegible]	পুরুষ	সদস্য	0১৪২৮৭৮০০৪	
৩।	মো: [illegible]	৭	সেক্রেটারি	৪৯৮২৪৬৫২৬৯	
৪।	[illegible]	৭	সদস্য	01772626966	
৫।	[illegible]	৬	সদস্য	01784185062	
৬।	[illegible]	৭	ইউপি সদস্য	01819517550	
৭।	[illegible]	৭			
৮।	[illegible]	মহি	ইউপি সদস্য	01843429085	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং	স্বাক্ষর
১।	[illegible]	[illegible]	[illegible]	01821045092	[illegible]
২।	[illegible]	[illegible]	[illegible]	01837749329	[illegible]
৩।	[illegible]	[illegible]			[illegible]
৪।	[illegible]	[illegible]	[illegible]	01830 320140	[illegible]
৫।	[illegible]	[illegible]		01323545473	[illegible]
৬।	[illegible]	[illegible]	[illegible]	01855854127	
৭।	[illegible]	[illegible]	[illegible]	[illegible]	
৮।	[illegible]	[illegible]	[illegible]	01824-948365	
৯।	[illegible]	[illegible]	[illegible]	01815403004	
১০।	[illegible]	[illegible]	[illegible]	01839245005	
১১।	[illegible]	[illegible]	[illegible]	01854109563	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং	স্বাক্ষর
২০।	[illegible]	[illegible]	[illegible]	01831140014	
২১।	[illegible]	[illegible]	[illegible]	01822009139	
২২।	[illegible]	[illegible]	[illegible]	01812803101	
২৩।	[illegible]	[illegible]	[illegible]	01838452923	
২৪।	[illegible]	[illegible]	[illegible]	01870519310	
২৫।	[illegible]	[illegible]	[illegible]	01717156015	
২৬।	[illegible]	[illegible]	[illegible]	01857447[illegible]	
২৭।	[illegible]	[illegible]	[illegible]	01815-808073	
২৮।	Anwar Rahman	[illegible]	Consultant EQMS	01713042360	
২৯।	Mahfuzur Rahman	[illegible]	consultant EQMS	01717567467	
৩০।	Md. Zahidul Islam	[illegible]	Principal consultant EQMS	01911569270	Zahid

Appendix C-2.2: Attendance List for the validation workshop at Maghadia Union

উপস্থিতি তালিকা

স্থান: মহাদিয়া ইউনিয়ন, মাগাদিয়া তারিখ: ২৯/০৪/২০২৪

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
১।	[illegible]				
২।	[illegible]		ইউপি সদস্য	01830140115	
৩।	[illegible]		ইউপি সদস্য	01810654538	
৪।	[illegible]		ইউপি সদস্য	01840391933	
৫।	[illegible]		ইউপি সদস্য	01823846093	
৬।	[illegible]			01818947737	
৭।	[illegible]	[illegible]	[illegible]	01815716538	
৮।	[illegible]			01885211031	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
৯।	[illegible]		[illegible]	01824[illegible]	
১০।	[illegible]		কৃষি	01[illegible]	
১১।	[illegible]		[illegible] কৃষি	01882812139	
১২।	[illegible]			01839782328	
১৩।	[illegible]				
১৪।	[illegible]		কৃষি	01810589862	
১৫।	[illegible]		কৃষি	01875854199	
১৬।	[illegible]		কৃষি	01610170850	
১৭।	[illegible]		কৃষি	01861029129	
১৮।	[illegible]			01845846660	
১৯।	[illegible]		কৃষি	01890824274	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
২০।	ছেমনা খাতুন		কৃষি	01857338351	
২১।	নবি হোসেন		কৃষি	01838983129	
২২।	[illegible]			[illegible]	
২৩।	[illegible]			[illegible]	
২৪	Salah uddin		[illegible]	01787888[illegible]	
২৫	[illegible]			01820063421	
২৬	মো: [illegible]		"	01824503388	
২৭	[illegible]			01810654780	
২৮	[illegible]				
২৯।	[illegible]		=	01[illegible]	
৩০	মনালুা			01881472198	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
৩১,	মো: সাহাবউদ্দিন		কৃষি	01830761097	
৩২	মো: নুর আলম		কৃষি	01306285728	
৩৩	মো: কামরুল ইসলাম		কৃষি	01750567505	
৩৪	সুমন দাস		কৃষি	01861029171	
৩৫	মফিজুর রহমান		কৃষি	01821029669	
৩৬	জাকির হোসেন		"	01822640558	
৩৭	বকুল রানী		কৃষি	01837595850	
৩৮	রিয়াজ হোসেন		কৃষি	01890823108	
৩৯	[illegible]		কৃষি	01838983120	
৪০	জোবায়ের হোসেন		কৃষি	01861030633	
৪১	কানাই		"	01835319426	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
৪২	দিলদার		কৃষি	01837207150	
৪৩	রোমজান		কৃষি	01852012123	
৪৪	কবির		কৃষি	01857338351	
৪৫	নুরুল হুদা		কৃষি	01312039631	
৪৬	রেজোয়ান হাবিব		ছাত্র	01830299832	
৪৭	[illegible]		[illegible] EQMS	01723042360	
৪৮	Md. Fahim Uddin.	Male.	Assistant Consultant EQMS	01641305408	Fahim
49.	Hafizur Rahman	"	Consultant EQMS	01777577477	
50.	Md. Zahidul Islam	"	Principal consultant EQMS	01911 569270	Zahid

Appendix C-2.3: Attendance List for the validation workshop at Mirsharai Upazila

উপস্থিতি তালিকা

স্থান: মিরসরাই, চট্টগ্রাম তারিখ: ৩০/০৪/২৪

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
১	আবুল কাশেম	পুঃ	সাংসদ সদস্য	০১৭৩৩ ৪৭২২২	
২.	মোঃ গিয়াস উদ্দিন	পুঃ	চেয়ারম্যান মীরসরাই পৌরসভা	০১৮-২৪৯৭৯৩০৪	৩০/০৪/২৪
৩.	দীপ্তিরানী	পুঃ	পুলিশ পরিদর্শক (ওসি) মীরসরাই	০১৭৬৪-১১৯৯১১	৩০/০৪/২০২৪
৪.	নাসরিন সুলতানা	মহিলা	UNO, মীরসরাই	০১৭৩৩৩৪৩৫১	
৫	মোঃ আবুল কাশেম খান	পুঃ	সহকারী কমিশনার (ভূমি)	০১২১৬৬৪৭৪৫৫	
৬.	মোঃ তৌফিক ইসলাম	পুঃ	সহকারী পুলিশ সুপার মীরসরাই সার্কেল	০১৩১৭৭২৩৫৫৪	
৭.	রুমী সাহা	পুঃ	উপজেলা আওয়ামী	০১৭৮১৬১২৬৫	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
৮	মোঃ মাহমুদ নাজেম		পরিচালক (বেসরা ইজিই)	০১৭৩৯৯৩৪৪৪৩	
৯	প্রভাষ চন্দ্র রায়		উপজেলা কৃষি অফিসার মীরসরাই, চট্টগ্রাম	০৩৩৪-০৮৮৮৬৪	
১০.	ডা. ফেরদৌস ফরিদ	পুঃ	উপজেলা স্বাস্থ্য কমপ্লেক্স মীরসরাই, চট্টগ্রাম	০১৯১২ ২২২৪৪৭ dzfarid@gmail.com	
১১	কে এম, সাইদ আহমেদ	male	সহকারী পুলিশ সুপার - বক্স অফিস পুলিশ	০১৭২-৩৭৭৫ ৩ kmsayed78@gmail.com	
১২	মোঃ হুমায়ুন কবির খান	male	উপজেলা সার্কেল শিক্ষা কর্মকর্তা	০১৫৫০৬৩৩০০ kabirkhan2020@gmail.com	
১৩	চাঁদনাথ তালুকদার চৌধুরী	male	সিনিয়র উপজেলা পাবলিক সিভিল	০১৭৬৯৪০০১১২ ctgpbn3mz20@gmail.com.	
১৪	মোঃ শাহজালাল	Male	সহকারী জেলা প্রাইমারী শিক্ষা কর্মকর্তা - ৬	০১৭৬৯৪০০৩৫৯ ctgpbs36smsms20@gmail.com	
১৫.	মেহের আফরোজ	Female	উপজেলা মহিলা বিষয়ক কর্মকর্তা,	০১৮৯৪৯৯২৩৪২, meherafroz30@gmail.com	
১৬	মোঃ তাজেমুল হোসেন	Male	উপজেলা যুব উন্নয়ন কর্মকর্তা	০১৯১৩-৬২১৬৪৫ hossain.tajemul@gmail.com	৩০/৪/২৪
১৭	নাসিরুল আলম মাহমুদ	পুরুষ	সিনিয়র সহকারী সমবায় কর্মকর্তা	০১৭২৩৪৩৪৫৭৪ nasim.sikder@gmail.com	
১৮	ওয়াকেল ইসলাম খালেদ চৌধুরী	Male	উপ-বিভাগীয় প্রকৌশলী, সীতাকুন্ড সড়ক উপ-বিভাগ	01730-782681 khaledwakil36@gmail.com	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
১৯	সীতাকুণ্ডা নুলদার	Male	উপ-বিভাগীয় প্রকৌশলী পানি উন্নয়ন বোর্ড	01682 146710 sde.sitakunda@swds.gov.bd	
20.	মো: গোলাম কাদের	Male	উপ সহকারী প্রকৌশলী বাপাউবো	01817 181599 leader.bwdb11@gmail.co	
২১.	মো: সেলিম রেজা	Male	সহকারী প্রকৌশলী BSWTA	01750-298796 selim.ce.biswta@gmail.com	
22	Md. Ruhul Amin	Male	Asst. Manager APBL	012 555 53462 ruhul.amin@asiampaper.com	
23.	ইমরান (নোমান) চৌধুরী	male	Station Officer FSCD.	01827-974138	
24.	Md. Khairul Islam	Male	Program coordinator OPCA	01864-956166 islamkhairul823@gmail.com	
25.	Homayoun Kabir Mollick	Male	Instructor / Trainer UCEP	01715472365 homayoun.mallick@ucepbd.org	30.09.24
26.	Md. Ashraf Uddin	Male	Research officer DoE	01920886635 ashraf223ft@gmail.com	
27.	Md. Ahmadul Huq Mondal	Male	AGM (RECD) Bashundhara Group Section-C	01799998209 ahmadul.huq@bgc-bd.com	
28.	Bapal Chandra Nath.		Forman.	01832-977468	30/09/2024.
29	Dipu Kirli		FOW.	01888035848	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
30.	Dr. Md. Tanveer Hossain	Male	MO (MCH-FP) & TFPO (Upazilla family planning officer)	01685416358	
31.	Md. Robiul Hossain Bhuiyan	Male	family planning Inspector	01817263227	
32	Mohammad Didarul Alam	Male	Headmaster Meghdia Alim Alsec City High School	01614684913	
৩৩	মো: [illegible]	পুরুষ	[illegible]	01819-096691	
৩৪	[illegible]		[illegible]	01833-268728	
৩৫	[illegible]	পুরুষ	[illegible]	01866980707	
৩৬	[illegible]	M	ACF [illegible]	01776061833	
৩৭	[illegible]	M	Environment Specialist	01783582472	
38	Md. Asifur Rahman	M	Occupational Health & Safety Consultant, BEZA	01925758138	
39	Engr. Md. Ali Azam Rokon	M	Principal, Textile Engineering College, Mirsarai.	01678060899	
40.	Kazi Farhad Iqubal	M	Team Leader RESA, EQMS	01911702074	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
41	MOH. RAFIQUL ISLAM	MAN	SR. SUB. ASST ENGR/WORKS	01711587640 (RAILWAY)	
42	Aulad Hossain	Mate	AEN/FNI.BR	01726541935	
43	Md. Istiak Ahamed	Male	Assistant Manager	01521255370	
44	Md. Shahid [illegible]	Male	Factory Manager	01729271102	
45	Ms. Shahida Khanam	female	Executive-HR	01971143501	
46	Sanjoy Paul	Male	Area manager	01955551457	
47	SANJIB BARUA	Male	Social counselor BEZA	01819884061	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
48	Anwar Rahman	Male	EQMS consultant	01723042360	
49	Rahim Uddin.	Male.	Assistant Consultant EQMS	01641305408	
50	Mahfuzur Rahman	Male	Consultant EQMS	01777576747	
51	Md. Zahidul Islam	male	principal consultant EQMS	01911 569270	

Appendix C-2.4: Attendance List for the validation workshop at Sonagazi Upazila

উপস্থিতি তালিকা

স্থান: সোনাগাজী উপজেলা পরিষদ

তারিখ: ২৯/০৫/২৪

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
০১	রাশেদুল আহসান	M	Deputy Secretary BEZA	0175-966410	
০২	কামরুন হাসান	M	UNO সোনাগাজী	01713-187316 unosonagazi@mopa.gov.bd	
০৩	তানিয়া আক্তার লুবনা	F	সহকারী কমিশনার (ভূমি)	01816633272	
০৪	মো: আবুল কাশেম খাঁন	পু:	সোস্যাল কমপ্লায়েন্স অফিসার	01216681456	
০৫	পাহিং ঈদিনেবাপ্রুদু লিপটন	M	উপজেলা চেয়ারম্যান	01711324450	
০৬	মিজানুর রহমান হিমেল মিলন	পু:	[illegible]	01817384526	
০৭	ডা: নেবু লাল দত্ত	পু:	উপজেলা স্বাস্থ্য কর্মকর্তা	01816528620	
০৮	মাসুদ আহমেদ	ম	ওসি (তদন্ত) সোনাগাজী সার্কেল	01320113029	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
০৯	ড. তালুকদার মো: ইকবাল পরিচালক-পরিকল্পনা, বেজা	পুরুষ	পরিচালক পরিকল্পনা	01783382472	
১০	ইকবাল হাসান	পুরুষ	[illegible]	01700-716893	
১১	তোফায়েল আহমেদ	ঐ	সেকশন অফিসার মাননীয় মন্ত্রী মহোদয়ের দপ্তর	01733100665	
১২	মো: নূরুল আমিন	,,	উপজেলা মাস্টারিনিং কিশন অফিসার	01819-147317	
১৩	কনক চিত্র	,,	সিনিয়র সোশ্যাল কমপ্লায়েন্স অফিস, সোনী পরিবার	01769401165	
১৪	মো: সেলিম হোসেন	,,	Asstt CO (Env) [illegible]	01769400445	21-05-24
১৫	মোকাদ্দেস হোসেন	,,	[illegible]	01817223879	
১৬	মো: আজাদ হোসেন ভূঁইয়া	,,	স্থানীয় মেম্বর - ০১ সোনাগাজী পৌরসভা	01714432464	
১৭	মাহিরী নাথ	মহিলা	পরিবার কল্যাণ পরিদর্শিকা চরচান্দিয়া ইউ: স্বা: উপ: কেন্দ্র	01812745660	
১৮	উত্তম চন্দ্র দাস	পুরুষ	পরিবার পরিকল্পনা সহকারী [illegible]	01813324948	
১৯	মো: নাসির উদ্দিন	পুরুষ	চর সোনাদিয়া স্থানীয় মেম্বর ১২ নং ওয়ার্ড	01814318376	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
২০	মো: শরিফুল ইসলাম	M	এলাকা ব্যবস্থাপক	০১৮৬৮৫৬১৮৮৫	
২১	মো: রেজাউল করিম ভূঁইয়া	M	এস ডব্লিউ	০১৪৪৩২৪৫৫৫৪	
২২	নাহিদা ইসলাম	M	[illegible]	০১৪৭৪৫৮১৭৯৪	
২৩	মো: দুলাল হোসেন	M	[illegible]	০১৪১৯১৪২০৯২	
২৪	মোশাররফ হোসেন খোকন	M	সাধারণ সম্পাদক	০৭৩০৫৮৯২৫৬	
২৫	অজয় চন্দ্র দাস	M	উপজেলা যুব উন্নয়ন কর্মকর্তা	০১৭১১৩৯০৩৫১	
২৬	মো: ওলি উদ্দিন	M	[illegible]	০১৪১৮৪৮৬৬১০	
২৭	মো: আইনুল হোসাইন মিলন	M	[illegible]	০১৭২৬৫৪৪৩৯	
২৮	মো: ফজলুল হক	M	[illegible]	০১৭২৩৪৪০০৫৭	
২৯	মো: কবির উদ্দিন (মিঠু)	M	[illegible]	০১৭৯৮৭৩১৯৯৫	
৩০	মো: আবু সায়েম	M	সহকারী প্রোগ্রামার	০১৯২৯-৩৪৬৬৪৭	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
৩১	[illegible]	পুং	[illegible]	০১৮১৬৪৮৫৮৩১	
৩২	মো: জয়নুল আবেদীন	পুরুষ	[illegible]	০১৩০৯১০৬৭০৪	
৩৩	মোঃ নুরুন্নবী ইসলাম	পুরুষ	[illegible]	০১৭১২-১১৭৬৭	
৩৪	নাজিয়া আক্তার	মহিলা	উপজেলা মহিলা বিষয়ক কর্মকর্তা	০১৫৫২-৩৪৪৯১০	
৩৫	ডাঃ ফারজিন ইসলাম খান	মহিলা	[illegible]	০১৭৭৭৮৮৭২০৬৫	
৩৬	শাওকত খায়া কলি	মহিলা	[illegible]	০১৭৩৩৬৩০৪৪	
৩৭	আব্দুল কাদের চৌধুরী	পুরুষ	[illegible]	০১৭০৪-১৬১৩৩৭	
৩৮	মোহাম্মদ শাহাদাত হোসেন	পুরুষ	[illegible]	০১৪১৫৩৫৬৮০	
৩৯	[illegible]	পুরুষ	[illegible]	০১৭৭২৯৮৭৮৭৯	
৪০	[illegible]	ঃ	[illegible]	০১৩৩৭৭২৬৮৮৮	
৪১	[illegible]	ঃ	[illegible]	[illegible]	[illegible]

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
৪২	[illegible]	মহিলা	[illegible]		
৪৩	[illegible]	ঃ	ঃ	০১৮১০২০২১২৪	
৪৪	[illegible]	ঃ	[illegible]	০	
৪৫	মো: হাসান উদ্দিন	পুরুষ	[illegible]	০১৮২০০৬৬০৫১	
৪৬	[illegible]	,,	[illegible]	০১৭৪৭-৬৬৫১৩১	
৪৭	[illegible]	,,	[illegible]	০১৮১৭-৫০৬৪৩৬	
৪৮	[illegible]	[illegible]	[illegible]	—	
৪৯.	Aminur Rahman	Male	Consultant, EQMS	০১৭২৩ ০৪২৩৬৬	
৫০.	Fahim Uddin.	Male	Assistant Consultant EQMS	০১৬৪১৩০৫৭০৪	
51.	Mahfuzur Rahman	Male	consultant EQMS	০১৭০৭৫৭৫৭৪৭	
52.	Md. Zahidul Islam	male	principal consultant EQMS	০১৯১১৫৬৯২৭০	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
53	Kazi Farhad Iqubal	Male	Team Leader RESA, EQMS	01911702074	
54	Aminur Rahman	"	Consultant EQMS	01729042360	

Appendix C-2.5: Attendance List for the validation workshop at Sitakunda Upazila

উপস্থিতি তালিকা

স্থান: সীতাকুন্ড উপজেলা পরিষদ তারিখ: ২৬/০৫/২৪

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
01	কে. এম. রফিকুল ইসলাম	Male	UNO, Sitakunda	01837711450 unositakunda.ctg@gmail.com	
02	প্রদ্যুৎ কুমার বসুনিয়া	Male	M.P Cat-4	01711749502	
03	[illegible]	Male	Mayor Sitakunda	01711375616	
04	হাবিবুর রহমান	Male	UAO, Sitakunda	01775881404	
05	[illegible]	Male	সাংবাদিক	01819-617570	
06	[illegible]	Female	[illegible]	01837-212122	
07	[illegible]	Male	[illegible]	01811962791	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
08	[illegible]		[illegible]	[illegible]	
09	[illegible]		[illegible]	[illegible]	
10	[illegible]		[illegible]	01711168357	
11	[illegible]		[illegible]	01819973782	
12	[illegible]		[illegible]	018 19630491	
13	[illegible]		[illegible]	01819 210462	
14	[illegible]		[illegible]	[illegible]	
15	[illegible]	পুঃ	[illegible]	01216681 457	
16	[illegible]	"	[illegible]	01320-107497	
17	[illegible]		[illegible]	01788 627765	
18	[illegible]	"	[illegible]	01819359950	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
19	[illegible]	Male	UEO, Sitakunda	01715297654 guddu7654@yahoo.com	
20	[illegible]	পুঃ	YPSA,	01819535319 [illegible]@gmail.com	
21	[illegible]	পুঃ	[illegible]	01715418312 [illegible]@gmail.com	
22	ইসমত আরা নূর	Female	[illegible]	01644239184	
23	মোঃ মাসুম কবীর	পুঃ	[illegible]	01882216119	
24	[illegible]	পুঃ	[illegible]	01729391331	
25	মোঃ আলাউদ্দীন	পুঃ	[illegible]	01817257349	
26	মোঃ আব্দুল মান্নান	পুঃ	[illegible]	01840894979	
27	মোঃ রাশেদুজ্জামান	পুঃ	[illegible]	01801-670402	
28	মোঃ জাহাঙ্গীর আলম	পুঃ	[illegible]	01730094369	
29	আবুর রহিম	পুঃ	[illegible]	01711-152414	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
30	আকলিমা আক্তার	নারী	তথ্যসেবা সহকারী	01867403284	
31	মোঃ মকসুদুল হোসেন	পুরুষ	[illegible]	01711225078	
32	মোঃ আলাউদ্দীন	পুরুষ	[illegible]	01817257349	
33	মোঃ ইমরোজ খান	পুরুষ	[illegible]	01811-927103	
34	ইসমত আরা নূর	নারী	[illegible]	01644239184	
35	মোঃ মাসুম কবীর	পুরুষ	[illegible]	01882216119	
36	মোহাম্মদ হাকিম [illegible]	পুরুষ	[illegible]	01830172680	
37	মোহাম্মদ আহসুদুর রহমান	পুরুষ	[illegible]	01931999129	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
38	[illegible]	পুঃ	[illegible]	01715-830393	
39	[illegible]	[illegible]	[illegible]	[illegible]	
40	[illegible]	পুঃ	[illegible]	01917079358	
41	নিতীন কুমার চৌধুরী	ঃ	[illegible]	01913000000	
42	[illegible]	[illegible]	[illegible]	[illegible]	
43	[illegible]	[illegible]	[illegible]	01819009155	
44	[illegible]	[illegible]	[illegible]	01825441666	
45	[illegible]	[illegible]	[illegible]	01930533318	
46	[illegible]	[illegible]	[illegible]	01813138847	
47	[illegible]	[illegible]	[illegible]	01955850060	
48	[illegible]	নারী	[illegible]	01712180757	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
49	[illegible]	নারী	[illegible]	01819612804	
50	[illegible]	নারী	[illegible]	01737516616	
51	[illegible]	নারী	[illegible]	01774871779	
52	[illegible]	পুরুষ	[illegible]	01831049293	
53	[illegible]	পুরুষ	[illegible]	01812381801	
54	[illegible]	পুরুষ	[illegible]	01819-100142	
55	[illegible]	পুরুষ	[illegible]	01813-577148	
56	[illegible]	পুরুষ	[illegible]	01918-632525	
57	[illegible]	পুরুষ	[illegible]	01852-897585	
58	Kazi Farhad Iqubal	Male	Team Leader, EQMS	01911702074	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
59	[illegible]	পুরুষ	[illegible]	02222000110 banikkbard@gmail.com	
60	[illegible]	পুরুষ	[illegible]	01515673590	
61	[illegible]	পুরুষ	[illegible]	01834-229454	
62	[illegible]	পুরুষ	[illegible]	02222697886	
63	[illegible]	নারী	[illegible]	—	
64	Aminur Rahman	Male	Consultant, EQMS,	01723 042360	
65	Fahim Uddin.	Male	Ass. Consultant EQMS	01641305408	
66	Mahfuzur Rahman	Male	Consultant EQMS	01717 574447	
67	Md. Zahidul Islam	Male	Principal consultant EQMS	01911569270	

Appendix C-2.6: Attendance List for the validation workshop at Feni District

উপস্থিতি তালিকা

স্থান: DC Office, Feni. তারিখ: 12.06.2024

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
০১	[illegible]	পুঃ	[illegible]	০১৭২৩ ৫৮ ৪০ ৪০	
০২	[illegible]	মহিলা	[illegible]	01713 187300	১৪/০৬/২০২৪
০৩	[illegible]	পুঃ	[illegible]	01550151271	১৪/০৬/২০২৪
০৪	[illegible]	পুঃ	[illegible]	01716 87458	
০৫	[illegible]	পুঃ	[illegible]	01819210462	
০৬	[illegible]	Male	[illegible]	01711-183377	
০৭	[illegible]	Male	[illegible]	01711750940	
০৮	[illegible]	Male	[illegible]	01821594411	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
১৯	[illegible]	পু	[illegible]	01712781756	
২০	বেলাল হোসেন	পু:	সহকারী পরিচালক মাটিকাটা বিভাগ	01518351422	Bilal
২১	মুহাম্মদ রাশেদুল আমিন	পু:	DPD, BSMSN, DP BEZA	01310760127	
২২	মোহাম্মদ নূরুল ইসলাম	পু:	XEN, BSMSN DP BEZA	01712 115747	
২৩	আখির আলম রনি	পু:	APD, BSMSN DP, BEZA	01788-627765	
২৪	মোহাম্মদ সাইফুল আফসারিয়া	পু:	XEN, BWDB, Feni	01318236012	
২৫	মো: শাহিউল হক	পু:	XEN, DPHE	01712709029	
২৬	মো: মাহমুদ আলম খাদেম	পু:	নি: পু এক্সিকিউটিভ	01708123195	
২৭	শেখ তোফেল ইসলাম	পু:	ডাপার ডাপোর্ট অফিসার ২৩৩৯ - ইমামগঞ্জ	01815-633358	
২৮	ওমর ফারুক মেহেদী	পু:	স্যাটেলাইট অপারেশন বিশ্ববাটাম বাংলাদেশ সেটেলাইট কোম্পানী	01916-721044	
২৯	[illegible]	পু:	সহকারী প্রকৌশলী DPHE	01521 483572	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
২০	আরিফুর দাদা	পুরুষ	আঞ্চলিক কৃষি প্রকৌশলী	01713187301 adcafeni@gmail.com	
২২	MD. Manirujjaman	Male	AE	01987913031	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
২২	[illegible]	পুরুষ	অতিরিক্ত জেলা ম্যাজিস্ট্রেট ফেনী	02[illegible] leoasm1@gmail.com	
২৩	রোকেয়া সুলতানা	মহিলা	অতিরিক্ত জেলা সুপারিনটেন্ডেন্ট (দায়িত্ব)	01713187302 adcfeni@gmail.com	
২৪	দীন মোহাম্মদ	M	অতি: সুপিরিয় সুপার ফুলিশ সুপার পদে পদোন্নতি	0[illegible]320-112902	
২৫	মাহফুজা ফুলফুল শানি	F	সিনিয়র সহকারী কমিশনার জেলা প্রশাসকের কার্যালয় ফেনী	01945878250 mahmuda18127@gmail.com	
২৬	নিখিল চন্দ্র সেনশর্মা	M	উপসহকারী প্রকৌশলক assistant	01815639991 e-mail: nikhil1@gmail.com	
২৭	আবাত হাবিব খান	M	সহকারী কমিশনার (জেলা প্রশাসন) ফেনী	01936-575838 khanfarazhabib@gmail.com	12.6.24
২৮	সাইলা ইয়াসমিন	F	সিনিয়র সহকারী কমিশনার Dc. office Feni.	sdcfeni@yahoo.com	
২৯	মোঃ আবদুল বাছেদ সরকার	M	Sub divisional Engr. Road Division, Feni	01730782655 mabs.rhd@gmail.com	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
৩০	আবু সিদ্দিক ইসলাম	M	জেলা নাজির কার্যালয় ফেনী	01710468647 dfofeni@gmail.com	
৩১	মোহাম্মদ রুহুল আমিন	M	বিভাগীয় বন কর্মকর্তা ফেনী	01720177184 dcfaminfel@gmail.com	12.06.24
৩২	তানভির হোসেন তমাল	M	সহকারী কমিশনার জেলা প্রশাসকের কার্যালয় ফেনী	01766333021 tanvirhossaintamal.tht@gmail.com	14-6-24
৩৩	তানিয়া আক্তার লুবনা	F	সহকারী কমিশনার (ল্যান্ড) ফেনী	01713187329 asland.sonagazi20@gmail.com	
৩৪	এ: লো: ইমাম হোসেন শিমু	M	জেলিকেন অফিসার ফিডিং গার্জেন কার্যালয়	01631743622 emu172@gmail.com	12.06.24
৩৫	[illegible]	M	জেনারেল ম্যানেজার ফেনী পল্লী বিদ্যুৎ সমিতি	0[illegible]-8000[illegible] fenipbs@24@gmail.com	
৩৬	শাওকত আরা কলি	F	ডেপুটি চিফ পরিবেশ অতিরিক্ত, ফেনী	01733063648 shaokatkoli@gmail.com	
৩৭	নাজমুল হক সলিম	M	জেলা প্রতিনিধি দৈনিক যায়যায়দিন	01717260620 mhshamim777@gmail.com	12.06.24
৩৮	[illegible]	M	সাংবাদিক	01817911535	
৩৯	আতিকুর রহমান (সুমন)	M	সাংবাদিক	01871352481	
৪০	Abdul Kalam Azad	M	Mayor, Sonagazi	01819193653	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
৪১	আবু মুসলিম	Male	সহকারী কমিশনার (ভূমি)	01711-152985	
৪২	[illegible]	Male	NDC, Rem	01718-187304	
৪৩	[illegible]	Female	[illegible]	01829522275	
৪৪	[illegible]	Male	[illegible]	01842917854	
৪৫	[illegible]	Male	[illegible]	01814888555	
৪৬	[illegible]	Female	[illegible]	01818700744	
৪৭	[illegible]	Male	[illegible]	01819132223	
৪৮	[illegible]	Female	[illegible]	01750758888	
৪৯	[illegible]	মু:	[illegible]	01818065557	
৫০	[illegible]	মু:	[illegible]	01719517525	
৫১	Jahidul Alam	মু:	[illegible]	01814257545	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
৫২	[illegible]	মু:	[illegible]	01628200606	
৫৩	Kazi Farhad Iqubal	Male	Team Leader, RESA study Team	01911702074	
৫৪	md. Zahidul Islam	male	principal consultant	01911569270	
৫৫	Mahfuzur Rahman	Male	Social Development Specialist, EQMS	01717576747	
৫৬	Md. Fahim Uddin	Male	Assistant Consultant - EQMS	01641305408	

Appendix C-2.7: Attendance List for the validation workshop at Chattogram (Regional)

উপস্থিতি তালিকা

স্থান: [illegible] তারিখ: ২৮/০৫/২০২৪

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
১.	[illegible]	মু:	[illegible]	02930984222	
২.	[illegible]	Male	[illegible]	01711544554	
৩	[illegible]	Male	[illegible]	01556329934	
৪.	[illegible]	Female	[illegible]	01712577900	
৫।	[illegible]	Male	[illegible]	01550151271	
৬।	[illegible]	Male	[illegible]	01811-088225	
৭.	[illegible]	male	[illegible]	01777766111	
৮	[illegible]	mele	[illegible]	01711-173449	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
১৯	মোঃ ওয়াসুল কাশেম	male	উপজেলা প্রকৌশলী, সাব-ডিভিশন অফিস, মিরসরাই	01711-772935 kashem1973bwdb@gmail.com	
২০	মোঃ নিজাম উদ্দিন	Male	Sub-Divisional Engineer, Road Sub-Division, Chattogram	01730-782880 nonyatctg@gmail.com	
২১	মোঃ সেলিম হোসেন	Male	Assistant Engineer	01750-298796 selim.ee.biwta@gmail.com	
২২	মোহাম্মদ আহিদুল ইসলাম	Male	DGM, Telecom, BTCL	01550151457 ahidwww@gmail.com	
২৩	মোঃ কাউসার আলম	Male	Sr. Manager McDonald Steel	01818-511713 Kawsar.Alam@McDonaldSteel.net	
২৪	মাহমুদুল হাসান	Male	ব্যবস্থাপক, বৈদ্যুতিক স্টাফ নিয়োগ	01817540866 mahmud170114@gmail.com	
২৫	ড. গাজী গোলাম মাওলা	Male	পরিচালক সাধারণ ওষুধ বিভাগ, ঔষধ	01815626292 a2zdbubu2012@gmail	
২৬	মোঃ কামরুল ইসলাম	Male	সেলস কিরন অফিসার, চেকপী	01710893664 feni.deo.feni@gmail.com	
২৭	প্রকৌ. মাসুদুর রহমান	Male	তত্ত্বাবধায়ক কার্যালয় চ.জে.বি.	01311180348 masudurkgde@gmail.com	
২৮	মোঃ ফেরদৌস আলমগীর	Male	উপজেলা প্রকৌশলী, DoE, ফটিকছড়ি জেলা	01757076710	
২৯	উত্তম শীল	Male	জেলা শিক্ষা কর্মকর্তা চট্টগ্রাম	01988682686 deoclittagong@yahoo.com	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
২০	নাসরীন আরজুমান	Female	উপজেলা পরিবেশ সহকারী কমিশনার (ইউএনও)	01914615266 dnofeni@gmail.com	
২১	আশিকুল ইসলাম	Male	জেলা ত্রাণ কর্মকর্তা ফেনী	dfofeni@gmail.com 01710468647	
২২	আবির মাহমুদ শাকিল	Male	সহকারী প্রকৌশলী (সিভিল)	01521483570 ampumtb33@gmail.com	
২৩	প্রসান্ত চন্দ্র দাশ	Male	উপ-বিভাগীয় প্রকৌ. পানি উন্নয়ন বোর্ড, চট্টগ্রাম	01684146710 xen.ctg2@gmail.com	
২৪	ড. এনামুল কবির	Male	অতিরিক্ত জিলা জজ	01783382492	
২৫	মোঃ আবুল কাশেম খান	M	সহকারী প্রকৌশলী (সিভিল)	01316681456	
২৬	তাহমিনা [illegible]	F	উপ-সহকারী কমিশনার (ইউএনও) চকরিয়া কক্সবাজার	01818228233	
২৭	তাহমিদুল আলম ইসলাম	Male	ইউনিয়ন পরিষদ সচিব, চট্টগ্রাম	01717102226	
২৮	মুহাম্মদ রেজাউল করিম	M	নির্বাহী ম্যাজিস্ট্রেট উপজেলা নির্বাহী কর্মকর্তা	01712984500	
২৯	Sohel Mahmud	M	Deputy Secretary BEZA	01775-966410 sohel.mahmud107@gmail.com	
৩০	মাহেনা আক্তার	F	সহকারী জেলা [illegible]	01713187302	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
৩১	[illegible]	M	DC South Cmp	01320062550 mastafiz017@gmail.com	
৩২	কে.এম. তাহমিদুল ইসলাম UNO, সীতাকুন্ড	Male	UNO, Sitakunda	01837711450 unositakunda.ctg@gmail.com	
৩৩	এস. এম. জাহিদুল হক	Male	SP. Chattogram	01320107400	
৩৪	মাহমুদ তাজওয়ার ইসলাম খান ACO, DoICT	Male	CO, DoICT	01811800177	
৩৫	নাসরিন [illegible]	Female	UNO, সীতাকুন্ড	01793334351	
৩৬	মোঃ এনামুল হাসান [illegible]	M/Male	[illegible]	01816813401	
	Kazi Farhad Iqubal	M	Team Leader, REZA EQMS	01911702074	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
৩৭	মো: তোফাজ্জেল ইসলাম	পুরুষ	বিভাগীয় সমিতিসমূহ চট্টগ্রাম	01713120795	28.02.24

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
৩৮	মো: মাহমুদুল হাসান		ডি.এস.সুপারভাইজার লিমিটেড	01554336343	
৩৯	ফারিহা সুলতানা		সহকারী কনসালটেন্ট (ই সাস্টেইনেবিলিটি এন্ড ক্লাইমেট)	01750282722	fmumtahina
৪০	মো: ফাহমুল নবী		সহকারী পরিচালক 3 এক্সিকিউটিভ ম্যাজিস্ট্রেট	01998365206	
৪১	মো: নজরুল ইসলাম		সহকারী পরিচালক, চট্টগ্রাম বিভাগীয় কার্যালয়	01827897585	
৪২	আবদুল কাদের সিকদার			01616880805	
৪৩	আবুল হোসেন হাবিব		যুগ্মসচিব সহকারী, সাধারণ বিভাগ কর্মচারী শাখা,	01747[illegible]555	
৪৪	শাহীদ হোসেন		সহকারী পরিচালক উপজেলা	01677339439	
৪৫	শ্রীমতি সাবিত্রী সরকার		অফিস সহকারী	01718-112803	

ক্রমিক নং	নাম	লিঙ্গ	পদবী	মোবাইল নং এবং ইমেইল	স্বাক্ষর
৪৬	S. M. Tanvir Hassan	Male	Assistant Consultant EQMS Consulting Ltd.	01676250500 tanvir.hassan@eqms.com.bd	
৪৭	Kazi Mahfuzul Haque	Male	Reporter EKHON TV	01819610277	
৪৮	[illegible]		এ: ম্যানেজার EMERGE-24	01818517407	

Appendix C-2.8: Attendance List for the National Validation Workshop at Dhaka

National Workshop on
RESA for National SEZ (Mirsarai, Sitakunda & Feni Economic Zone)

Serial No	Name of Participant	Designation	Organization	Contact & Email	Signature
1.	K. M. Nayeem Khan	Addl. chief Engineer	BREB	01552480522 aceepndnreb@gmail.com	20/11/24
2.	M. D. Taher	Business		01875824241	20-11-24.
3.	Mst Mourysheda Ferdous	Joint Secretary	Energy and Mineral Resources Division	01553565726 mourysheda@gmail.com	
4.	Jahir Raihan (TBS)	Staff Reporter	TBS	01675589426 Jahir.raihan88@gmail.com	
5.	Reyasat Al Wasit	Joint secretary	MoLE	01712061558 reyasat15040@gmail.com	
6.	Mr. Kaysar Rahman	SE, BEPZA	BEPZA	01716877096 kaysar92@gmail.com	
7.	Md. Nuvul Amin	SE	CWASA	01554336027 ratanbd@gmail.com	
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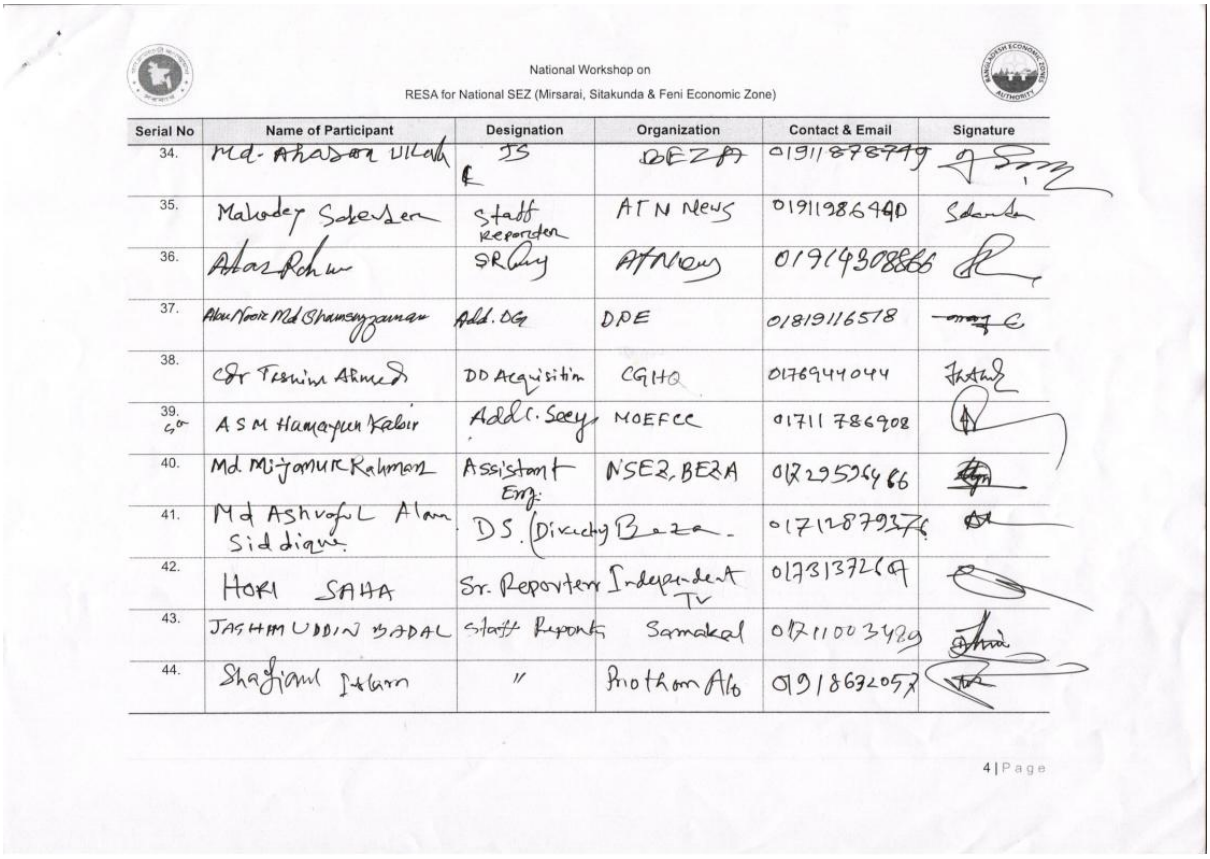

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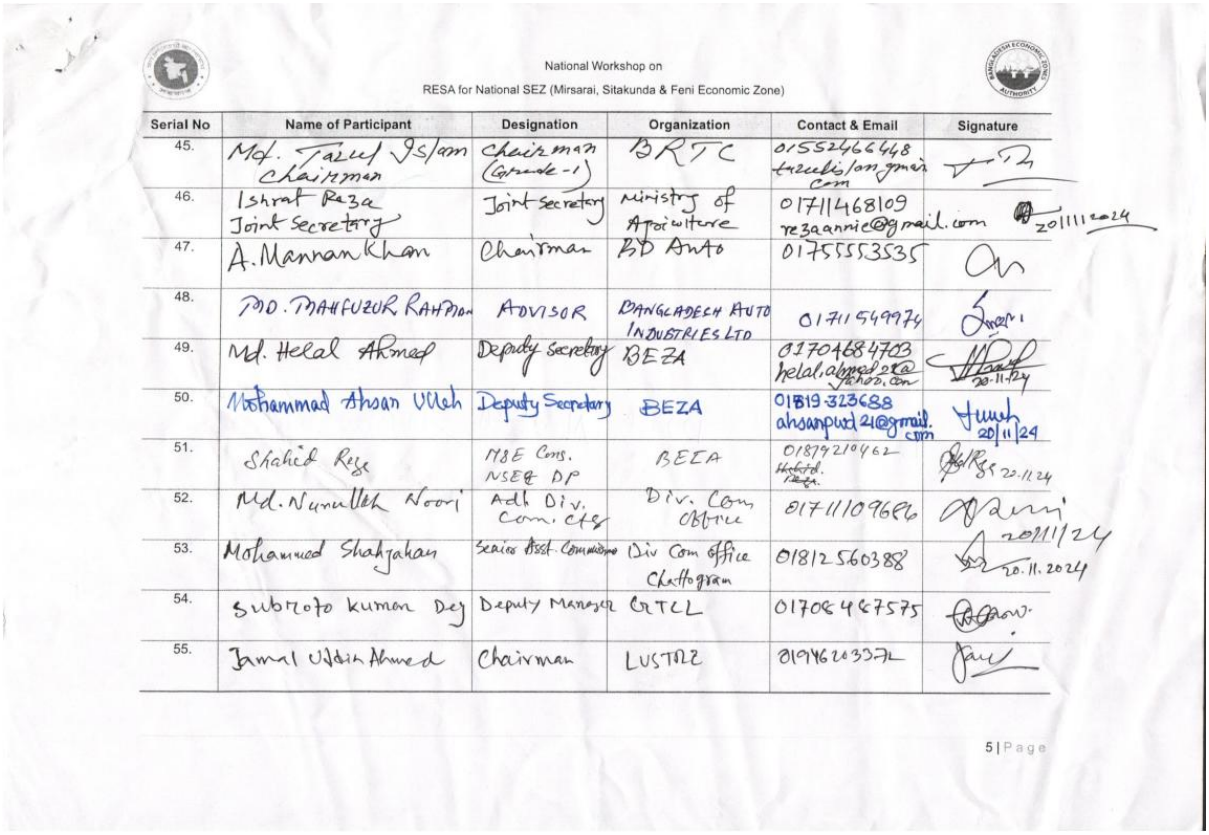

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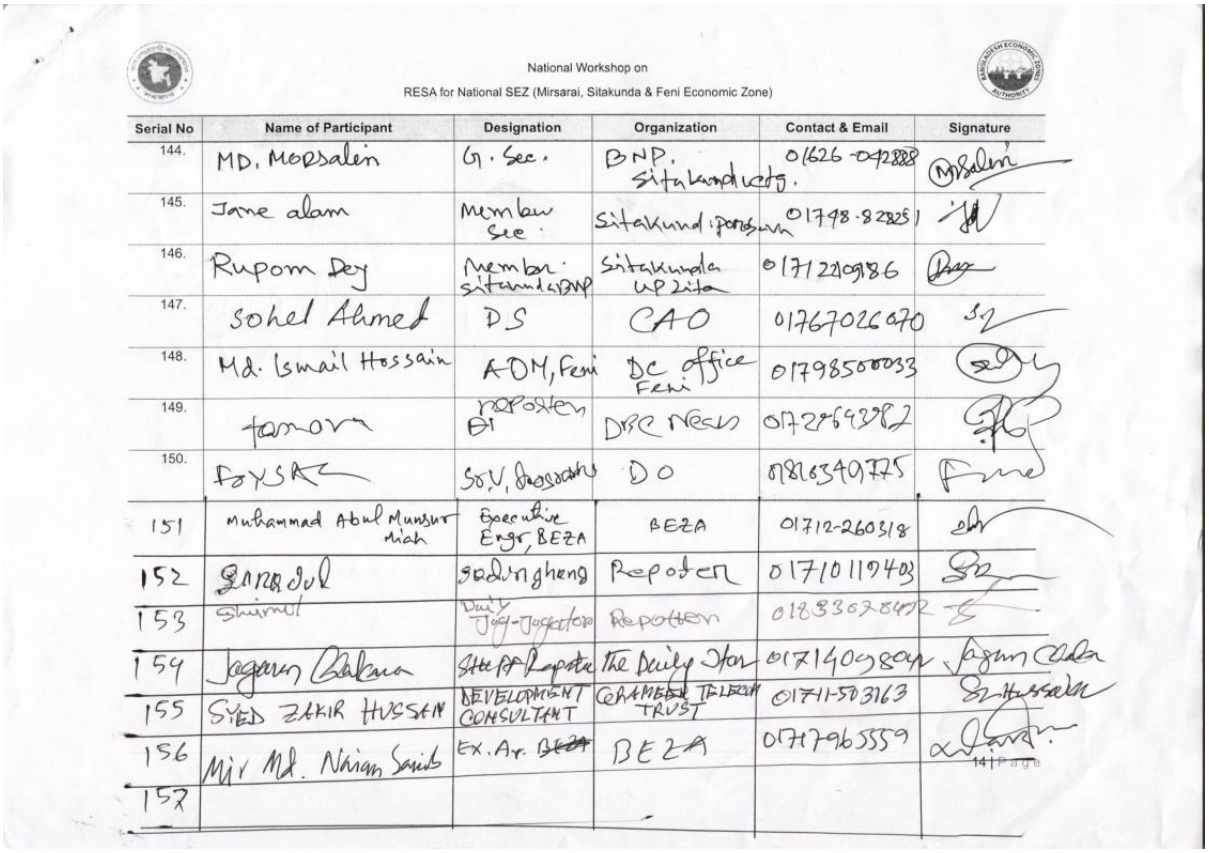

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Appendix C-3: Meeting Minutes of Stakeholder Consultation

1.1 NSEZ Affected Parties

1.1.1 Consultation with Buffalo Grazers

Basic Details
Location: NSEZ area (near Bamansundor Khal)
District: Chattogram
Date: 14 January 2024
Purpose of the Visit: To consult with buffalo grazers about their perception regarding the development and operational activities, the impact of NSEZ on buffalo grazing and buffalo grazer communities of EZ areas, etc.
Key Point discussed

Perception about the NSEZ

- The local buffalo grazers were found aware of the NSEZ, and they knew about the development activities under the NSEZ.

Overview

- Most of the consulted grazing boys and buffalo owners are from Bamansundor and Ichakhali areas.
- There are various types of buffalo grazers such as (a) some take care of other owner's buffalo with their own buffalos on some condition and benefits like profit sharing; (b) some graze only their own buffalos; (c) buffalo boys who are the paid boys (locally called 'Batainna'/ 'Rakhal') and responsible to take care of one or several owners' buffalos.
- There are two major types of buffalo (1) reared at owners' homes at domestic environment like cows; and (2) 'deshi'/local type which are grazed and kept in the open space and natural environment all the time.

Previous Buffalo Grazing Areas and Lands

- Before the development under NSEZ, open spaces near Ichakhali Khal and Bamansundor Khal were mostly used for buffalo grazing.

Current Buffalo Grazing Areas and Lands

- Once the development started, the grazers witnessed a reduction of grazing land and they gradually shifted to areas of the western part of the NSEZ boundary.

Grazers' Targeted Lands for Grazing in the Future

- They demanded to be allowed to move to the newly arisen char at the seashore, as per their opinion – there are huge amounts of fodder such as grass, straw, etc. Currently, the forest department does not allow any kind of grazing on this Char as opined by the grazers.
- According to their opinion, they have targeted the areas from 2 No sluice gates/crossing the Ichakhali Khal to crossing the 16 bridges.

Anticipated Impact on Grazing Land and Buffalo grazers

- Due to the EZ and reduction of buffalo grazing land, many of the grazers have sold their buffaloes. The amount of buffalo grazing is decreasing day by day.
- One buffalo owner stated, *"I had 70 to 80 buffaloes before the EZ started and it was the source of income of my family. I used to graze the buffaloes here (on the NSEZ site). Due to the development in the area, we have lost grazing lands. Some buffaloes also died due to insufficient fodder. Facing such a great loss, I have decided to sell my buffaloes and seek another way of livelihood."*

Suggestions/Recommendation

- Buffalo grazers suggested alternative grazing land. They demanded to allow them to graze in the newly arisen Char areas in the western part of the NSEZ Boundary.
- They want to access the NSEZ roads so that they can move their buffalo herds from one place to another place of grazing land and even from community to grazing land.

Participant

Buffalo grazers and owners in the Bamansundor and Ichakhali areas

1.1.2 Consultation/FGD with Fishermen Community-Char Khandakar

Basic Details

Location: Char Khandakar Fisheries Landing Ghat, Sonagazi Upazila

District: Feni

Date: 8 November 2023

Purpose of the Visit: To consult with the Community about their perception regarding the development and operation activities, and the potential impact of NSEZ on the fishermen community, in their livelihood, health, traditions & culture, etc.

Key Point Discussed

Overview:

Muslim & 'Jaldas' community fishermen were present in the FGD. Both the fisherman and owner of the boats were present in the discussion and expressed their opinion and concerns to the consultant team.

The fishermen and boat owners are aware of the NSEZ and expressed their concern regarding their future as fishermen. They are concerned about the loss of livelihood due to the acquisition of coastal land by the government, restricted access to the khal, low fish yield, and loss of fishing nets due to increased cargo vassal traffic.

The majority of the community members had taken loans from NGOs or other sources. The main source of their income is related to fishing. Some are directly involved in fishing and others are boat and net owners.

Boat & Equipment:

There are three types of boats currently used by fishermen to catch fish from the sea. The mainstays are small boats with 08-12 HP engines and have limited endurance. 2-4 fishermen venture in a single boat and typically spend 6-12 hours per sortie. There are a limited number of bigger boats with lengths near 12-15 meters. Typically, 22 fishermen are employed in one boat. These boats venture deep into the sea. A single boat costs more than 50,00,000 BDT. Additionally, the fishing nets cost between 50,000-1,20,000 BDT depending on type and size.

The fisherman community also expressed their concern about their safety and security. During winter, cargo vessels collide with stationary fishing boats due to limited visibility with fog. There is also the risk of pirates. Additionally, rough seas and wind make fishing in the open sea or the deep sea risky.

Impact:

- Reduced fish yield
- Risk of loss of occupation
- Difficulty in access to boats
- Low income as a result of low fish yield
- Impact on the living and culture of the artisanal fisherman community as they are fishermen not only by profession but also by tradition and inherited the skills from previous generations.

Recommendation:

- Provision of jobs from the fisherman community in the newly built factories. (they proposed that NSEZ should provide jobs to a member of every fisherman family who is in danger of losing their livelihood due to the implementation of the NSEZ).
- Alternative Livelihoods.
- Reduction of marine traffic.
- Do not change the fish landing stations/Ghats (as they came to know about the relocation of the Ghat in the Mirsharai areas).
- Financial assistance to commission bigger fishing boats which will enable them to catch fish from deeper seas.
- Enforcing laws to restrict banned fishing nets to increase fish yield.
- Increase assistance to fishermen during government-enforced fishing bans.
- Permission to fish in areas near and beyond Sandwip. There is a dispute between fishermen from different areas and zones are divided. Fishermen from Sonagazi are unable to fish beyond the Sandwip Channel. If they fish beyond this channel, it will create the possibility of a clash between the fisherman community from Chattogram and Cox's Bazar.
- They need better wood to make better boats.

Participant

Fishermen community members

1.1.3 Consultation/FGD with Community Members- Sonagazi Union

Basic Details

Location: Char Chandia Union, Sonagazi Upazila

District: Feni

Date: 8 November 2023

Purpose of the Visit: To consult with the Community about their perception regarding the development and operational activities, and the potential impact of NSEZ on the community, in the livelihood, health, traditions & culture, etc.

Key Point Discussed

Overview

- An FGD was conducted in a local tea shop to consult with local community members. Males aged between 30-60 attended the FGD from diverse backgrounds. Some of the respondents had prior information about NSEZ. The consultant team provided a brief description of the NSEZ to the community members present in the discussion.
- Farming is the main livelihood in the locality. Additionally, people are engaged in fishing, buffalo grazing, cow & sheep rearing, crab catching, aquaculture, small businesses/shops, daily wage laborer etc. People are living below the poverty line in many cases as reported by the respondents.
- Half of the respondents are involved in farming and expressed concern about future economic stability in their lives. One respondent specifically expressed concern about the additional land acquisition by the government which denotes they were not satisfied with previous land acquisitions.

Potential Impact

- The price of land in the NSEZ surrounding area will be increased.

- Some people lost their only land because of acquisition. They have received compensation but there are some socioeconomic consequences mentioned by the respondents. Impacted people may not be able to buy land due to increased prices.
- Due to acquisition, community members who were dependent on those lands for various types of income-generating activities lost their livelihoods. ('Rakhal'-buffalo grazers, 'Borga Chashi'-contract farmer, fisherman, Crab hunters lost their jobs).
- Traffic may increase.
- Chance of Pollution.
- NSEZ will create job opportunities.
- Business opportunities will also increase as with the population influx; market demand will increase.
- Grazing land has already been reduced, and agricultural land will also decrease in the future. Habitat for wild species should be conserved.

Recommendation

- Job opportunities in nearby factories and specific quotas for the community people during recruitment.
- Fishery resources should be saved from any harmful impact. This is our most important asset.

Participant

Male community member, Char Chandia

1.1.4 Consultation/FGD with Female members of the community

Basic Details

Location: 7 no ward, Mirer Hat, Saidpur Union

District: Chattogram

Date: 8 November 2023

Purpose of the Visit: To consult with the female members of the Community about their perception regarding the development and operation activities, the potential impact of NSEZ on the community (especially among females), livelihood, health, traditions & culture, etc.

Key Point Discussed

Overview:

- FGD was conducted with the female members of the community in the Saidpur union of Sitakunda Upazila. During the FGD, the male aged between 30-75 were present and expressed their view regarding the NSEZ. The respondents were not aware of the NSEZ. The RESA team informed the respondents and restaurant owners about the NSEZ. Respondents were from diverse socio-economic backgrounds. The majority of the respondents were housewives and not involved in any wage-earning activity. Unemployment, dowry, eve teasing.

Perceived Challenges & Risk Factors for Females Due to NSEZ

- High divorce rates in the Chattogram region and rapid urbanization may affect the community as well.
- Eve-teasing is prevalent and perceived to be increasing with the influx of workers.
- Pollution from factories in NSEZ when they start operation.
- Dowry is an existing social problem and may remain an issue.
- Female members may face difficulties in accepting changes and coping with the population influx and associated changes in the community. The respondents expect the number of males will increase in the community. Road traffic will also expand.

Impact:

- NSEZ will create jobs for the community.
- It may change the way of life and population dynamics in the community. It could also impact on community cohesion.
- The respondents also suspect a major population influx will occur; they may have to adjust their current way of life.
- Due to the potential influx, there is a risk of social conflict between outsiders and local people, the crisis of healthcare facilities, and other services and infrastructure-related services.

Expectations

- New job opportunities for females can be created in the NSEZ.
- Skill development training from the government (sewing, handicrafts, etc.)

Recommendation:

- Pollution control should be ensured. During construction, dust and flying sand should be prevented by following proper measures.
- Considering females for jobs and arranging skill development training for disadvantaged female community members.
- Saving wild animals from surrounding forest areas.
- Ensure safety for women and women workers.
- Ensure the health facilities of local people.
- Employ local people.

Participant

Female community members, Saidpur Union

1.1.5 FGD with Student/School-Going Children

Basic Details

Location: Nurul Absar Choudhury High School, Maghadia, Mirsharai

District: Chattogram

Date: 8 November 2023

Purpose of the Visit: To consult with students about their perception regarding the development and operational activities, the potential impact of NSEZ on the community (especially among school-going children), in the school, health, transportation & culture, etc.

Key Point Discussed

Overview:

Students are aware of the NSEZ, and the government already acquired land for road extension from school-owned land. The students emphasized cultural aspects while discussing the potential effect of the NSEZ on school-going children and adolescents. Another major concern for the students is road safety as traffic has increased manyfold on the road adjacent to the school and many students have to cross the road regularly to attend class.

Current Situation & Potential Impact:

- According to the students, due to NSEZ's economic establishment, road connectivity has improved and BEZA is going to further improve the road network in the area which will enable the community to communicate with ease by road.
- The implementation of an economic zone will create employment opportunities for the community.
- Students are involved in many extracurricular activities like playing football, cricket, etc.

- The influx of population from outside may create issues like a language barrier for the time being. However, students suggest it will not create any major social issues.
- There are incidents of eve-teasing, but female students show enthusiasm in pursuing their studies and careers in professional jobs.
- Families in the community are supportive of female education and encourage female employment especially if they pursue careers in medicine, teaching, banking, and government jobs.
- Despite having the option of vocational trade and a career as a skilled worker, none of the students showed interest in developing a career as a skilled worker. Almost every one of them is in pursuit of white-collar jobs.
- No recommendations were provided by the students.

Suggestion and Recommendations

- Local administration should take stronger steps to prevent any future possibility of sexual harassment and violence against female children.
- Dust and noise should be controlled so that it does not harm students.
- Increase playgrounds in the community.

Participant

Male and Female students, at Nurul Absar Choudhury High School

1.1.6 FGD with Student/School-Going Children

Basic Details

Location: Captain Shamsul Huda High School, Muradpur, Sitakunda

District: Chattogram

Date: 30 August 2023

Purpose of the Visit: To consult with students about their perception regarding the development and operation activities, the potential impact of NSEZ on the community (especially among school-going children), in the school, health, transportation & culture, etc.

Key Point Discussed

Overview:

Students are unaware of the NSEZ. The RESA team informed the students about the NSEZ and provided a brief description of the EZ.

Perceived Impact:

- Lifestyle may change due to industrialization.
- Living costs will increase.
- Cultural changes.
- Competition will increase in education/academics.
- The amount of waste will increase.
- Deforestation and environmental degradation.
- Pollution may increase.
- The number of tourists and outsiders will increase.
- Sound pollution.
- Wild animals will lose their habitat due to the movement of humans.

Recommendation:

- Waste management.
- We need to increase the number of playgrounds.

- Reduce pollution like air pollution, water pollution, and noise pollution.
- Increase playing equipment.

Participant

Male and Female students, Captain Shamsul Huda High School, Muradpur, Sitakunda

1.1.7 FGD with Student/School-Going Children

Basic Details

Location: Azizul Hoque Maymun Ara High School, Sonagazi

District: Feni

Date: 11 November 2023

Purpose of the Visit: To consult with students about their perception regarding the development and operational activities, the potential impact of NSEZ on the community (especially among school-going children), in the school, health, transportation & culture, etc.

Key Point discussed

Overview:

Students of Azizul Hoque Maymun Area High School, Sonagazi shared their understanding of the NSEZ and related activities. They discussed a few concerns and asked questions about the ongoing activities and their potential outcomes. The RESA team provided an overview of the EZ and the future activities planned for the NSEZ.

Impact:

- Students perceived an escalation in competition in not only the academic sphere but also in co-curricular activities, especially in the playground.
- According to consultation data, the students don't feel any issue regarding the future integration of outsiders in the community (population influx).

Recommendation:

- Students recommended establishing additional police stations in the area to ensure safety and security.
- They expect the roads will be widened; and footpaths will be constructed to ensure road safety for the students.
- NSEZ authority should take precautions to reduce all forms of pollution that may occur during development and operation activity.

Participant

Male students, Azizul Hoque Maymun Area High School, Sonagazi

1.1.8 FGD with Student/School-Going Children

Basic Details

Location: Azizul Hoque Maymun Ara High School, Sonagazi

District: Feni

Date: 11 November 2023

Purpose of the Visit: To consult with students about their perception regarding the development and operation activities, the potential impact of NSEZ on the community (especially among school-going children), in the school, health, transportation & culture, etc.

Key Point discussed
Overview: Students of Azizul Hoque Maymun Area High School, Sonagazi shared their understanding of the NSEZ and related activities. The female students were concerned about future social cohesion and their safety related to social mobility. They also asked questions about the ongoing activities and their potential outcomes. The RESA team provided an overview of the EZ and the future activities planned for the NSEZ. Current situation and perceived Impact: • Families support female students in pursuing their academic goals. The majority of the female students will continue their studies despite changes in socioeconomic changes caused by NSEZ. • It is reported by the participants that there is a prevalence of eve teasing, and the situation may worsen with the influx of population from outside of the community. • Students perceived an escalation in competition in not only the academic sphere but also in co-curricular activities, especially in the playground. • According to consultation data, the students don't feel any issue regarding the future integration of outsiders in the community (population influx). Recommendation: • Students recommended establishing additional police stations in the area to ensure safety and security. • They expect the roads will be widened and footpaths will be constructed to ensure the road safety of the students. • NSEZ authority should take precautions to reduce all forms of pollution that may occur during development and operation activity.
Participant
Female students, Azizul Hoque Maymun Area High School, Sonagazi

1.1.9 FGD with Student/School-Going Children

Basic Details
Location: Captain Shamsul Huda High School, Muradpur, Sitakunda
District: Chattogram
Date: 11 November 2023
Purpose of the Visit: To consult with students about their perception regarding the development and operation activities, the potential impact of NSEZ on the community (especially among school-going children), in the school, health, transportation & culture, etc.
Key Point Discussed
Overview: Students were not aware of the EZ but showed a positive attitude towards the NSEZ. Current situation and future Impact: • Presently no activities of the NSEZ in the surrounding area and the female students haven't observed any changes in their surrounding community. • They face issues like eve-teasing occasionally. However, the majority of female students are determined to continue their studies. Most of them plan to continue their study, get higher education, and want to engage in the job sector as professionals. • Students are concerned about environmental pollution and sound pollution.

- With the influx of the population and additional students, there will be a scarcity regarding access to the playground. They suspect competition will increase among students regarding access to playgrounds and other amenities.
- Lifestyle may change due to industrialization.
- Living costs will increase.
- Cultural changes.
- Competition will increase in education/academics.
- The amount of waste will increase.
- Deforestation and environmental degradation.
- Pollution may increase.
- The number of tourists and outsiders will increase.
- Sound pollution

Recommendation:

- Waste management.
- Ensuring road safety. Roads need to be widened.
- Reduce pollution.
- Creating opportunities for females.

Participant

Female students, Captain Shamsul Huda High School, Muradpur, Sitakunda

1.2 Other Interested Parties

1.2.1 Consultation with the Organization for the Poor Community Advancement, Mirsharai

Basic Details

Location: Abu Torab Bazar, Maghadia, Mirsharai Upazila

District: Chattogram

Date: 8 November 2023

Purpose of the Visit: To consult with stakeholders about their perception regarding the development and operation activities, current situation regarding educational institute capacity, scope of future involvement, preparation recommendation of school regarding future demand of NSEZ, the impact of NSEZ on students and in the school, etc.

Key Point Discussed

- Organization for the Poor Community Advancement provides microcredit services and health services to their credit recipients.
- There is huge scope for working with the issues of health and community safety issues. Due to the population influx, demand for such services will increase.
- NGO personnel are aware of the EZ.
- Due to the improvement of roads and communication, OPCA could provide more services to more areas.

Recommendations

- Ensuring health services to the increased size of the population would be a challenge. The number and services of health facilities should be increased with the rise of population in the areas.
- Proper mitigation should be followed to avoid dust, air, and noise pollution during construction works otherwise it would harm community health.
- The number of traffic police should be increased in the NSEZ Saroni, CP mor, and local bazar/market to avoid future traffic congestion.

- Industries should adopt advanced technology to avoid water pollution during operation.
- There is a risk of air and water-borne disease if pollution increases. Therefore, all forms of pollution should be avoided.

Participant

Pradip Chandra Shaha, Paramedics, OPCA, Abu Torab, Mirsharai Upazila, Chattogram

1.2.2 Consultation with the Young Power for Social Action, Mirsharai

Basic Details

Location: YPSA area office, Mirsharai Upazila

District: Chattogram

Date: 27 April 2024

Purpose of the Visit: To consult with stakeholders about their current activities in the NSEZ surrounding area and the region, action for youth development, disability welfare, vulnerable community development, skill development program, economic enhancement activity, etc.

Key Point Discussed

- YPSA is currently working with a variety of social and economic issues in the Mirsharai and Sitakunda region for the development of the local community. Their current area of coverage includes the following:
    a. Microcredit
    b. Disability welfare
    c. Women development
    d. Child development
    e. Poor and economically vulnerable households' protection and development
    f. Environment and Sanitation
- YPSA has been working in the greater Chattogram for a long time and is well-experienced in local contexts.
- A representative of YPSA opined that there is a huge scope for working on the issues of health and community safety issues in the NSEZ's nearby community. Due to the population influx, demand for such services will increase and YPSA could contribute to this sector.
- NGO personnel are aware of the EZ.

Recommendations

- Youth should be provided with skill-developing training.
- Disability family should be supported with livelihood assistance if their livelihood is affected due to the EZ.
- Prepare a community development plan for proper sanitation system development considering future demand.

Participant

Mr. Alamgir, Branch Manager, YPSA, Mirsharai, Chattogram

1.2.3 Consultation with Jagoroni Chakra Foundation, Sonagazi

Basic Details

Location: Sonagazi Upazila

District: Feni

Date: 11 November 2023

Purpose of the Visit: To consult with stakeholders about their perception regarding the development and operation activities, current situation regarding educational institute capacity, scope of future involvement, preparation recommendation of school regarding future demand of NSEZ, the impact of NSEZ on students and in the school, etc.

Key Point discussed

- NGO personnel are aware of the NSEZ.
- The NGO provides micro credit to community people in the area.
- Most of the clients are non-resident Bangladeshis.
- They also provide credit to agribusinesses, farmers, fishermen, etc.
- Initially, they provide loans of up to 300,000. With proof of income, they provide bigger loans.
- When a client takes a loan from multiple lenders, it becomes difficult for the organization to recover the loan.
- The loan recovery rate is satisfactory as per consultation. Above 95%.
- According to consultation, they perceive this EZ as a development opportunity for the area and a window for growth of their portfolio. The NGO is also preparing to open branches in Chattogram.
- The NSEZ will contribute to the livelihood of local people. Many income-generating activities will be increased such as construction works, business, industry employment, etc.

Recommendations

- BEZA should engage NGOs/Civil Society Organizations for community development activities including livelihood restoration and training programs.
- The area is naturally rich in terms of natural resources like fish and fresh air. Any Industrial development should not affect these resources.

Participant

Bishwajit Kumar Das, Accountant, Jagoroni Chakra Foundation, Sonagazi Upazila, Feni

1.2.4 Consultation with Bangladesh Investment Development Authority

Basic Details

Location: Bangladesh Economic Zone Investors Association

District: Dhaka

Date: 14 May 2024

Purpose of the Consultation: As a part of the stakeholder consultation of the RESA, the study team communicated with the Bangladesh Economic Zone Investors Association (BEZIA) clarifying the purpose of the consultation. The BEZIA provided the responses of 4 investors to the RESA team clarifying their present status, challenges and concerns, and recommendations.

Key Points

- The investors provided information on NSEZ development, transportation, utility services, challenges, accommodation, etc.

Issues and Recommendations of McDonald Steel Building Products Limited

- BEZA should take steps for labor accommodation, and transportation facilities.
- The Investor urges duty-free concessions for purchasing vehicles to transport the labor within NSEZ.
- Establish a hospital in NSEZ for better health services for workers and staff.
- Establish the fire station as soon as possible.
- TAX exemption.

- Condition for investment of a minimum of 5 million USD or an equivalent amount could attract more investors.
- Provision of duty-free import of construction materials for industries within NSEZ.
- Long-term tax exemption for foreign workers and staff of industries of NSEZ.
- Establish a help desk at government offices within NSEZ for the investors.

Current Issues/Problems and Recommendations of BSRM

- Along with the lease fee, BSRM had also paid 15% VAT on lease free which was not initially mentioned in the land lease agreement rather BEZA authority imposed later. Therefore, to have a refund of the VAT amount, the issue needs to be raised with the BEZA Authority.
- For electricity transmission, the clauses that are not protecting the interest of the investors need to be addressed.
- Complete the 40m-wide road in Zone-3 as per the master plan as soon as possible.
- Drainage: To set up BSRM's intended project, the drainage system is to be developed by BEZA along with road connectivity.
- Water Supply: For the intended steel manufacturing plant, the BSRM group shared the water requirement for the plot at Zone-3 of NSEZ, which is yet to be assured from BEZA.
- Gas Connectivity: Visible progress regarding gas pipeline establishment is expected.
- Utility Charges: BSRM considered the charge of utilities like water to be high at BDT 37.00 per cubic, with an additional 5% service charge on the tariff. BSRM urges to review such charges. They also suggested keeping the charge as same as the prevalent in the country.
- Port Facility: Port facilities should be provided as soon as possible.
- Establish workers' villages in at least three different areas.
- Rail connectivity for workers and passengers.
- Cargo rail from Chattogram Port with enough space.
- Private jetty permission is expected for plots next to the Feni River or sea over the super dyke and dredging is to be done by BEZA.
- Tree plantation on the coastline to protect against cyclones or tidal surges.
- A garbage collection system is to be established.
- A sewerage treatment network should be set up by BEZA.
- Buses and Truck terminals are to be set up for parking.
- It is also suggested to remove the condition of the BRTA registration requirement for moving vehicles within NSEZ.
- Refueling stations should be established as soon as possible.
- Public toilets should be established. Hospitals, restaurants, clubs, and other facilities should be established as soon as possible.
- Make the access of investors to the BEZA officials easy so that they can communicate as and when required.

Current Issues and Recommendations from Healthcare Life Science Limited

- Ensure gas facilities as per the demand of the industries.
- Establish connecting roads and drainage lines for those industries that have already started their construction.
- Establish waste dumping location under BEZA's supervision.
- Sometimes, the water supply is interrupted. Ensure uninterrupted water supply as soon as possible.
- Residential Hotels, housing, educational institutes, hospitals, etc. should be established as soon as possible.
- Modernize the rail station of Borotakia and introduce stop facilities for intercity coaches.

Current Issues and Recommendations from ACI Limited

- Accommodation facilities/colonies for laborers and staff.

- ETP, water, electricity, and gas facilities should be ensured as soon as possible.
- Since the first few years of operation of large capital factories go into demand generation and the business is run at a risk of loss, the existing tax exemption should be increased to 100% for the first 10 years and gradually reduced tax exemption in the next 5 years instead of the first 3 years.
- Fully concession of Tax, duty, and VAT for 1-10 years on importing raw materials.

Participant

1. McDonald Steel Building Products Ltd.
2. Bangladesh Steel Re-Rolling Mills Limited (BSRM)
3. Healthcare Life Science Limited
4. ACI Limited

1.2.5 Consultation with Investors of NSEZ - Samuda Construction

Basic Details

Location: Samuda Construction, NSEZ

District: Chattogram

Date: 16 January 2024

Purpose of the Visit: To consult with a stakeholder about their perception regarding the development and operation activities, the impact of NSEZ, etc.

Key Point discussed

Product and Current Capacity of Services

- Prestressed High Strength Concrete Pile. Currently, they usually produce 120 to 125 piles per shift and 240 to 250 piles per day in two shifts (8 am to 5 pm and 5 pm to 2 am).
- They have a target to increase the production rate to 400 piles per day. To meet the target, they engaged foreign trainers to provide training to the workers to enhance their capacity and skills.

Availability of Business Association

- They have no information about the existence of any business association in the NSEZ till now.

Initiatives/Steps Taken to Increase Their Capacity

- At present, they are providing training to their workers to enhance their skills and increase their production capacity. They also have a plan to build new factories in their 60-acre area.

Facilities for Workers

- They provide accommodation as well as 3-time food facilities and a snack for both their workers and staff. They do not impose any for these facilities. Samuda Construction provides accommodation facilities called ‘Workers’ Sheds’ where workers live. Currently, there are two sheds – one is a workers’ shed and another one is for other professional staff of the company. The worker shed is 2 to 3 minutes walking distance from the industry. Most of the workers live in this shed. Some of them are local and live in their residence (home). As a benefit of these facilities, the industry authority did not face any challenges regarding the recruitment of the workers. Moreover, no conflict/labor unrest has occurred among the employed laborers.

Transportation Services

- No transportation service is provided to the workers. Only the officers get transportation facilities from the industry. They have plans for providing transportation facilities and constructing a garage in their area.

Safety and Security

- Already they have prepared their own security cell with their own employees. Moreover, they have installed an attendance system for both in and outgoing records, a fire extinguishing system, etc.
- Occupational health and safety are also observed to be maintained. Workers always maintain safety gear (e.g., helmet, vest, gloves, gumboot, etc.). Dedicated supervisors always follow up on their activities.

Benefits and Challenges

- BEZA provided land to Samuda Construction, and the company constructed their building by themselves.
- They will enjoy tax-free opportunities for a period of 10 years.
- They are also provided access to the NSEZ roads to transport and move their vehicles, goods, and materials.
- Security Systems in the NSEZ area such as security check posts at different points of the NSEZ area.
- The construction works sometimes cause environmental pollution like flying dust, some extent of noise, etc. but those do not have any significant impact since modern technology is being followed.
- Electricity and Water Supply facilities from BREB and DPHE on the condition of payment.

Suggestions

- Roads are yet to be developed to carry the load of heavy vehicles.
- The drainage system needs to be more developed.
- The supply of Electricity, Gas, drinking water, etc. needs to be improved.

Participant
Abdul Ahad, Chief Operating Officer, Samuda Construction Md. Belal Hossain Majumdar, Production In charge and Plant Head, Samuda Construction

1.2.6 Consultation with Investors of NSEZ - Basundhara Chemical Industries

Basic Details
Location: Basundhara Chemical Industries, NSEZ
District: Chattogram
Date: 16 January 2024
Purpose of the Visit: To consult with a stakeholder about their perception regarding their operation in NSEZ, the impact of NSEZ, recommendations, etc.

Key Point discussed

Product and Current Capacity of Services

- They have five types of chemical products and Ready-Mix Products. As they are in the construction period, they do not have any current production or services.

Initiatives/Steps Taken to Increase Their Capacity

- At present, they are in the construction period. They have planned to install high-capacity machines as they could produce a greater number of products at a time. Moreover, they would engage skilled manpower from their other industries and train the local workers to

make the local ones skilled. They would also bring foreign trainers to build the capacity of the employees.

Business Association and Membership

- Basundhara Chemical Industries stated that as of now, there is no information regarding any business association within NSEZ.

Facilities of Workers

- At present the industry is in the construction period. The construction labors are supplied by the EPC contractors. The industry has planned to recruit workers from the local area and provide transportation support to them during the operation period. They have prioritized the local labor as the local labor does not need accommodation facilities.
- The Ready-mix industry has started its operation in a very small portion. The industry has provided accommodation facilities to the workers. The worker shed is around 1 km distant from the industry and no transportation facilities are provided to them.

Transportation Services

- At present, no transportation service is provided to the workers. Only the officers get transportation facilities from the industry. They have plans for providing transportation facilities for the workers and constructing a garage in their area.

Plan and Preparation for Own Security Concerns

- They have their own security company from where they deploy trained security personnel.
- They have also engaged security guards from Bangladesh Ansar.
- They have installed CC cameras in different areas of their surroundings.

Observed Benefits

- The industry got the documentation (EIA, TOR, Building Plan) approval easily through the support of BEZA authorities.
- BEZA provided land to Basundhara, and they constructed their building themselves.
- Get prompt support from the local office of BEZA in different cases such as security issues, traffic issues, or any other local challenges.
- They are also provided access to the NSEZ roads to transport and move their vehicles, goods, and materials.
- Electricity and Water Supply facilities from BREB and DPHE on the condition of payment.

Challenges Faced

- The internal traffic controlling system of the Economic Zone is yet to be improved.
- The roads are comparatively narrow with frequent turnings, which makes it difficult for heavy vehicles to move inside the NSEZ.
- The representative of BASHUNDHARA opined that they did not get gas, electricity, and water supply as easily as it was supposed to be provided by the BEZA. The company requires their own efforts to ensure it as per their demand.

Recommendation

- Develop the internal traffic controlling system.
- Widen the roads. Construct more connecting roads with the Dhaka-Chattogram highway.
- Provide natural gas, uninterrupted electricity, and fresh drinking water supply properly and quickly in a more sustainable manner.
- Strengthen the internal security system. Recruit more security guards and install CC cameras in different areas of the economic zone.

Participant
Md. Foyez Rahman, GM, Admin, Basundhara Group
Md Jahangir Alam, Dy. General Manager (HR & Admin), Basundhara group

1.2.7 Consultation with Bangladesh Garment Manufacturers & Exporters Association, Dhaka

Basic Details
Location: Bangladesh Garment Manufacturers and Exporters Association, Dhaka
District: Dhaka
Date: 29 January 2024
Purpose of the Visit: To consult with the stakeholders about their perception regarding the development and operation activities, current status regarding construction and operation of their member investors, future plans & preparation, recommendation of BGMEA, etc.
Key Point discussed
Perception about the EZ • The RESA team conducted a consultation meeting with the Deputy Secretary, BGMEA, Dhaka. He provided his insight on their activities, membership type, etc. Current Status and Plan • Till now, the 40-member factory has signed an agreement with BEZA, and the number will increase to around 60 in total soon. • The total allocated area for 40 BGMEA factories is 237 acres. • BEZA will provide ready land, utilities, roads, and port facilities. • BGMEA is also discussing with other investors about agreement with BEZA. • The last agreement was signed in 2018 and BGMEA expected that their member factory could start construction in 2020. • The area is close to Chattogram Port, and it would be an advantage for investors. Roles of BGMEA • BGMEA played a role as a bridge between BEZA and member investors. • BGMEA is communicating with BEZA so that they speed up the progress and the factory can at least start construction. • BGMEA has a separate environmental sustainability team that deals with environmental and compliance issues. • There are trade unions and labor associations among BGMEA factories. Labor and Employment • Around 3-4 lakh laborers would be employed in BGMEA's member factory at NSEZ. • It could be a temporary problem to find and retain laborers initially but in the long run, the factories would fix it and get the benefit. • They have a plan to make unskilled labor skilled by providing training in the future. Suggestions • BEZA needs to increase its progress so that the factories can start construction. • Workers' rights should be reserved.
Participant
Engr. Md. Moniruzzaman, Joint Secretary, BGMEA, Dhaka.

1.2.8 Consultation with Bangladesh Economic Zone Authority - Assistant Project Director, NSEZ

Basic Details
Location: Head Office, Bangladesh Economic Zone Authority (BEZA), Agargaon
District: Dhaka

Date: 8 January 2024

Purpose of the Visit: To consult with stakeholders about the current status of the implementation of the master plan, BEZA's recent initiative, organizational capacities, the potential impact, and associated risk of NSEZ, etc.

Key Point Discussed

Overview

- BEZA is continuously progressing the implementation according to the master plan.
- BEZA is working to develop all facilities for the investors so that they can start operations as soon as possible.
- Currently, six factories are in operation and some others are in the progress of starting work.

Current Capacity

- BEZA is now fully formed in terms of human resources to run activities in the field.
- There is a dedicated environmental and development unit of BEZA to prepare plans and accomplish work in fields. There are six counselors under the unit, who execute work in the field.
- The ES unit follows a reporting mechanism to generate its activity findings and keep records on a regular basis.
- The counselors all are graduates and well-experienced.
- BEZA has a plan to provide accommodation facilities to its field staff. Currently, all counselors live outside the NSEZ.
- Some motorcycles have also been provided to the field staff to facilitate their movement in the field.
- The human resources are sufficient to meet the demand of the next 5 years. After a period of 5 years, the capacity could be increased based on needs.

Opinion Regarding Environmental and Natural Resources

- Currently, groundwater is being utilized in the NSEZ. DPHE installed Deep Tube Wells (DTW) to meet the demand as a short-term solution.
- BEZA has plans to harness water from the Muhuri Reservoir and desalinate sea water as a long-term solution in the future.
- The development of a green belt will increase greenery in the NSEZ area.
- All industries adopt modern technology to control sound and air pollution. As a result, there is no mentionable change in environmental pollution in the NSEZ area.

Current initiatives of BEZA

- Considering the present and future demand for water for the NSEZ, a feasibility study is being conducted for desalination. If desalination is feasible, it will help to meet the need for water within the entire NSEZ.

Potential Impact/Risks

- Population influx in the area due to the creation of employment.
- Urban Development Directorate (UDD) has prepared a development plan for NSEZ's surrounding area.
- Law and order will be maintained by law enforcement agencies as it is their responsibility. If any impact is made on law and order due to the influx in the EZ and the EZ's surrounding areas and the police department asks for any support from BEZA, they will provide it. In that case, specific guidelines will be required.

Suggestions/Recommendation

- An audit could be undertaken in the future to assess E&S Compliance.

- Other service-providing agencies need to take preparation to meet future demand. BEZA is always cooperative for coordinated development.

Participant

Mahid Al Hasan, Assistant Project Director, NSEZ, BEZA, Dhaka

1.2.9 Consultation with Bangladesh Economic Zone Authority (BEZA) - General Manager, Planning & Development

Basic Details

Location: Head Office, Bangladesh Economic Zone Authority (BEZA), Agargaon

District: Dhaka

Date: 8 January 2024

Purpose of the Visit: To consult with stakeholders about the current status of the implementation of the master plan, BEZA's recent initiative, organizational capacities, the potential impact and associated risk of NSEZ, etc.

Key Point Discussed

Overview

- BEZA is taking all initiatives to ensure facilities so that industries can start production in full phase.
- Currently, 5 factories are in operation and 15 others are in the process of starting work.
- An investor club is being established.

Current Capacity

- There is an E&D unit under the PRIDE Project. There are 6 counselors under the unit.
- Counselors are dedicated to conducting field-level activities such as indicator-wise E&S monitoring.
- The number of field staff and counselors is adequate, and it could be proportionately increased in the future based on the increasing scope.
- There are disbursement-linked indicators (DLIs) under the PRIDE project.
- Currently, there is no accommodation facility for the laborers and field staff of NSEZ.
- There is a plan to provide accommodation facilities for staff, where a certain level of staff will be housed.

Opinions regarding Environment

- Considering the importance of greenery, there is a plan for green belt development in around 212 acres of land.
- In addition to that, there is a provision for gardening in each economic zone. Different industries would also plant trees in their industrial areas.
- Environmental counselors are dedicated to handling environmental issues in the NSEZ.
- All industries adopt modern technology to control sound and air pollution. As a result, there is no mentionable change in environmental pollution in the NSEZ area.

Opinion on Social Issues

- There is a plan to provide houses for those whose houses are impacted by the development.
- The progress of resettlement activity is slow due to the difficulties in finding proper land for this purpose.
- There is a plan to provide livelihood training to around 22,000 persons.
- There is a grievance mechanism under the E&S unit. They have a Grievance Redress committee.

Health Safety

- An emergency response plan will be prepared in the future. There is a plan to develop a digitized emergency response plan.
- Two (2) fire stations are being established and two more fire stations are planned to be established in the NSEZ area to respond to any fire break or other incidents.

Potential Impact/Risks

- A great extent of employment will be created in the area.
- Different factories have already employed local workers.
- A great extent of development will be made in the Mirsharai area.

Suggestions/Recommendation

- E&S unit should be strengthened in the future.

Participant

Doyananda Debnath, General Manager, Planning & Development, BEZA, Dhaka

Shenjuti Barua, Deputy Manager (Monitoring), BEZA, Dhaka

1.2.10 Consultation with Social and Environmental Counselor, NSEZ, BEZA

Basic Details

Location: NSEZ, Mirsharai

District: Chattogram

Date: 30 November 2023

Purpose of the Visit: To consult with NSEZ officials regarding the development and operation activities, scope of involvement of NSEZ, potential impact and associated risk of NSEZ, etc.

Key Point discussed

Overview

- Social counselors work with factory management and workers to ensure OSH, and workers' rights, create a space for dialogue, facilitate communication among stakeholders, and conduct factory visits.
- They use a monitoring checklist during visits which is provided by BEZA.
- They conduct monthly monitoring in the factories.
- Factories are helpful and worker-friendly.
- BEZA has appointed a doctor.
- Currently, around 3,000 workers are working in 5 factories. The majority of the workers live in factory dormitories.
- Number of female workers is very low. 16 females working in the Marico factory.
- No child labor.
- There is a GRM committee in the BEZA office.

General advice provided by the counselors

- The counselor highlights different aspects of labor law and works to increase awareness about labor law and rights among workers.
- They inform and report to BEZA authorities on irregularities. They also work on issues between workers and factory management.

Challenges

- Inadequate public transportation to reach the NSEZ/Factory area from nearby bus and train stations.

- Limited option for residential facilities for factory workers and officials who will be interested in living in the community. This is a very valuable development that they need.
- Lack of standard educational institutions and higher educational institutions
- Absence of support infrastructures like health centers, ambulances, etc.
- Near the NSEZ area, among working-age males, the number of migrants is very high.
- Workers leave their jobs after a few months due to lack of transportation and residence with inflation and price hack.
- Syndication in utility, transportation, goods, and consumables makes everyday life difficult for workers and officials as well as for community people.
- The sustainability of the operation of factories could be an issue with workers leaving jobs regularly due to various reasons.

Potential Impact/Risks

- The socio-economic situation in adjacent communities will improve. Especially in regard to education and skill development, employment opportunities, and business.
- Those who were engaged in agriculture-related activity will be engaged in service providing such as small-scale businesses/shops, autorickshaw driving, laundry, etc.
- Although NSEZ will follow its mechanism to avoid environmental pollution, there is a risk of environmental pollution at the community level such as air pollution, sound pollution, pollution in tourist spots, etc.

Suggestions/Recommendation

- Public transportation should be introduced.
- Establishment of schools and colleges as per future needs.
- Establishment of health centers with associated logistics, facilities, resources, and support services like ambulance, diagnostics, etc. to maintain community health and safety services.
- Local administrations should take steps to protect natural resources such as forests, wild animals, and lands from both local and migrated people in the future.
- Local government and other concerned departments should take steps to avoid environmental pollution such as air, noise, and water pollution due to any unplanned development works in communities.

Participant

Sanjib Barua, Mahfuja Khatun, Social Counselor- NSEZ, Mirsharai, Chattogram

1.2.11 Consultation with Deputy Manager, BEPZA

Basic Details

Location: NSEZ, Mirsharai

District: Chattogram

Date: 30 November 2023

Purpose of the Visit: To consult with a stakeholder about their perception regarding the development and operation activities, scope of involvement of BEPZA, preparation of BEPZA regarding future demand of NSEZ, the potential impact and associated risk of NSEZ, etc.

Key Point Discussed

Overview

- BEPZA is creating infrastructure in the BEPZA-owned export processing zone.
- There is an abundance of labor/ people who are seeking employment.
- BEPZA expects to create jobs for 95,000 people in its designated zone.

- BEPZA has 140 plots, and one factory is already operational.

Current initiatives of BEPZA

- BEPZA established its own power generation unit and 55-acre water reservoir along with a deep tube well to meet the demand.
- BEPZA is attracting foreign and domestic investors and business proprietors to invest in BEPZA/NSEZ.
- Proposed circular road around Export Processing Zone to ease of transportation.
- Establishment of a Five-star hotel for investors.
- BEPZA established its own housing zone for its officials.

Challenges and major issues

- The availability of residential facilities in the vicinity of NSEZ could be a potential issue in the future. Migrant people will be housed in the community in large numbers in the future, local infrastructure should be ready to meet such a challenge.
- Population density and residential building density will increase with rapid urbanization around the EZ area.

Potential Impact/Risks

- Population influx in the area due to the creation of employment.
- Land prices in adjacent areas of NSEZ have increased.

Suggestions/Recommendation

- BEPZA officials recommended engaging and maintaining liaison with foreign embassy officials to promote NSEZ to foreign investors.
- Increasing cooperation among stakeholders and authorities.
- Further, the study explores alternative opportunities for residents in the area to meet future demands.
- BEPZA recommends a service-oriented approach and one-stop services to attract investors.

Participant

Masud Parvez, Deputy Manager, BEPZA, NSEZ, Mirsharai, Chattogram

1.2.12 Consultation with Indian Economic Zone

Basic Details

Location: Head Office, Bangladesh Economic Zone Authority (BEZA), Agargaon

District: Dhaka

Date: 23 January 2024

Purpose of the Visit: To consult with stakeholders about the current status of implementation of the Indian Economic Zone, BEZA's recent initiative, organizational capacities, the potential impact and associated risk of NSEZ, etc.

Key Point Discussed

Overview

- Indian Economic Zone (EZ) has developed its own master plan. The size of the Indian EZ is 885 acres.
- As per the proposal, the following tasks are being conducted for establishing the Indian EZ:
  - Land development (150 lakh cubic meters approx..).
  - Access roads (5 km approx..).
  - Admin building (2,000 square meters approx.).
  - Security sheds (300 square meters approx..).

- Water Supply System (15 km).
- Gas Supply System 2.5 km).
- Power Supply System (5 km), etc.

- All facilities such as water, gas, and electricity will be available aligning with BEZA's service facilities for the investors.
- Not only Indian companies but all eligible investors would also be allowed to invest in the Indian EZ.
- For land development, goods and materials will be provided from both India and Bangladesh (India: 50% and Bangladesh: 50%).

Current Capacity

- Along with the dedicated team in the Bangladesh office, consultants from India are also working as part of the establishment project.
- The contractor has been selected by the Indian government.

Challenges

- Consultants are working from India. Such a geographical distance between the teams is sometimes a challenge for the timely completion of work.

Potential Impact/Risks

- They have no particular plan for handling labor influx and any impact on the population as it is being dealt with by BEZA as their broader areas are under the development of NSEZ.

Recommendation

- BEZA is coordinating among different investors of NSEZ. It should be kept continuous in the future to attract investors.
- BEZA needs to ensure all utility facilities in NSEZ are as per their master plan and commitment so that investors start operation as soon as possible.

Participant
Md. Mokhlesur Rahman, Project Director, Indian Economic Zone

1.2.13 Consultation with Bangladesh Investment Development Authority (BIDA)

Basic Details
Location: E-6/B Agargaon, Sher-e-Bangla Nagar
District: Dhaka
Date: 21 March 2024
Purpose of the Visit: To consult with stakeholders about their perception regarding NSEZ, concern issues, expectations, suggestions, etc.

Key Point discussed

- Bangladesh Investment Development Authority (BIDA) is a separate entity under the Prime Minister's Office. Therefore, there is no direct connection between the Bangladesh Economic Zone Authority (BEZA) as well as the NSEZ. However, in general, they have the following comments, observations, and suggestions based on their experience in other projects in Bangladesh.

Opinion and Recommendation

- Water is one of the major requirements for establishing an industrial city. Future impacts on the water resources in the region must be considered for the NSEZ.

- Easy access to the land should be ensured for both national and international investors. Equity between national and international investors should be maintained. Plot plan or land allotment information can be disclosed to the organization's website.
- The provision of different sizes of land plots should be considered in the planning and small plots should be allowed to the small-scale investors considering their land requirements.
- Preference to green projects should be given to reduce the environmental impacts and sustainable development should be ensured.
- Central Effluent Treatment Plants (CETPs) and Sewage Treatment Plants (STPs) must be established and the operation of CETPs and STPs must be ensured. It should be considered that the cost and technology of CETPs and STPs must be investment-friendly. If the cost of CETPs and STPs is higher, then the investor will not be interested in establishing and using them. Modern and cost-effective treatment systems for individual industries should be ensured. As an example, lessor learning of ETP of Savar tannery industrial estate can be considered.
- Forest, livestock, and fisheries resources in the EZ area should not be damaged. Industrial development should be parallel with not harming the environment.
- Solid waste management systems must be introduced to protect water, biodiversity, fisheries, etc. Waste to energy or other management technology can be introduced, if feasible.
- Liquid wastes that would be generated from the industries in the industrial city should be treated and reused. The 3Rs (reduce, reuse, and recycle) principles of waste management can be followed.
- Organic waste can be used to produce fertilizer.
- International standards/compliance issues of buyer/lending agencies should be followed.
- Tax holidays, VAT and tax exemption, and import duty/customs duty can be introduced to import environment-friendly equipment and machinery.
- Existing environmental policies and procedures of the Department of Environment (DOE), Bangladesh can be revised for the industries/development activities that are going to be established in the economic zones, high-tech parks, Bangladesh Small and Cottage Industries Corporation (BSCIC), etc. It should be easier and more friendly for the investors.
- Types of industries should be defined.
- E-waste will be generated from the industries therefore e-waste management systems should be considered in the planning for NSEZ.

Participant
Mohsina Yasmin, Executive Member, International Investment Promotion and Local Investment Promotion, BIDA
Shah Mohammad Mahboob, Director General (Joint Secretary), International Investment Promotion, BIDA
M. Jashim Uddin Khan, Director (Deputy Secretary), Registration & Incentives-Foreign Industry, BIDA Md. Atik Sarker, Assistant Director, Foreign Work Permit, BIDA

1.2.14 Consultation with Sonagazi Bazar Bonik Samiti

Basic Details
Location: Sonagazi
District: Feni
Date: 18 January 2024

Purpose of the Visit: To consult with stakeholders about their perception regarding the development and operation activities, impact of NSEZ on business and local businessman communities of EZ areas, etc.

Key Point discussed

Perception about the EZ

- The President of Sonagazi Bazar Bonik Somiti was informed about the NSEZ, and he knew about the development activities under the NSEZ.

Scope of work of the Business Association

The main responsibilities of the Business association are -

- To protect the interest of the businessmen.
- To look after and support the overall pros and cons of traders.
- To maintain the overall discipline and security of the market.

Usually, the Paurashava authority takes care of the other issues.

Opportunities and Adverse Impacts

- Due to the NSEZ, all sorts of business will increase. As a result, the number of shops and markets will increase drastically, and many people will get employment.
- Imports and exports will be easier due to the EZ.
- The industries of the NSEZ will collect their raw materials from the local area. As a result, local people will benefit.
- The EZ will contribute to increasing the income security for the local workers.
- As per the President of Sonagazi Bazar Bonik Somiti, the local business community will not face any kind of adverse impact due to the NSEZ. Rather the EZ will bring a lot of opportunities to the locality.

Shifting of Business opportunities, Training for skill development, Lack of Business workers

- Some of the business owners might have the potential to shift themselves adjacent to the NSEZ area to ensure the enhancement of their existing business opportunities. Nevertheless, most business owners will install another branch of their business instead of shifting the business.
- The local businesspeople and business workers need skill development training for their improvement. To date, the business association has not been able to arrange/ provide these sorts of training facilities. They expect training facilities from the government as well as the NSEZ authority.
- During the operation period of the EZ, a lot of job opportunities will be created in the different industries. Some of the local business workers may change their profession and get employed in the industries for better facilities. But this will not be a matter of worry about. The business owners will recruit new business workers from the local areas.

Expectations and Recommendations

- Training facilities need to be provided for the local youths and business owners.
- Provide special facilities for the development of the local market.
- Prioritize the local people in the case of recruitment.
- Collect the raw materials from the local area.
- NSEZ authorities need to give special priority to vulnerable groups in the case of training and recruitment.

Participant

Md. Nur Nabi, President, Sonagazi Bazar Bonik Somiti.

1.2.15 Consultation with Sitakunda Paurasava Baboshayi Dokan Malik Somiti

Basic Details
Location: Sitakunda
District: Chattogram
Date: 18 January 2024
Purpose of the Visit: To consult with stakeholders about their perception regarding the development and operation activities, impact of NSEZ on Business and local businessman communities of EZ areas, etc.

Key Point discussed

Perception about the EZ

- The President of Sitakunda Paurasava Baboshayi Dokan Malik Somiti was briefed on the NSEZ, and he was aware of the progress and initiatives taking place as part of the NSEZ's development activities.

Scope of work of the Business Association

The Sitakunda Paurasava Baboshayi Dokan Malik Somiti is registered by the Bangladesh Dokan Malik Somiti (BDMS). The main responsibilities of the business association are -

- Safeguarding the concerns of business professionals.
- Overseeing and endorsing the general advantages and disadvantages faced by traders.
- Upholding the overall order and safety within the market.

The Municipality Mayor is the Chief Advisor of this business association. Usually, the municipal authority addresses other issues.

Opportunities and Impacts

- Due to the implementation of the NSEZ, a significant number of people will reside here. Already, some of the contractors are staying in this area. As a result, the house rent business will increase.
- The implementation of the NSEZ is expected to lead to significant growth in various businesses. Consequently, there will be a substantial increase in the number of shops and markets, creating numerous job opportunities for many individuals.
- According to the President of Sitakunda Paurasava Baboshayi Dokan Malik Somiti, the NSEZ will not adversely affect the local business community. Instead, it is expected to bring numerous opportunities to the area.
- The industries within the NSEZ have the option to receive various forms of support from the local area. Currently, the operational business entity from NSEZ sources its canteen and other logistics from the local market.
- Shifting of Business opportunities, Lack of Business workers, Conflict between locals and outsiders
- Due to the anticipated increase in population, some business owners might consider relocating to the NSEZ area. However, the majority of them are more inclined to establish additional branches of their businesses instead of completely relocating.
- The execution of the EZ will generate numerous job opportunities across various industries. Some local business workers may opt to switch professions and join these industries for better amenities. However, this is not a cause for concern, as business owners are expected to hire new workers from the local areas. There is a substantial pool of individuals eagerly awaiting such employment opportunities.
- There is no possibility of occurring conflict between the local businesspeople and the outsiders. But if any issue occurs, the local representatives will take care of the issues.

Expectations and Recommendations

- There is a necessity for the improvement of the access road to the market. Currently, local businesspeople utilize the Kumira – Boro Darogar Hat Road for transporting their goods. However, due to the poor condition of this road, they are compelled to use the Dhaka-Chattogram highway. Enhancing the access road could alleviate the overall pressure on the Dhaka-Chattogram highway.
- The streets need to be cleared by the eviction of mobile shops and pavement shops.
- The drainage system of the market area needs to be developed.
- Ensure the provision of training facilities for local youths and business owners.
- Implement special measures to facilitate the development of the local market.
- Prioritize the recruitment of local residents.

Participant

AKM Rejaul Karim Bahar, President, Sitakunda Paurasava Baboshayi Dokan Malik Somiti.

Belal Hossain, Secretary, Sitakunda Paurasava Baboshayi Dokan Malik Somiti.

1.2.16 Consultation with Head Teacher, Nurul Absar Choudhury High School, Mirsharai

Basic Details

Location: Nurul Absar Choudhury High School, Maghadia, Mirsharai Upazila

District: Chattogram

Date: 8 November 2023

Purpose of the Visit: To consult with stakeholders about their perception regarding the development and operation activities, current situation regarding educational institute capacity, scope of future involvement, preparation recommendation of school regarding future demand of NSEZ, the impact of NSEZ on students and in the school, etc.

Key Point discussed

Perception about the EZ

- The Head Teacher of Nurul Absar Choudhury High School, Mirsharai, Chattogram informed about the NSEZ. NSEZ officials previously visited the school and conducted a consultation with the head teacher.

Impact of the NSEZ on the school and others

- During road extension, the government acquired land from schools. It also took the land of the local people. Those who have not yet received compensation are facing economic miseries.
- On the other hand, local people are now enjoying the high price of land.
- Traffic on the road increased manyfold after the commencing of the development and operation activities. If an influx takes place, these roads and connectivity will require further development.
- According to information provided during consultation, due to traffic, road crossing was deemed dangerous for the students.
- The EZ will highly contribute to creating new business activities and employment.

Current Capacities of the School

- The school has 1.6 acres of land and has enough space for additional building construction for future demand.
- There are around 1,200 students who are currently enrolled in the school.
- The allocated number of posts for teachers is 16 of which 4 posts are vacant. According to the head teacher, the number of teachers is insufficient to meet the current demand and the

school employed an additional 10 teachers from the school fund to meet the current demand.
- The school has a vocational trade curriculum, both male and female students are currently enrolled in the vocational course and will appear in the Secondary School certification exam on trade courses like general mechanics and refrigeration & air conditioning.
- There is a computer lab in the school with 11 laptops.

Preparation and requirement to Meet the Future Demand

- The school can start additional skill development courses and vocational trade courses to meet the future demand.
- The school will need additional resources like teachers, new classrooms, logistics, and support staff if the number of students rises significantly.

Suggestions/Recommendation

- Construction of a foot-over bridge on NSEZ Saroni to ensure the safety of students.
- The government should allocate more posts of teachers for the school.
- Save wild animals and natural resources, particularly the forest areas. This asset is not much in our country.
- Air and noise pollution should be controlled as a priority during construction.
- Traffic safety should be considered for the adjacent roads.
- Drainage systems should be developed for the community since there will be an influx and great housing and infrastructural development will take place.
- Emphasize keeping the existing khals functional.

Participant

Md. Didarul Alam, Head Teacher, Nurul Absar Choudhury High School, Maghadia, Mirsharai, Chattogram

1.2.17 Consultation with Head Teacher, Magadia Anzumer Govt Primary School, Mirsharai

Basic Details

Location: Magadia Anzumer Govt primary school, Maghadia, Mirsharai Upazila

District: Chattogram

Date: 8 November 2023

Purpose of the Visit: To consult with stakeholders about their perception regarding the development and operation activities, current situation regarding educational institute capacity, scope of future involvement, preparation recommendation of school regarding future demand of NSEZ, the impact of NSEZ on students and in the school, etc.

Key Point discussed

Perception about the EZ

- The headmaster is aware of the NSEZ.

Impact

- Increased risk of road accidents.
- Sound Pollution from the movement of vehicles.
- The wash block needs to be relocated due to the expansion of the road.
- The EZ will contribute to creating livelihood although it also impacted on livelihood of buffalo grazers, buffalo owners, and fishing communities.
- Buffalo grazing land has been reduced due to the implementation of the NSEZ.

Suggestions/Recommendation

- Need to reduce risk of accident. Accidents may increase among the community such as fire breaks, road accidents, crime, etc.
- Need to reduce pollution. An influx of people has a great risk of environmental pollution.

Participant

Nazrul Islam, Headteacher, Magadia Anzumer Govt primary school, Magadia, Mirsharai Upazila, Chattogram

1.2.18 Consultation with Head Teacher, Captain Shamsul Huda High School, Sitakunda

Basic Details

Location: Captain Shamsul Huda High School, Muradpur, Sitakunda Upazila

District: Chattogram

Date: 9 November 2023

Purpose of the Visit: To consult with stakeholders about their perception regarding the development and operation activities, current situation regarding educational institute capacity, scope of future involvement, preparation recommendation of school regarding future demand of NSEZ, the impact of NSEZ on students and in the school, etc.

Key Point discussed

Perception about the EZ

- The Head Teacher of Captain Shamsul Huda High School, Muradpur, Sitakunda Upazila, Chattogram is informed about the NSEZ. NSEZ officials previously visited the school and conducted a consultation with the head teacher.

Impact of the NSEZ on the School

- Presently, NSEZ has no impact on the school.

The current capacity of the institution

- The school has a land of 2.62 acres.
- 1300 students are currently enrolled in the school.
- Number of teachers: 19
- 13 posts are government-approved posts, and 6 teaching posts are supported by the school's own fund.

Perceived impact

- The number of students may increase significantly with the labor influx.
- There is a plan to establish a well-equipped training complex in the Upazila to provide training with residential facilities.
- Some schools have cyclone shelters, which are used as a community structure. These structures should be increased considering the impact of future population influx.

Suggestions/Recommendation

- Schools will need additional buildings and teachers to accommodate additional students in the future.
- Schools can take initiatives to open vocational trades to provide skill development training.
- BEZA/NSEZ can take interns from vocational trades in the future and create a pool of skilled workers required in the factory.
- Tourist places like beaches, lakes, hills, and forests should be protected from all forms of pollution including water, air, and noise.

Participant

Biltu Kumar Singha, Head Teacher, Sitakunda Upazila, Chattogram

1.2.19 Consultation with the Department of Youth Development, Mirsharai

Basic Details

Location: Upazila Youth Development Office, Mirsharai

District: Chattogram

Date: 28 August 2023

Purpose of the Visit: To consult with a stakeholder about their perception regarding the development and operation activities, scope of involvement of DYD, the scope of skill development under DYD existing projects, preparation of DYD regarding future demand of NSEZ, the impact of NSEZ on the youth of EZ areas, etc.

Key Point discussed

Perception about the EZ

- Department of Youth Development, Mirsharai, Chattogram is informed about the NSEZ although they did not participate in any activities of the NSEZ.

Current Activities of DYD

- Currently, DYD is providing training on different trades at various unions of the Upazila. Freelancing, cattle rearing, poultry rearing, animal husbandry, crafting, sewing, and entrepreneurship are the mentionable ones among the current training trades.
- The training programs are usually one to six months long.
- DYD also provides support to the Youth Groups/voluntary organizations to arrange the training activities and provide training in collaboration with DYD. The *Shanto Neer* is one of the successful youth groups of the Upazila.
- DYD provides training to 420 youth in the Upazila each year.
- Besides, training programs and entrepreneurship loan programs are also running as current activities.
- Only people aged 18-35 years can access the training of DYD.

Curriculum Preparation and Updating

- Usually, the training plans and curriculum are prepared by the head office in Dhaka.
- The Upazila Office can send training requirements to the district authority based on local demands.

Current Capacities of DYD

- Currently, there is no Training/Govt Facility/center in the Upazila.
- The Upazila youth development office incorporates youth groups for their programs.
- Trainers/instructors are involved from different government departments like the Department of Fisheries, Department of Agricultural Extension, etc.
- Everyone has access to the courses through online applications.
- The majority of training is conducted in the district-level Youth Training Center (YTC).

Preparation to Meet the Future Demand

- It is anticipated that there will be a great demand for skilled labor/resources due to the NSEZ in the area. Since it will be a great scope of employment for local people, it is time to take steps to get prepared.
- There is a plan to establish a well-equipped training complex in the Upazila to provide training with residential facilities.

Suggestions/Recommendation

- If there is any scope for training and skill development in NSEZ, DYD could provide the support.

Participant

Md. Tozammel Hossain, Upazila Youth Development Officer, Mirsharai Upazila, Chattogram

1.2.20 Consultation with Export Competitiveness for Jobs (EC4J)

Basic Details

Location: EC4J Office, 116 Kazi Nazrul Islam Ave, Dhaka 1205

District: Dhaka

Date: 19 February 2024

Purpose of the Visit: To consult with a stakeholder about the plan and scope of EC4J in NSEZ, the environmental and social impact of NSEZ in the region, current capacity and resources, the demand for their services, opportunities, challenges, suggestions, etc.

Key Point discussed

About EC4J

- The Export Competitiveness for Jobs (EC4J) Project is financed by the World Bank Group and implemented by the Ministry of Commerce.
- EC4J is establishing a General Engineering Technology Center (GETC) in NSEZ with the aim of providing services like advanced training for industry workers, certification, and some specific testing services so that the industries can meet international standards.
- The project is currently focusing on four sectors such as leather, footwear, plastic, and light engineering.
- The EC4J is different from other technical training institutes or departments like the Department of Youth Development (DYD) for its nature of work. For example, EC4J is focusing on advanced training courses adopting international standards while other technical/skill training providers are working on the general or ordinary trades.

Current Activities

- The GETC of EC4J in NSEZ is the progress of establishment.
- For the establishment of GETC, the EC4J Project has received an allotment of 10 acres of land within the NSEZ.
- Design and drawing work for the GETC establishment has been completed, taking into account both environmental and social considerations.
- The project authority is not involved in any compensation disbursement activities. This issue lies with the responsibilities of BEZA.
- A boundary wall has been constructed marking the EC4J's areas within the NSEZ.
- The GETC will start its operation within NSEZ in 2026.

Future Plans

- Services such as quality testing, training, and certification will be provided to meet industry demands and the scope will be changing following the demands of the time.
- Training programs will cover various aspects, including critical component jobbing, business advisory, advanced skill training, development project design, project development, and market information related to the industry supply chain.
- The EC4J authority has a plan to explore the scope of future collaboration with nearby training providers and DYD in the common areas.

- Collaboration with other training institutions is being pursued for better synergy and mutual benefit.
- A "Sandwich program" is being considered, involving collaboration with other institutions.
- Plans include dormitories for short-term and long-term training participants, as well as a separate dormitory for company employees.

The capacity of EC4J within NSEZ

- The project authority will increase its capacity based on the service demand in the future.
- They will involve experienced and capable managerial staff, instructors, and other support staff.
- They have a plan to deploy foreign instructors to provide advanced training.
- The project aims to start providing services in the year 2026, with a dual focus on technology and management.
- Efforts are being made to recruit and hold meetings with potential partners from China and Korea.

Local Community and Needs

- The local community is taking the project positively about the project due to the anticipated job opportunities and improved communication infrastructure.
- Occupational shifting may take place in the project's surrounding areas.
- Recognizing the importance of vehicular support in the area, the project plans to address this need.

Anticipated Challenges

- Foreseen challenges include running and operating the company effectively, providing services efficiently, and ensuring adequate facilities for hygienic food, accommodation, and communication in the area.

Suggestions

- The DPD suggests assessing the social reaction to the project.
- The stakeholders also suggest introducing services like transportation, restaurants for hygienic foods, and accommodation facilities in the NSEZ surrounding areas.

Participant

Sheikh Mohammad Abdur Rahman, Deputy Project Director, EC4J Project, Ministry of Commerce.

1.2.21 Consultation with the National Housing Authority (NHA)

Basic Details

Location: Dhaka

District: Dhaka

Date: 04 April 2024

Purpose of the Visit: To consult with stakeholders regarding the development and operation activities, future plans, impact of NSEZ, etc.

Key Point discussed

NHA's Activities and Plans for NSEZ

- NHA has realized the future demand for housing and accommodation facilities for the future population influx in the NSEZ surrounding areas. They have already taken initiatives to assess the scope of developing housing near NSEZ.
- As a part of NHA's initial assessment, a team of experts and officials conducted a field visit at NSEZ and the Muhuri Reservior-adjacent areas to explore potential land for housing.

- NHA targets populations of different layers - workers and employees, Low-income people, and other socioeconomic categories.
- NHA also coordinated with BEZA and issued a letter stating their initiatives and scopes of coordination between them.
- NHA is undertaking Land Survey and Proposal Preparation for this “Abashon” project.
- Masterplan and feasibility will be conducted later.
- They will develop a plot/flat and provide it to the people.

Potential Lands/Locations

- NHA has initially identified around 200 – 300 acres of open lands which are adjacent to the NSEZ’s boundary (at the opposite side of the BEPZA main gate).
- They have also identified another portion of land near the Muhuri Reservoir. Although there are reclaimed lands beside the Muhuri project, it will take time to develop.
- UDD suggested some areas which require further assessment to check their feasibility.

BEZA’s Plan

- According to the master plan of BEZA, it already has a provision of Housing facilities for the Managerial Level Employees.

Suggestion

- Plotting needs to be finalized based on the availability of the local facilities.
- Private lands need to be acquired.
- More collaboration between NHA and BEZA will be needed to make the task easy.

Participant

Khondoker Mostafizur Rahman, Chairman, National Housing Authority

Md. Harisur Rahman, Executive Engineer (Planning), National Housing Authority

1.2.22 Consultation with the Urban Development Directorate (UDD)

Basic Details

Location: Dhaka

District: Dhaka

Date: 6 February 2024

Purpose of the Visit: To consult with a stakeholder about their perception regarding the development and operation activities, Mirsharai Upazila Development Plan (MUDP), the impact of NSEZ on the area, scope and need of future development in the area, suggestions, recommendations, etc.

Key Point Discussed

Perception about NSEZ

- The Deputy Director of the Urban Development Directorate (UDD) was the Project Director of the Mirsharai Masterplan project. He opined that NSEZ is a specialized Economic Zone, which is the first and largest economic zone of Bangladesh. He also stated that heavy industries will be established in Sitakunda, and light industries and residential facilities will be constructed near the Sonagazi site.
- Mirsharai will be the main concentration area of the NSEZ. He also discussed the future population and labor influx and its pressure on local infrastructures and road networks, utility services, social cohesion, cultural patterns, etc.

About the MUDP

- Mirsharai Upazila Development Plan (MUDP) was implemented aiming at reducing unemployment and poverty problems and socio-economic development by creating

employment opportunities through protecting agricultural land and building industrial and tourism-based cities.

- The unique geographical and social features were considered while the project was undertaken for example it considered potential tourist areas, potential human resources, social structure, cultural richness, occupational diversity, natural disasters (e.g., cyclones, flash floods, earthquakes, etc.), physical and social infrastructure and other factors.
- The project also emphasized the land use pattern in the region.
- Since the MUDP also aligned with the NSEZ's master plan, they followed different methods to understand and assume what could be the future scenario in the area.
- NSEZ is going to be the first one in its nature in Bangladesh, therefore, MUDP experts struggled to get any similar reference in Bangladesh to study. However, to overcome this challenge, they study other industrial areas of Bangladesh like Savar Upazila of Dhaka District.
- Although Savar and other industrial areas of Bangladesh were not developed following any comprehensive plan like that of NSEZ, those helped give an idea about how impacts on locality including society and human lifestyle take place as a result of any industrial development.
- NSEZ follows a well-prepared master plan from the very first stage of its construction.

Local Culture Considered during MUDP

- By 2030, around 10 to 15 lacs people along with their families will reside in the region.
- It will create great pressure on the land, culture, and utility services of the area.
- There are different cultural groups named *"Darailla and Sorailla".* The Darailla are from the Chattogram area, and they usually have yards within the boundary of their house. Whereas the Sorailla are from the Baraiyar Hat area, and they do not have a yard facility in their house. These are the cultural groups of the area. The original people of Mirsharai used to build houses made of wood.
- As Chattogram is the busiest and oldest port area of Bangladesh, many merchants from different countries have come here for many years. As a result, the Chattogram area is mixed up with different cultures. However, the culture of Chattogram is supposed to be impacted due to the huge population flow. This should be in consideration of any development in the area.
- Nowadays, cultural meetings take place in the Upazila between the local people and the outsiders. A cordial relationship needs to be formed between them.
- As more than one million people are going to be housed around the NSEZ, the local people are likely to feel minority in numbers in the future.
- However, UDD developed a structure plan for Mirsharai upazila.

Impact on Agriculture and Infrastructure

- The agricultural pattern is changing regularly. The amount of agricultural land and agricultural practice is decreasing day by day.
- BEZA has planned for the infrastructural development of the area and already started to work according to the plan.
- UDD has planned to reside the laborers at Domkhali and Karerhat.
- Jorarkhali to Jorarganj road has been planned to develop as per the BEZA master plan. A service road needs to be constructed from Sitakunda to Noakhali to decrease the pressure of heavy vehicles on the Dhaka - Chattogram Highway.

Disaster (Cyclone, Flash Flood)

- Flash flood is a big challenge for the area.
- The flood water passes the community area by surface drainage and existing khals. Therefore, the khals should be active.
- Sometimes, the flood water inundates some areas for 3 – 4 days.

- UDD developed a drainage map of the area.
- UDD also prepared an eco-sensitive map.
- The area is also prone to severe cyclone events. UDD also considered it during their master plan preparation.

Plan Water Supply

- UDD did not work and planned anything about the water supply system.
- The stakeholder has suggested installing a rubber dump at the existing falls (Chhara) and harnessing water from there.
- Now, groundwater is the most reliable source of water for local people.

Waste Management Plan

- UDD developed a waste management plan during their studies. They suggested a waste treatment plant in the Domkhali area. They prepared the plan for local areas only. BEZA may use it if they want.

Utilities

- The government will look after the utility facilities of the area, ensuring coordination among the concerned departments.
- The consulted stakeholder suggested conserving the heritage sites such as Abu Torab Bazar and a few other markets which are very old and have a history behind them. Abu Torab Bazar, for example, was established during the British period and holds the colonial history of the area.

Road Network

- UDD also considered the importance of the road network in the area. The consulted representative mentioned that currently around three lakh people are living in Mirsharai, and the road network already seems insufficient. It must increase in numbers and size to meet future demand.
- He also suggested that the capacity of Dhaka-Chattogram Highway also needs to be increased.
- He further suggested that one road should be constructed from Sitakunda to Sonaimuri (Noakhali) via Domkhali to facilitate the movement in this direction. This road will work as a buffer.

Recommendations

- Protect local culture and people.
- Take initiative to protect local agricultural practices.
- Focus on the opinion of the youth group. They were involved in monitoring and evaluation of the master plan preparation by UDD. They need to be employed as much as possible.
- Alternative livelihood should be proposed for local traditional communities like artisanal fishermen, grazers, etc.
- Housing facilities should consider other facilities such as proper drainage, sanitation, etc.
- Community and the NSEZ surrounding areas should be protected from pollution.
- No waste should drain out to the khal or sea. It will harm the fishery resources.
- Protect the natural habitat from all types of interventions.

Participant
Ahmed Akhtaruzzaman, Deputy Director (Research and Coordination), Additional Charge, Urban Development Directorate. He served as the project director of MUDP.

1.2.23 Consultation with Environment and Development Unit, BEZA

Basic Details

Location: BEZA Office, Agargaon, Dhaka
District: Dhaka
Date: 2 April 2024
Purpose of the Visit: To consult with the stakeholders about their activities, status, plans & preparation, recommendation of ES unit, the impact of NSEZ in the area, etc.
Key Point discussed

Perception about the EZ

- The consulted representative of the ES unit shared the structure of the unit, scopes, and activities of the ES unit.

Current Activities and Resource Allocations

- The ES unit deals with environmental social issues such as compliance, adoption of environmental laws and policies, social protection, stakeholder and community level engagement, Grievance Management, and other environmental and social safeguarding issues, etc.
- The ES unit is formed as a team of the Director, Deputy Director, Assistant Director, and Social and Environmental Counselors. There is a scope for increasing human resources based on the demand in the future.
- ES unit has a plan to increase the number of counselors once the investor's number increases in the field.
- The ES unit also works as an environmental development branch.
- An online-based OHS software is being developed where all indicators of social and environmental issues will be updated by month.
- Investors' information is also being adjusted to the OHS software to track the indicator-wise progress.
- The ES unit keeps up-to-date records of all activities of the counselors who are working in the field. They also keep their activities planned in their system.
- ES unit generates a half-yearly progress report.

Recommendation

- A mechanism should be made to report counselors' recommendations to decision-makers.
- Lecture-based classes, case studies, and role-play-type capacity training could be provided to the counselors.

Participant
Shohel Mahmud, Deputy Secretary, Manager, Environment and Development Unit.

1.2.24 Consultation with Roads & Highway Department (RHD), Feni

Basic Details
Location: Roads & Highway Division, Feni
District: Feni
Date: 28 November 2023
Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, current situation regarding road connectivity, future plans & preparation, recommendation of RHD regarding future demand of NSEZ, the impact of NSEZ in the area, etc.
Key Point discussed
Perception about the EZ

- The RESA team conducted a consultation meeting with the subdivision engineer of the Roads and Highway division of the Feni office. The SDE some insight on the current situation of the upazila regarding the road network, and the future expansion plans. He suggested to consult with the Executive Engineer for further information.

Current situation

- RHD developed a DPP for the future expansion of roads and highways in Feni.
- New roads will be constructed, and existing roads will be expanded to meet the current and future demand.
- Road from Lalpool to Sonagazi and Sonagazi to Muhuri project is under the RHD Feni office and is a key pathway to connect the NSEZ in the Feni district.

Participant

Md Abdul Baten Sarkar, Sub-divisional Engineer, RHD, Feni

1.2.25 Consultation with Roads and Highways Department (RHD), Chattogram

Basic Details

Location: Roads & Highway Department, Chattogram

District: Chattogram

Date: 16 January 2024

Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, current status regarding road connectivity, future plans & preparation, recommendation of RHD regarding future demand of NSEZ, the impact of NSEZ in the area, etc.

Key Point discussed

Perception about the EZ

- The RESA team conducted a consultation meeting with the Subdivisional Engineer (SDE), Roads and Highway Department, Sitakunda, Chattogram. The SDE provided his insight on the status of their work regarding the road network, and the future expansion plans.

Current Status and Plan

- SDE has highlighted the existing 10 km road from the highway to CP more under the management of RHD.
- The plan is to expand this road to six lanes, and the Detailed Project Proposal (DPP) has already been submitted to the ministry for consideration.
- Additionally, he mentions the proposal for a new road connecting the Feni Muhuri River to the NSEZ area.

Suggestions

- The RHD representative suggested the implementation of a U-loop elevation in the main highway to enhance the traffic system. These recommendations aim to optimize the infrastructure and transportation network for the successful development of the NSEZ area.

Participant

Engr. Rokanuddin Khaled Chowdhury, Sub-Divisional Engineer, Chattogram

1.2.26 Consultation with Local Government Engineering Department (LGED), Mirsharai

Basic Details

Location: LGED, Mirsharai

District: Chattogram

Date: 03 October 2023

Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, scope of services of LGED, preparation of LGED regarding future demand of NSEZ, the impact of NSEZ on electricity supply in the areas, etc.

Key Point Discussed

Perception about the EZ

- A consultation with Upazila Engineer, LGED, Mirsharai was conducted which reveals a positive perception of LGED about the NSEZ. The Upazila office is prepared to coordinate with other departments and with the proposed development aiming at the development related to NSEZ.

Current and Future Plan

- Till the day of consultation, there was no mentionable preparation of the Upazila LGED office to meet the future demand. No mapping has been conducted targeting NSEZ.

Housing and Accommodation

- Housing and accommodation facilities should be developed in Borotakia and Mirsharai areas.
- Ichakhali, Borotakia, Abutorab Bazar, Julpur Bazar, Aburhat Bazar, and Mithachara should be developed as a growth center. LGED can work in these cases.

Recommendation

- There is a scope for developing community-level roads such as roads from Mithanala Up to Upazila Sadar.
- Carrying capacity of the roads to be increased.
- All the 18-feet wide roads should be expanded.
- Upazila LGED needs skilled manpower such as quality surveyors, GIS operators, Digital surveyors, etc.

Participant

Roni Shaha, Upazila Engineer, LGED, Mirsharai, Chattogram

1.2.27 Consultation with Local Government Engineering Department (LGED), Sonagazi

Basic Details

Location: LGED, Sonagazi

District: Feni

Date: 03 October 2023

Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, scope of services of LGED, preparation of LGED regarding future demand of NSEZ, the impact of NSEZ on electricity supply in the areas, etc.

Key Point Discussed

Perception about the EZ

- A consultation with the Upazila Sub-Assistant Engineer (in the absence of the Upazila Engineer), LGED, Sonagazi was conducted which reveals a positive perception of LGED about the NSEZ. The Upazila office is prepared to coordinate with other departments and with the proposed development aiming at the development related to NSEZ.

Current and Future Plan

- There is a plan for the development of the existing Shahpur to *Jelepara* roads (both earthen and pucca parts). The development will be carried out under the Chattogram division strengthening project.
- Another plan is to develop road connectivity from Madina mosque to Sonagazi.
- The other plan is to develop a road from Shahpur to Mahipal via Beribandh and Koska.

Recommendations

- A comprehensive assessment should be conducted for LGED to identify the need for road development.
- LGED should be given more projects to increase the capacity of local roads.

Participant

Md. Nazmul Huda, Sub-Assistant Engineer, LGED, Sonagazi, Feni

Sukdev Narayan, Sub-Assistant Engineer, LGED, Sonagazi, Feni

1.2.28 Consultation with Chattogram Water Supply and Sewerage Authority (CWASA)

Basic Details

Location: Chattogram Water Supply and Sewerage Authority (CWASA)

District: Chattogram

Date: 18 January 2024

Purpose of the Visit: To consult with a stakeholder about their perception regarding the development and operation activities, activities, and involvement of CWASA, the progress of CWASA's activities, etc.

Key Point discussed

Perception about the EZ

- Engineer Mr. Nurul Amin is currently serving as the Project Director (PD) for the Water Supply Project from the Meghna River to the NSEZ site. He expressed a positive perception of BSMSN and assumed that it would be a great intervention for the development of the region.

Overview and CWASA's Plan

- CWASA is implementing a project aligning with the Master Plan of the BEZA, projecting a total water demand of 98.8 crore liters per day by the year 2040.
- Following BEZA's investor-driven demand calculation, a letter was issued to Chattogram Water Supply and Sewerage Authority (CWASA), indicating a requirement of 700.16 million liters per day (MLD) of water supply up to 2040.
- CWASA has developed a strategic plan for phase-wise water supply.
- In the first phase (2024-2027), the project aims to supply 250 MLD from the Meghna River, with an additional 250 MLD planned for the second phase (2027-2030).
- BEZA has also proposed the collection of 100 MLD from the Feni Reservoir and 40 MLD from the Chotto Feni River to meet the growing water demand.
- The ongoing land acquisition plan for the Meghna River water supply project underscores the commitment to timely project execution.
- However, the pricing for water, a critical aspect, is still in the evaluation stage.
- The stakeholder highlighted that the price rate may differ from the usual standards due to the unique nature of this project.
- Although the establishment of a dedicated water station in the NSEZ area is under consideration, it remains unconfirmed.

- All project-related activities are currently coordinated from the CWASA headquarters.

Participant

Engr. Nurul Amin, Superintending Engineer (Mod Circle), CWASA, Chattogram

1.2.29 Consultation with Bangladesh Telecommunications Company Limited, Dhaka

Basic Details

Location: Bangladesh Telecommunications Company Limited Office, Nilkhet, Dhaka

District: Dhaka

Date: 13 March 2024

Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, current preparation, and works undertaken by BTCL, recommendations regarding future demand of NSEZ, the impact of NSEZ, etc.

Key Point Discussed

Perception about the EZ

- BTCL is well-informed about the future demand for their services in the NSEZ. They are taking all preparations to ensure their services.

Current Situation/Activities

- Currently, BTCL is implementing a project titled “Installation of Telecommunication Network at Mirsharai Economic Zone in Chattogram” with the aims:
    a. Installation of fiber optic link to provide uninterrupted connections.
    b. Establishment of telecom exchange with modern facilities.
    c. Installation of advanced routers and switches to provide high-speed internet services.
    d. Establishment of telecom equipment, construction of office building and telecom compound
- This installation project is expected to be completed by the end of 2024.
- Currently, BTCL is preparing to provide service only in NSEZ, and in the future, they will also target the local communities.
- The current setup could be able to meet the demands of the next 10 years. After that, the setup will be updated according to the demand.
- BTCL will collect the tariff on its own and has no involvement with BEZA regarding tariff collection.

Recommendation

- The strength of BTCL should be increased in the future considering the increasing demand.
- BTCL staff should play their roles properly to meet the demand.

Md. Humayun Kabir Bhuiyan, Project Director, Installation of Telecommunication Network at Mirsharai Economic Zone in Chattogram

1.2.30 Consultation with Bangladesh Telecommunications Company Limited, Chattogram

Basic Details

Location: Bangladesh Telecommunications Company Limited Office

District: Chattogram

Date: 3 December 2023

Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, current preparation, and works undertaken by BTCL, recommendations regarding future demand of NSEZ, the impact of NSEZ, etc.

Key Point Discussed
Perception about the EZ • BTCL is well-informed about the details and has informed them of their readiness to meet the demand for their services in and around NSEZ areas. Current Situation/Activities • BTCL holds a clear understanding of the development under NSEZ. He mentioned the presence of a dedicated station near the EZ area, equipped with a 10,000-line exchange. If necessary, the BTCL is prepared to upgrade the exchange to meet the project's communication needs.
Participant
Md Amjad Hossen, Junior Assistant manager (Technical), BTCL, Chattogram

1.2.31 Consultation with Bangladesh Industrial Technical Assistance Center (BITAC)

Basic Details
Location: BITAC Office, Chattogram
District: Chattogram
Date: 9 January 2024
Purpose of the Visit: To consult with the stakeholders about their perception regarding the development and operation activities, status, plans & preparation, recommendation of BITAC, the impact of NSEZ in the area, etc.
Key Point discussed
Perception about the EZ • The consulted representative of BITAC expressed a positive perception of the establishment of NSEZ. Current Status, Allocations, and Plan • BITAC is primarily focused on providing support in the form of spare parts for machines across various industrial sectors. • BITAC is also committed to providing training for both skilled and unskilled manpower to support them in increasing their skills and enhancing their capacity. • Around 10 acres of land have been allocated for BITAC to establish a well-organized and well-equipped center in the NSEZ area. • BITAC has a plan to provide possible support to NSEZ's industry. • Within the scope of the NSEZ area, BITAC aims to deliver training for middle to high-skilled employees, addressing the specific workforce demands of the region. • All details including the Detailed Project Proposal (DPP) are set to be finalized, and BITAC plans to commence its work soon. • To facilitate this initiative, BITAC has received a budget allocation of 800 crore BDT for the project. • This collaboration aims to contribute significantly to the skill development and employment prospects within the NSEZ area. Recommendation • BITAC will provide training to employees to meet the demand for skilled manpower in NSEZ. Industries are suggested to recruit their Lower mid to mid-level staff from the BITAC.
Participant

Md. Rezaul Karim, Assistant Director (Admin), Bangladesh Industrial Technical Assistance Centre (BITAC), Chattogram

1.2.32 Consultation with Karnaphuli Gas Distribution Company Limited (KGDCL), Chattogram

Basic Details

Location: Karnaphuli Gas Distribution Company Limited Office

District: Chattogram

Date: 3 December 2023

Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, current preparation, and works undertaken by KGDCL, recommendations regarding future demand of NSEZ, the impact of NSEZ, etc.

Key Point discussed

Perception about the EZ

- KGDCL is well-informed about the project details and holds a favorable perspective although they have not yet played any roles in any activities designed for NSEZ.

Current situation/Activities

- KGDCL is well acquainted with the project details and expresses a positive perspective.
- Currently, there is a pipeline upgrade project underway from Fozdarhat to Baraiarhat, with a demand of approximately 400 m^3.
- Presently, the supply stands at 50 m^3. The gas supply will be facilitated through a GTCL station located in Baratakia.
- Notably, the pipeline is laid on RHD land, and no additional land acquisition is required. The pipeline has a diameter of 20 inches, and it is designed to support a pressure of 150*10 bar, as per the specifications outlined in the DPD.
- GTCL has already established a sub-station at NSEZ Saroni targeting NSEZ. Gas supply to NSEZ will be connected with the FSM Gas Network Upgradation Project of KGDCL.

Recommendation

- The capacity of KGDCL should be increased in the future considering the increasing demand.

Participant

Engr. Md. Shahidul Rahman, DPD (FSM Gas network upgradation project), KGDCL, Chattogram

1.2.33 Consultation with Gas Transmission Company Limited (GTCL), Chattogram

Basic Details

Location: Gas Transmission Company Limited Office

District: Chattogram

Date: 10 January 2024

Purpose of the Visit: To consult with a stakeholder about their perception regarding the development and operation activities, current preparation, and works undertaken by GTCL, recommendations regarding future demand of NSEZ, the impact of NSEZ, etc.

Key Point discussed

Perception about the EZ

- GTCL is well-informed about the EZ details and holds a positive perception of NSEZ.

Opinion Regarding GTCL's Activities and Future Demand

- While GTCL is not directly engaged in NSEZ, it plays a crucial role through a dedicated station that supplies 200 MMSCFD per hour of natural gas. The distribution authority for this gas is KGDCL, and the source of the gas is LNG from Moheskhali.
- The representative also opined that the current supply of 200 MMSCFD seems sufficient for the factories operating in the NSEZ area.
- In case of any increasing demand in the future, there should be no concerns regarding the uninterrupted gas supply in the NSEZ area.

Recommendation

- The strength of GTCL should be increased in the future considering the increasing demand.

Participant

Engr. Shafiuddin Md. Farhad Omar, DGM (RTD, CTG), GTCL-East Division, Chattogram

1.2.34 Consultation with the Department of Disaster Management, Sonagazi, Feni

Basic Details

Location: Project Implementation Office, Sonagazi

District: Feni

Date: 29 November 2023

Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, nature and frequency of natural disasters, community preparedness and resilience, works undertaken by PIO/DDM, future plan & recommendation regarding future demand of NSEZ, the impact of NSEZ, etc.

Key Point discussed

Perception about the EZ

- The project implementation officer under the Department of Disaster Management is aware of the NSEZ and provided important insight regarding the nature of disasters, frequency, government preparation, existing infrastructure, and work undertaken by the Project implementation office.

Current situation/ Type of Natural disaster

- Cyclones and tropical storms are the main natural disasters which are prevalent in the area.
- Char Chandia, Sonagazi, Amirabad, and Char Darbesh, these four unions are most likely to be affected by cyclones.
- There are 33 cyclone centers in these four unions. Some are also used as community centers. Any future influx of more people will require more shelter and capacities.
- Additionally, lighting is identified as a hazard by PIO. River erosion is another natural disaster faced in the upazila.
- The vulnerability of females is found high in the area compared to males. Females are often reported to lack awareness about preparedness while facing potential natural disasters.
- To ensure safety and security during disasters, Ansar members are deployed in every cyclone center.

Capacity of Shelters

- The total capacity of the above-mentioned cyclone centers is 20,550 persons. In Sonagazi upazila, there are a total of 44 cyclone shelters including the 33 centers mentioned above. The total capacity of these shelters is 23,600 persons.
- Works and projects undertaken by PIO.

The project implementation office undertakes activities which include:

- Building bridges and culverts up to 15 meters.
- HBB road construction
- TR, Food/Cash for Work, GR, and VGF are provided to vulnerable people.
- Providing support and food during any disaster, especially during cyclones, the Project implementation office spearheads the preparedness activity along with the COO.

Challenges

- The project implementation office faced challenges while providing food during cyclones and emergencies due to the cultural diversity of the community. Hindu and Jaldas community members are not comfortable receiving foods that may contain beef or other meat.
- Limited human resources. Sanctioned number of posts: two.

Perceived Impact of NSEZ:

- Residential areas will be constructed in the areas of Sonagazi and Char Chandia which are identified as prone to natural disasters.
- In the future, the distribution of relief can cause dissatisfaction or conflict among the local community and migrants since there may be less social cohesion between locals and outsiders.
- PIO can declare any building as a cyclone shelter. Considering the fact that NSEZ will create many high-rise buildings, PIO will have access to a large pool of buildings to utilize as a cyclone shelter during an emergency.

Recommendation

- Disaster management plan for NSEZ.
- Policy should be revised in regard to providing relief to nontitle holders. Currently, only owners of land receive relief for reconstruction.
- Response functions and plans should be culturally responsive and should be able to address the needs of people from every community/religion.
- Logistics, infrastructure, and human resources should be increased to meet future demands.
- Training for CPP volunteers to increase cultural sensitivity, gender awareness, etc.

Participant

Iqbal Hasan, PIO, Sonagazi, Feni

1.2.35 Consultation with the Cyclone Preparedness Programme (CPP), Ministry of Disaster Management and Relief (MODMR), Mirsharai, Chattogram

Basic Details

Location: Assistant Director's Office, Cyclone Preparedness Programme (CPP), Ministry of Disaster Management and Relief, Mirsharai, Chattogram

District: Chattogram

Date: 16 March 2023

Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, nature and frequency of natural disasters, community preparedness and resilience, works undertaken by DDM, future plans & recommendations regarding future demand of NSEZ, the impact of NSEZ, etc.

Key Point discussed

Perception about the EZ

- The consulted representative of the Department of Disaster Management is aware of the NSEZ and provided important insight regarding the nature of disasters, frequency, government's preparation, existing infrastructure, and work undertaken by the Project implementation office.

Current Situation/Type of Natural Disaster

- Cyclone Preparedness Program (CPP) is a joint programme of the Government of Bangladesh and the Bangladesh Red Crescent Society.
- Cyclone Preparedness Program (CPP) volunteers work in coordination with the Upazila Disaster Management Committee and Union Disaster Management Committee during cyclone emergencies. The total number of volunteers in Mirsharai upazila is 1,600 (800 male and 800 female).
- Emergency Response Team (ERT) and Rapid Relief Team (RRT) consist of 20 members. The First Aid team, along with the Emergency Response Team (ERT), has direct communication with the Upazila Health Complex and nearby hospitals. The teams are also able to communicate with other departments such as the Fire Service and Civil Defense, Department of Forest, Department of Environment, etc. through hotline numbers displayed in the Upazila and Union offices.
- Warning the community of an approaching cyclone is the responsibility of the CPP. CPP volunteers are both males and females. They wear bright orange jackets. They support disseminating early warning messages, support search and rescue operations and deliver immediate first aid, work with the authorities to shift the injured if needed or manage any fatalities, etc.
- If a cyclone approaches or intensifies at night CPP volunteers use megaphones and sirens to ensure the community receives the message and can prepare.
- Bangladesh Meteorological Department (BMD) knows about a cyclone formation in the deep sea several days before it reaches the coast and contacts CPP by mobile phone.
- A total of 85 cyclone shelters are available in the Mirsharai Upazila. Among them, four shelters are situated in Saherkhali and Ichakhali unions. Additionally, one cyclone shelter operated by the Red Cross is situated in Tekerhat village under the Ichakhali union.
- CPP conducts awareness campaigns and drills in the villages throughout the year.
- CPP volunteers will use a '3 flag system' to communicate the level of danger to the community. CPP early warning flags are red, with a black square in the middle.
    - One flag is the lowest level of warning (signal no 1-4), it means that a storm has formed in a distant area that has the potential to develop into a cyclone. There is no need for panic, the storm might also get weaker and never turn into a cyclone. In this stage, direct communication via radio and walkie-talkies is established with the fishermen. A coordination meeting with CPP members and the UNO is also conducted at this stage.
    - If two flags are raised (signal no 5-7), have approximately 24 hours until the cyclone arrives. Before this time, there may have been heavy rain and strong winds. This is the time to prepare. At this stage public addressing through microphones/mike begins in the union and villages.
    - If three flags are raised (signal no 8-10), have approximately 10 hours until the cyclone arrives. Before this time, there may have been heavy rain and strong winds. At this stage, public addressing through microphones and sirens commences in the union and villages.
- During a cyclone emergency, a coordination meeting is organized at Upazila headquarters in the presence of the representatives of different departments.
- Cyclones and tropical storms are the main natural disasters that are prevalent in the NSEZ area.
- They use a depression tracking map during the formation of a cyclone in the deep sea/Bay of Bengal.

- Ichakhali, Saherkhali, and Bamansundor are close to the sea and these areas are often affected by cyclones.
- The current condition of the cyclone shelter is not good and not adequate considering the number of populations. More cyclone shelters will be required considering the future influx of population during the implementation of the NSEZ.
- DDM/MODMR is working to create awareness among local people about disaster preparedness.
- Security management will be more organized during disasters in the future.
- They are not aware of other disasters like earthquakes, tsunamis, etc. as well as search and rescue operations.
- They maintain communication using community radio technology during emergencies.
- They informed that nowadays Interactive Voice Response (IVR) system is used to disseminate disaster-related early warnings among the common people via mobile phone.
- They use megaphones, hand sirens, raincoats, vests, first aid kits, rescue kits, life jackets, signal flags, signal flag masts, hard hats, gumboots, etc. during cyclone emergencies.

Recommendation

- A disaster management plan for NSEZ should be prepared and implemented properly.

Participant

Md. Jashimuddin, Assistant Operator, Cyclone Preparedness Program, MODMR, Mirsharai, Chattogram

1.2.36 Consultation with Upazila Social Services Officer, Sonagazi

Basic Details

Location: Department of Social Services Office, Sonagazi Upazila

District: Feni

Date: 30 August 2023

Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, scope of involvement of DSS, preparation of DSS regarding future demand of NSEZ, the potential impact of NSEZ on the safety net programs, etc.

Key Point discussed

Perception about the EZ

- The Department of Social Services, Sonagazi, Feni is informed about the NSEZ although they did not participate in any activities of the NSEZ.

Current Activities of DSS

- The Social Services department provides different safety nets for the disadvantaged and backward communities, widows, poor, etc. total of 57 types of different activities under the office.
- Loan programs
- Probation activities
- Hospital social welfare activities
- Awareness programs
- Child marriage prevention

Types of Stipends and Allowances

- Old Age, Vulnerable Group Development (VGD), Vulnerable Group Feeding (VGF), Disability, Education, Disadvantage community, etc.

Current Capacities of DSS

- The department is staffed with 60% vacant posts with an office organogram from 1984.
- The officer has additional responsibilities as a probation officer and hospital social services officer.

Challenges to Meet the Future Demand

- Low resources
- Additional responsibilities are mentioned above.

Potential Impact

- Inflation
- Infrastructure development
- Population influx
- Increase in deviant behaviors and crimes.
- Climate-induced vulnerability may decrease as a result of embarkment.

Suggestions/Recommendation

- Department of Social Services is required to set up a regional office and RMC to meet future demand.

Participant

Tarek Ahammad, Upazila Social Services Officer, Sonagazi Upazila, Feni

1.2.37 Consultation with Upazila Social Services Officer, Mirsharai

Basic Details

Location: Department of Social Services Office, Mirsharai Upazila

District: Chattogram

Date: 30 August 2023

Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, scope of involvement of DSS, preparation of DSS regarding future demand of NSEZ, the potential impact of NSEZ on the local communities, etc.

Key Point discussed

- Additionally, he suggested seeking information from the PIO office.
- DSS provides loans and runs different safety net programs.
- They have not yet taken any initiative focusing on NSEZ's potential impact on the local community.
- If the demand for their services increases, they will take steps to respond in a timely manner.

Recommendation

- A livelihood restoration plan should be implemented for people whose employment and income are impacted.
- Groundwater should not be used in the EZ.
- Buffalo grazers and fishermen should be covered under the livelihood restoration program.
- Social cohesion should be maintained.
- Employment and business activities should be prioritized for local people. The local small business community should also support them so that they can compete with other business holders.

Participant

Upazila Social Services Officer, Mirsharai Upazila, Chattogram

1.2.38 Consultation with Upazila Woman Affairs Officer, Sonagazi

Basic Details
Location: Upazila Women Affairs Office, Sonagazi Upazila
District: Feni
Date: 30 August 2023
Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, the potential impact of NSEZ on agriculture, the scope of involvement of DWA to mitigate future perceived impacts, etc.
Key Point discussed
Perception about the EZ • The Department of Women Affairs, Sonagazi, Feni is informed about the NSEZ although they did not participate in any activities of the NSEZ. Overview • DWA has different skill development programs for women. They also run different awareness programs and campaigns. • Major risks for women & girls are eve teasing, domestic violence (dowry-related assault), and child marriage. • DWA involves different CSOs/NGOs in their activity. Current Activities of DWA • Skill development training. • Awareness campaign. • VBB, cooperative, social work, legal assistance, child marriage counseling, and GVB are the main activities of the office. Current Capacities of DWA • Upazila office is understaffed with 5 vacant posts out of 7 allocated posts. Potential Impact • Risk of GBV due to labor influx. Other crimes and community-level disharmony may also increase. • Eve teasing. Suggestions/Recommendation • Emphasis on awareness-raising activity. • Ensuring a safe environment for women. • Ensure community safety and harmony. • Ensure employment for women.
Participant
Nargis Akhter, Upazila Woman Affairs Officer, Sonagazi Upazila, Feni

1.2.39 Consultation with Upazila Nirbahi Officer, Mirsharai, Chattogram

Basic Details
Location: Mirsharai
District: Chattogram
Date: 4 October 2023

Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, scope of involvement of the UNO office, their insight and recommendation regarding the NSEZ, current socioeconomic scenario of the upazila, preparation of government department regarding future demand of NSEZ, the potential impact and associated risk of NSEZ, etc.

Key Point Discussed

- The UNO is well-informed about the NSEZ and implementation activities although he is new in the area.
- Land was acquired for the NSEZ from Mirsharai Upazila. The land of NSEZ is mostly reclaimed.
- UNO informed that the LA office could provide detailed information regarding land acquisition.
- In the beginning, resettlement activities were somewhat delayed due to some unavoidable reasons.

Present Socio-economic Situation

- Impacted people will get compensation and livelihood training. Since the livelihood particularly some buffalo grazers, farmers, and landowners have been impacted, they are getting compensation as per national legislation of the country.
- Some people are yet to be rehabilitated as per the commitment of the EZ authority.
- UNO office is always ready to help people and concerned authorities if required.
- It has been 8 years, but the greenery activities have not yet been completed. It is important to save the environment.
- There are many tourist spots in Mirsharai and Sitakunda. It will be a highly attractive place if an influx occurs, and we can disseminate positive information about it.
- Since law and order is a major issue, a new police station is being established to maintain the security of the economic zone and surrounding areas.

Suggestions/Recommendation

- Save biodiversity, particularly wild animals such as deer, birds, etc.
- If there is any endangered species, it requires to take steps to save them.
- Employ local workers as much as possible.
- It will be good if the roads are left out of the security wall.
- It needs to increase the capacity of the government offices of the Mirsharai Upazila to handle the potential population influx. Particularly, a specific focus will be required to increase the capacities of road connectivity, hospitals, and transportation systems.
- Need to give support to fishery communities to keep their access to fishery resources and fish landing stations/ghats.
- Proper implementation of plantation and saving of natural forests will be required to save wild animals and wild animals from human intervention around the forest areas.
- Local roads, playgrounds, and other community structures should be increased.
- Healthcare facilities, including hospitals, should be increased.
- All forms of pollution including air, water, and sound pollution should be avoided.

Participant

Mahfuza Jerin, UNO, Mirsharai Upazila, Chattogram

1.2.40 Consultation with Upazila Nirbahi Officer, Sitakunda, Chattogram

Basic Details

Location: Sitakunda

District: Chattogram

Date: 4 October 2023

Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, scope of involvement of the UNO office, their insight and recommendation regarding the NSEZ, current socioeconomic scenario of the upazila, preparation of government department regarding future demand of NSEZ, the potential impact and associated risk of NSEZ, etc.

Key Point Discussed

- The UNO is aware of the NSEZ and implementation activities.
- Land coverage is comparatively lower in the Sitakunda upazila.
- Land acquisition is being handled by the LA office of the DC office.

Present Socio-economic situation

- Currently, the preparation of government offices and other private service providers is not ready to tackle the future anticipated demand.
- Since Sitakunda is already an industrial area, the response is always prompt from government offices of Chattogram in any emergency.
- If local administration requires any additional support, they will apply for it and take preparation.

Challenges: The UNO identified the following challenges to the NSEZ and the community due to the implementation of the NSEZ.

- Water crisis may be observed by local people if groundwater is lifted for industries.
- It will have a negative impact on the environment if biodiversity is not saved properly.

Potential Impact/Risks

- The influx of population may adversely impact the natural resources like hilly areas, sea sides, and forest areas of Sitakunda region although the hills and forest areas are protected.

Suggestions/Recommendation

- Proper waste disposal and management plans and treatment facilities should be established.
- Protect and plan for agricultural land.
- Employ local people.
- Prevent pollution of water and air.
- Construction works could produce excessive sound. The use of advanced technology is suggested to avoid such sound pollution.
- Highlight the sea beaches and other spots to attract tourists.
- Increase the number of health facilities and other services for the local people.
- Protect the habitat and biodiversity.
- Security systems should be maintained for both NSEZ and communities.

Participant

Rafikul Islam, UNO, Sitakunda Upazila, Chattogram

1.2.41 Consultation with Upazila Nirbahi Officer, Sonagazi, Feni

Basic Details

Location: Sonagazi, Feni

District: Feni

Date: 29 November 2023

Purpose of the Visit: To consult with UNO about their perception regarding the development and operation activities, scope of involvement of UNO office, their insight and recommendation regarding the NSEZ, current socioeconomic scenario of the upazila, preparation of government department regarding future demand of NSEZ, the potential impact and associated risk of NSEZ, etc.

Key Point Discussed

- The UNO is aware of the NSEZ and implementation activities.
- Land was acquired for the NSEZ from Sonagazi Upazila.
- The UNO office was unable to verify any information regarding compensation and suggested consulting with the AC-land office for detailed information on land acquisition.
- The UNO is not a member of any GRM or other committee related to NSEZ.
- The UNO office perceives this project as a medium for infrastructure development in the region.
- Government departments are well-equipped and prepared to meet future demand.

Present Socio-economic situation

- Communities living in Sonagazi upazila are backward and socially conservative. People are reported to be culturally vindictive. The people will take time to culturally assimilate with the migrant workers in their areas. Since a huge population influx is anticipated, maintaining social cohesion will be an important issue in the future.
- As per the consultation, the NSEZ may not cause any environmental degradation.
- They inform and report to BEZA authorities on irregularities. They also work on issues between workers and factory management.
- The literacy rate is low compared to other upazila of the region. Only 37% of the students were able to pass a higher secondary school certification exam.
- There is a prevalence of petty theft like livestock theft is a regular occurrence in rural communities.

Challenges: The UNO identified the following challenges to the NSEZ and the community due to the implementation of the NSEZ.

- Coordination among various stakeholders.
- Conservative communities.
- Low literacy and awareness among people.
- Large number of stakeholders.
- Coordination among stakeholders.
- Absence/Limited recreational facilities.
- Integration of outsiders in a conservative society.

Potential Impact/Risks

- Cultural vulnerability for communities like Jaldas fishermen community.
- They may experience changes in their employment and livelihood. Many of them will shift their occupation to business activities.
- Changes in social structure and community perception toward development.
- The NSEZ will create new employment opportunities.
- Road networks, infrastructure, and utility services will be developed and improved in the region.
- The potential of development of a market/business hub in the upazila.
- Agricultural land reduction due to urbanization.

Suggestions/Recommendation

- Proper waste disposal and management plans and treatment facilities to save the environment from pollution and degradation.
- Well-planned integration of outsiders/migrants into the conservative community.

- Commissioning of recreational facilities to meet current and future demands.
- Creating a politically stable environment through dialogue and consultation with stakeholders.
- Biodiversity and natural resources such as forests, and rivers should be protected.

Participant

Kamrul Hasan, UNO, Sonagazi Upazila, Feni

1.2.42 Consultation with the Department of Environment (DOE), Chattogram

Basic Details

Location: Department of Environment, Chattogram

District: Chattogram

Date: 09 January 2024

Purpose of the Visit: To consult with a stakeholder about their perception regarding the development and operation activities, activities, and involvement of DOE, the impact of the NSEZ on the environment, natural resources, suggestions and recommendations, etc.

Key Point discussed

Perception about the EZ

- The Department of Environment, Chattogram, is well-informed about the NSEZ. The consulted representative of DOE opined that NSEZ will contribute substantially to the socioeconomic development of the region. He hoped all environmental guidelines and mitigation measures would be followed by the NSEZ authority properly.

Opinion Regarding any Obligation for Implementation of NSEZ

- Currently, there is no established plan for the establishment of any dedicated environmental monitoring station within the NSEZ area. These insights provide clarity on the environmental considerations and regulatory processes associated with the ongoing project.
- He points out that, as per Environmental Conservation Rules (ECR) 2023, there is no specific obligation for the implementation of the NSEZ.
- The prevailing procedure involves obtaining Environmental Clearance Certificates (ECC) for individual industries. Industries receive site clearance directly, followed by obtaining ECC individually.
- Currently, there is no establishment of any dedicated environmental monitoring station within the NSEZ area. If any demand arises in the future they will do it.
- These insights provide clarity on the environmental considerations and regulatory processes associated with the ongoing project.

Impact of EZ

- He emphasizes that there are no protected areas in close proximity to the EZ site and any impact on protected areas is deemed unlikely due to their considerable distance from the EZ location.

Suggestions/Recommendation

- BEZA would make the industry aware of current environmental rules and regulations.
- If any environmental rule is violated by any industry of NSEZ, BEZA should stop all its support to that particular industry.
- BEZA needs to encourage its investors to adopt environmentally friendly equipment and technology to avoid environmental pollution, particularly water, air, and sound.

Participant

Md. Ashraf Uddin, Assistant Director, DOE, Chattogram

1.2.43 Consultation with Upazila Health & Family Planning Officer (UHFPO), Directorate General of Health Services (DGHS), Sitakunda

Basic Details
Location: Upazila Health Complex, Sitakunda
District: Chattogram
Date: 28 November 2023
Purpose of the Visit: To consult with a stakeholder about their perception regarding the EZ, current situation regarding health infrastructure, future plans & preparation, recommendation of DGHS to meet the future demand of NSEZ, the impact of NSEZ in the area, etc.
Key Point discussed

Perception about the EZ

- A consultation meeting was carried out with the Upazila Health and Family Planning Officer which revealed a positive perception of the NSEZ. The UHFPO office is prepared to coordinate with other departments and with the proposed hospitals to provide healthcare services to people in need.

Current Situation

- The Upazila Health Complex is a 50-bed hospital and there are sufficient numbers of doctors posted in the hospital against allocated posts.
- There are 6 community clinics in Saidpur and Muradpur Union.
- The hospital has a working ambulance.
- The UHFPO has to work long hours to meet the administrative workload and number of patients received by the hospital.

Recommendation/Requirement to Meet the Future Demand

- As per consultation data, the hospital beds need to increase, and the Upazila Hospital needs to upgrade to a 100-bed hospital with the necessary logistics, support, and resources.
- The number of community clinics and other health centers should be increased in accordance with an increase in population.
- Pollution-caused diseases may be observed due to the influx. Therefore, all forms of pollution should be prevented as maximum as possible.

Participant
Md Nur Uddin, UHFPO, Sitakunda

1.2.44 Consultation with Bangladesh Rural Electrification Board (BREB)

Basic Details
Location: Palli Bidyut Samity-3, Mirsharai and BREB, NSEZ
District: Chattogram
Date: 16 January 2024
Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, scope of services of BREB, preparation of BREB regarding future demand of NSEZ, the impact of NSEZ on electricity supply in the areas, etc.
Key Point discussed

Perception about the EZ

- BREB, Mirsharai, Chattogram are well-informed about the NSEZ, and they are taking preparation to meet future demand for their services in NSEZ's surrounding areas.

Current Activities of BREB

- Currently, Palli Bidyut Samity (PBS)-3 is providing electricity in different places in the Mirsharai areas except the economic zone.
- The current served area of Palli Bidyut Samity-3 includes Chaitonner Ghat of Borotakia in the North, Jorarganj in the South, Aburhat in the West, and Hils (*Dakshin Ghonar Pahar*) in the eastern part of the Mirsharai.
- Most of the households of Mirsharai Upazila have electricity connections currently.
- At present, there are substations at Mithachara (Mirsharai) and Abutorab.

Preparation to Meet the Future Demands of Community

- BREB is preparing to meet the future demand as a result of NSEZ-centered influx in the area such as they are looking for land to establish more substations in the future. They are keeping 5 areas in their focus from where future demand will be created. The areas are:
    a. Borotakia
    b. Mirsharai Municipality Area
    c. Bamansundar
    d. Abutorab
- A dedicated grid has been established within NSEZ to circulate electricity within the economic zone/NSEZ particularly.
- On the other hand, the electricity to the surrounding communities will be supplied from the Baroirhat grid.
- They will also increase the number of grids and 4-5 more substations to avoid interruption to the electricity supply in the future.

Present Condition and Future Preparation for NSEZ

- Currently, there are 3 substations, a switching station, and 1 grid station in the NSEZ to provide electricity in NSEZ areas.
- BREB is prepared to provide up to 132 MW although the demand is 11 MW per day.
- An office is being under construction for a dedicated Executive Engineer who will be in charge of looking after the service BREB in the NSEZ area. In the future, human resources and supply capacity will be increased in response to the demand.
- Considering the risk of any accident or fire break, they have safety measures such as Air Breaker Circuits (ABR), fire alarms, etc.
- To enhance the capacities and skills of staff, BREB continuously provides training to their staff at the Training Directorate at Khilkhet Dhaka.

Recommendation

- BREB should increase its capacity in the future.

Participant

Adnan Ahmed, DGM, Palli Bidyut Samity-3, Mirsharai, Chattogram

Udayon Dasgupta, AGM, Palli Bidyut Samity-3, Mirsharai, Chattogram

Saikot Hossen, Line Construction Inspector (LCI), BREB, NSEZ

Abdul Momin, Line Technician, BREB, NSEZ

1.2.45 Consultation with Fire Services and Civil Defense, Sonagazi

Basic Details

Location: Upazila Fire Services Station, Sonagazi

District: Feni

Date: 30 August 2023

Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, scope of involvement of Fire services, preparation of Fire services regarding future demand of NSEZ, the potential impact and associated risk of NSEZ, etc.

Key Point discussed

Perception about the EZ

- The Department of Fire Services & Civil Defense, Sonagazi, Feni is well aware of the NSEZ although they did not participate in any activities of the NSEZ.

Overview

- The main task of the fire services & civil defense department is to defuse any type of fire and rescue people from any hazards, both man-made and natural. Additionally, they provide first aid, and conduct rescue operations in every emergency, from rescuing cats from a tree top to saving humans from drowning. They also provide ambulance services.
- In the Sonagazi upazila, yearly 50 fire accidents on average occur. Fire service is unable to reach most of the areas of Char Chandia by vehicle due to narrow roads. One fire truck is in repair, which reduces their firefighting capacity, but they stated that the vehicle will return promptly.
- In the process of upgrading the station to a 2nd class fire station which will enhance its capacity, human resources, and equipment.
- Fire officers mentioned about their attempt to save fishermen from drowning, but the narrow road acted as a major constraint to reach the affected person in time.

Current Capacities of Station

- The station has one large fire truck, one small fire truck, multiple other vehicles like motorbikes & ambulances, and different types of tools and water pumps. They are also equipped with oxygen cylinders and can conduct rescue operations in water.
- Station regularly conducts fire drills, and they provide services 24*7.

Challenges to Meet the Future Demand

- Narrow roads are a major concern for any future activities as vehicles are unable to access those narrow roads in the peripheries of the upazila.
- Limited resources
- Crowds and gathering in incident areas hamper department activity which will remain a major challenge in the future.

Potential Impact/Risks

- Chemical fire hazards will increase.
- Electrical fire hazards may increase.
- Gas-related fire hazards may increase.
- With increased traffic, road accidents may occur more frequently.

Suggestions/Recommendation

- Need wider roads to the peripheral areas.
- Need to increase awareness among general people to reduce gatherings during rescue missions.
- Water-based rescue vehicles are required.
- Industries need to take a No Objection Certificate (NOC) from the Fire Services Department, and they should follow proper building codes with fire safety instructions from the department.

- Need to increase the capacity and manpower of the department.

Participant

Jamil Ahammad, Station Officer, Sonagazi Upazila, Feni

1.2.46 Consultation with Fire Services and Civil Defense, Sitakunda

Basic Details

Location: Upazila Fire Services Station, Sitakunda

District: Chattogram

Date: 28 November 2023

Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, scope of involvement of Fire services, preparation of Fire services regarding future demand of NSEZ, the potential impact and associated risk of NSEZ, etc.

Key Point discussed

Perception about the EZ

- The senior station officer of Fire Services & Civil Defense, Sitakunda, Chattogram is well aware of the NSEZ and provided us with a number of recommendations and insights that should be incorporated into the disaster management plan. Sitakunda Fire Service and Civil Defense Station is a first-class station with the required vehicles and human resources allocated for a 1st class fire services station. The station regularly conducts fire drills, and they provide services 24*7. During the consultation, a scheduled drill was conducted.

Challenges

- Narrow roads are inaccessible to fire vehicles.
- The station does not have foam tender, chemical tender, two turntable ladder (TTL) snorkels which are required to extinguish industrial fires.
- Limited office and accommodation space in the station for officers and firefighters.
- The majority of the industries in the region are situated beside Dhaka Chattogram highway and loading and unloading of goods on the highway or near the highway causes regular accidents.
- The number of vehicles and equipment at the station is insufficient.

Challenges to Meet the Future Demand

- Narrow roads are a major concern for any future activities as vehicles are unable to access those narrow roads in the peripheries of the upazila.
- Limited resources and unavailability of required instruments and vehicles like chemical tenders, foam tenders, TTL, etc.
- Crowds and gathering in incident areas hamper department activity which will remain a major challenge in the future.

Potential Impact/Risks

- An increase in road traffic may increase the risk and frequency of road accidents.
- Rapid industrialization may have an adverse effect on the environment. Industries clearing hills to create more industrial plots in the upazila.
- Electrical fire hazards may increase.
- Gas-related fire hazards may increase.
- With increased traffic, road accidents may occur more frequently.

Suggestions/Recommendation

- 2.5-inch diameter water hose connections to ensure compatibility with equipment used by fire service
- A dedicated fire hydrant line should be installed in both residential and industrial areas.
- Need wider roads to the peripheral areas.
- Establishment of 6 additional 1st class fire service stations.
- Builders need to take NOC from the Fire Services Department and they should follow proper building code with fire safety instructions from the department.
- Need to increase the capacity and manpower of the station. Specifically, the station needs foam tender and other vehicles to contain chemical-induced fire and hazards.
- A master fire safety plan should be prepared for the NSEZ.

Participant

Md Nurul Alom Dulal, Senior Station Officer, Sitakunda Upazila, Chattogram

1.2.47 Consultation with the Department of Public Health and Engineering, Mirsharai

Basic Details

Location: Upazila Department of Public Health Engineering (DPHE) Office, Mirsharai

District: Chattogram

Date: 28 August 2023

Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, scope of involvement of DPHE, preparation of DPHE regarding future demand of NSEZ, the impact of NSEZ on water and sanitation in the areas, etc.

Key Point Discussed

Perception about the EZ

- DPHE, Mirsharai Upazila of Chattogram is informed about the NSEZ and DHPE participated in deep tube well construction for the NSEZ.

Current Activities of DPHE

- DPHE installed 50 deep tube wells in the NSEZ site. These tube wells are intended for emergency use only.
- The department regularly installs shallow and deep tube wells in the upazila.

Perceived Impact of the EZ

- Regular use of deep tub well water will significantly reduce water levels in the area and have far-reaching consequences.
- Potential pollution can destroy nearby ecosystems if no treatment plants are used.

Current Situation of the Upazila

- There is arsenic, iron, and saltwater contamination in shallow water.
- The usual depth of deep tube well is 550 feet to 850 feet. The depth of a shallow tube well is 100 feet to 150 feet on average.
- There are two municipalities in the upazila.
- The areas are mostly dependent on groundwater considering the inadequacy of surface water.

Preparation to Meet the Future Demand

- The main water source for NSEZ will be the Muhuri reservoir. Additionally, water from the Mohamaya project could be used in the future.
- Desalination plant to meet the future demand of the NSEZ.

Suggestions/Recommendation

- NSEZ should not use sub-surface water from deep tube wells for regular activities.
- BEZA and related industries need to commission ETP and related facilities to reduce pollution.

Participant

K M Saeed Mahmud, Assistant Engineer, DPHE, Mirsharai Upazila, Chattogram

1.2.48 Consultation with the Department of Public Health and Engineering, Sonagazi

Basic Details

Location: Upazila Department of Public Health Engineering (DPHE) Office, Sonagazi

District: Feni

Date: 30 August 2023

Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, scope of involvement of DPHE, preparation of DPHE regarding future demand of NSEZ, the impact of NSEZ on water and sanitation in the areas, etc.

Key Point Discussed

Perception about the EZ

- Department of Public Health Engineering, Sonagazi, Feni is informed about the NSEZ although they did not participate in any activities of the NSEZ.

Activities of DPHE

- Tube well installation project
- 13 km long pipe water implementation project in the municipality.
- Testing of water quality.
- DPHE is focused on water supply and sanitation is currently not a major focus of the department.

Water and Sanitation Situation in the Upazila

- No central sewerage treatment plant in the Upazila.
- Around 30% of the shallow tube wells have arsenic contamination.
- 5% of the tube wells have iron and saline water contamination.
- The only possible source of surface water is the Muhuri reservoir.
- The average depth of a deep tube well is 220 meters, for shallow tube wells 10 to 15 meters.
- The water table is 40-50 feet.
- The areas are mostly dependent on groundwater considering the inadequacy of surface water. Agriculture practices face a shortage of irrigation water.

Current Capacities of DPHE

- DPHE building a new office building on its own premises.
- DPHE has the capacity to implement future projects.

Preparation to Meet the Future Demand

- DPHE will get involved in all future water supply-related projects.

Suggestions/Recommendation

- Future pipeline expansion to meet the demand.
- Use of subsurface water for future water supply projects.
- The area will require proper drainage in the future. This should be covered in the current development plan for the area.

Participant
Md. Abu Sayem, Assistant Engineer, DPHE, Sonagazi Upazila, Feni

1.2.49 Consultation with Narcotics Department, Chattogram

Basic Details
Location: Narcotics Department
District: Chattogram
Date: 30 November 2023
Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, current preparation and works undertaken by the Narcotics Department, recommendations regarding future demand of NSEZ, the impact of NSEZ, etc.
Key Point Discussed
Perception about the EZ • The Narcotics Departments of Chattogram are well-informed about the EZ details and hold a favorable perspective although they have not yet played any roles in any activities designed for NSEZ. Current Situation/Activities • In the Chattogram area, a total of 15 upazilas are divided into two parts: Hathazari (ka), which includes seven upazilas from Hathazari to Sandwip, and Patiya (kha), which consists of eight upazilas. Mirsharai Upazila is under the jurisdiction of the Hathazari circle. • There is no specific plan for the economic zone in their jurisdiction. However, if the government expresses interest, they are willing to establish a special wing dedicated to the NSEZ. • Additionally, for industries related to chemicals, certification from the narcotics department is mandatory. Recommendation • Law enforcement agency's operations will need to increase to control the movement of narcotics/drugs in the communities and industrial areas. • Community awareness should be increased in the future.
Participant
Papiya Mozumder, Assistant Officer, Narcotics Department, Chattogram

1.2.50 Consultation with Forest Department - Coastal Afforestation Division, Mirsharai Range, Chattogram

Basic Details
Location: Forest Bit Office (Bamansundor), Mirsharai Range
District: Chattogram
Date: 05 October 2023
Purpose of the Visit: To consult with stakeholders about their perception regarding the development and operation activities, the impact of NSEZ on Forest resources like Mangrove afforestation, natural resources, avifauna, etc.
Key Point Discussed

Perception about the EZ

- The Forester, Forest Range Office, Coastal Afforestation Division, Mirsharai, Chattogram was found informed about the NSEZ and he knew about the development activities under the NSEZ.

Overview of the Coastal Forest Range of Mirsharai

- The amount of forest land of the Coastal Range of Mirsharai is 26,314 acres.
    - Forest area under section 20: 22,355 acres (approximately)
    - Forest area under section 6: 3,974.39 acres (approximately)
    - The forest area adjacent to the Forest range office: 5 acres
- Afforested forest area from 1976-77 to 2014-15: 18,498.09 acres
- The forest area under the Economic zone: is 6,648 acres
- Approximately 1,482 acres have been afforested at the west part of the super dyke area.

Mouza wise Forest area of Forest Range, Mirsharai

- The total afforested area under five Mouzas: 851.58 acres
    - Saherkhali Mouza: 58.07 acre
    - Dokhsin Mogadia Mouza: 521.17 acres
    - Domkhali Mouza: 101.84 acres
    - Purbo Ichakhali Mouza: 42.82 acre
    - Poschim Ichakhali Mouza: 127.68 acres

Afforested Forest area of Different Charland of Mirsharai

- Sadhur Char: 1,644.1039 acres
- Char Mosharrof: 1,504.2927 acres
- Pirer Char: 1,415.9105 acres
- Shilper Char: 1,852.5385 acres

Prime floral species of Afforested Forest

- Keora (*Sonneratia apetala*), Gewa (*Excoecaria agallocha*), and Bain (*Avicennia officinalis*) comprise 95% of the afforested area.
- Some Golpata (*Nypa fruticans*) were also planted on the bank of Ichakhali Khal (Outside of the Super Dyke Area).

Anticipated Impact on Forest Resources

- Afforested Mangrove species will be cut down due to the construction of road facilities, infrastructure, etc. for the NSEZ. Coastal mangroves act as a defense mechanism from cyclones and tidal surges. Without the mangrove species, the area would be vulnerable to cyclones & its associated tidal surges, and tsunamis.
- Habitat degradation and fragmentation of wild animals/species like migratory/winter birds, Spotted deer, Golden jackal, Monitors, Snakes, etc.

Suggestions/Recommendation

- Vegetation clearance should be at a minimum level.
- Green belt development on empty land inside the EZ area or within the EZ influence area should be established as early as possible.
- Poaching, and hunting of wild animals (migratory birds, spotted deer, monitors) should be prohibited.
- Building awareness related to the conservation of wild animals and other tree species in and around the EZ influence area.

Participant

Abdul Gafour Mollah, Forester, Range Officer, Mirsharai Range

1.2.51 Consultation with Forest Department - Coastal Afforestation Division, Sitakunda Range, Chattogram

Basic Details
Location: Forest Range Office, Sitakunda Range
District: Chattogram
Date: 05 October 2023
Purpose of the Visit: To consult with stakeholders about their perception regarding the development and operation activities, the impact of NSEZ on Forest resources like Mangrove afforestation, natural resources, avifauna, etc.
Key Point Discussed

Perception about the EZ

- The Forester, Forest Range Office, Sitakunda Range, Coastal Afforestation Division, Chattogram was found informed about the NSEZ and he knew about the development activities under the NSEZ.

Overview of the Coastal Forest Range of Sitakunda

- Afforested forest area from 1968 to 2021 is 7923.09 acres.
- In 2020-21 FY, the western part of the Bogachatar bit area and Bakkhali area has been afforested and the amount of afforested land was approximately 990 acres. In addition, another 1000 acres (approximately) of land will be afforested by 2024.
- In 2019-20 FY, 247 acres (approximately) of land has been afforested by non-mangrove species (1500 saplings) at the adjacent part of the Super dike area of Bogachatar under the 'Sustainable Forest and Livelihoods (SUFAL) project.'
- Total area of forest land under NSEZ needs to be confirmed.

Reserve Forest under the Section-20 of The Forest Act, 1927:

- A total of 6814.25 acres of land has been notified as "Reserve Forest" by the Gazette of the Peoples Republic of Bangladesh Government dated January 28, 2019 (Memo number: 22.00.0000.066.65.034.12-352).

Prime floral species of Mangrove Forest of Sitakunda Range

- Keora (*Sonneratia apetala*), Gewa (*Excoecaria agallocha*), and Bain (*Avicennia officinalis*) are the prime mangrove species in the Sitakunda Range.
- Goran (*Ceriops decandra*), Golpata (*Nypa fruticans*), and Casuarina Plantation have a minimum share.
- Non mangrove species like Casaurina, Babla (*Vachellia nilotica*), Rain tree (*Samanea saman*), Arjun (*Terminalia arjuna*), Akashmoni (*Acacia auriculiformis*), Jarul (*Lagerstroemia speciosa*)

Anticipated Impact on Forest Resources

- Mangroves provide a unique and diverse ecosystem that supports a wide variety of flora and fauna. Deforestation disrupts this delicate balance, leading to the decline or loss of various species, including fish, crabs, and mollusks that rely on mangrove habitats for breeding and feeding.
- Mangrove conservation becomes not just an environmental concern but a crucial aspect of safeguarding the socio-economic fabric of these regions.
- The planned construction of road facilities and infrastructure for the NSEZ poses a threat to mangrove species, essential for safeguarding coastal areas from cyclones and tidal surges. Without these mangroves, the region becomes more vulnerable to disasters.

- The degradation and fragmentation of habitats are impacting diverse wild animals, including migratory birds, spotted deer, golden jackals, monitors, and snakes. This poses a significant risk to the biodiversity and ecological balance of the area.

Suggestions/Recommendation

- Protecting the Super Dike and ensuring sustainable development within the NSEZ requires several crucial actions.
- Restricting illegal sand extraction in the Sandwip Channel, a particularly vulnerable area, is essential to maintain the dyke's stability.
- Implementing the Master plan's recommendation to afforest 25% of the Zone with native trees will support long-term sustainability.
- To preserve the ecological balance, we should set clear limitations on clearing mangroves and other vital vegetation.
- Establishing green belts of native trees on vacant land within the EZ area and its surroundings should be a top priority.
- Protecting wild animals through a strict ban on poaching and hunting of migratory birds, spotted deer, and monitors is vital for biodiversity conservation.
- Creating awareness campaigns about the importance of wild animals and tree conservation among local communities will foster engagement and promote long-term environmental protection.

Participant

Md. Kamal Hossain, Forester, Range Officer, Sitakunda Range

1.2.52 Consultation with Department of Agriculture Extension (DAE) – Mirsharai, Chattogram

Basic Details

Location: Upazila Agriculture Office, Mirsharai

District: Chattogram

Date: 18 January 2024

Purpose of the Visit: To consult with stakeholders about their perception regarding the NSEZ, impact of NSEZ on agricultural resources and local farmer communities of EZ areas, etc.

Key Point discussed

Perception about the NSEZ

- The Upazila Agricultural Officer, Department of Agriculture, was informed about the NSEZ and he knew about the development activities under the NSEZ.

Overview of Local Agricultural Practices, Farmer Communities and Resources

- Most of the land in the NSEZ is reclaimed. A few portion of that area is cultivated once a year.
- Most of the agricultural lands in the Upazila are single and double-cropped land.
- Major crops are:
    - *Aman/Rice (rice is the major crop. Currently around 1800 ha are rice cultivated land)*
    - *Boro is less cultivated due to the shortage of irrigation water.*
- BADC has a project which has not yet been functional.

Major Issues Hampering Agriculture

- Groundwater depletion is the main problem
- Salinity in groundwater
- One crop in a year in the char area

- Shallow tube wells
- Water shortage (both ground and surface) for irrigation.

Anticipated Impact on Agriculture

- Although some adverse impact is anticipated, farmers will also be benefited from the increased value of their production.

Suggestions/Recommendation

- High-yielding variety should be cultivated in more areas.
- Agricultural land should be avoided for infrastructural development.
- Proper mitigation should be adopted to protect agricultural land from the entrance of polluted water.
- Water should be protected from all types of pollution.

Participant

Protap Chandra Roy, Upazila Agricultural Officer, Mirsharai, Chattogram

1.2.53 Consultation with Department of Agriculture Extension (DAE) – Sonagazi, Feni

Basic Details

Location: Upazila Agriculture Office, Sonagazi

District: Feni

Date: 18 January 2024

Purpose of the Visit: To consult with stakeholders about their perception regarding the NSEZ, impact of NSEZ on agricultural resources and local farmer communities of EZ areas, etc.

Key Point discussed

Perception about the NSEZ

- The Upazila Agricultural Officer, Department of Agriculture, Sonagazi, Feni was found informed about the NSEZ and he knew about the development activities under the NSEZ.

Overview of Local Agricultural Practices, Farmer Communities and Resources

- Most of the agricultural lands are single-cropped land. The Agricultural Department is trying to convert these lands into double-cropped lands. The officer said, *"Around 90-95 percent of cultivated land of the area is cultivated once a year. We have already converted around 30% of single-cropped lands into double-cropped lands by introducing some short-term varieties, new agricultural practices, and creating awareness among the farmers."*
- The main products of this area are – watermelon, maize, paddy/Aman, mustard, sunflower, Indian pea/Khesari, etc. Watermelon yield is very high in the areas around the economic zone.
- The major cropping patterns of this area are –
    - Fellow – Maize – Fellow
    - Paddy – Maize – Fellow
    - Fellow – Watermelon – Paddy
- People usually cultivate these lands on lease.
- The market price of these lands is lower compared to residential land. Different companies target these lands to establish their industries.
- The number of Agriculture-dependent people is decreasing day by day. Oversees employment is popular in the area and many people look for employment abroad. Moreover, it is very common that local landowners rarely cultivate their farming land on their own. They usually lease their land to others and utilize the time doing other work.

- Now local farmers are using different types of agricultural technology and machines. As a reason, the need for agricultural labor is decreasing day by day.

Major Issues Hampering Agriculture

- Salinity in groundwater
- One crop in a year in the char area
- Shallow tube wells
- Water shortage (both ground and surface) for irrigation.

Anticipated Impact on Agriculture

- The local people use the water of the Muhuri Reservoir for irrigation purposes. The NSEZ authority will intake water from the Muhuri project/ Choto Feni River. It will have a great impact on the agriculture of the area.
- Due to the Economic Zone, the local people tend to lose an amount of their agricultural land. After the operation period, many people will be in this area for their residences and other facilities. As a result, a lot of new facilities such as hospitals, markets, and educational institutions will be established in the area. As a result, the amount of agricultural land will decrease.

Suggestions/Recommendation

- To build new facilities, avoid agricultural lands.
- Single-crop land needs to be converted into double-cropped land by adopting advanced agricultural technology and machinery.
- Excavation of irrigation khals and creation of additional reservoirs to preserve rainwater.

Participant

Mainuddin Ahmed, Upazila Agricultural Officer, Sonagazi, Feni

Md. Alamin Sheikh, Agricultural Extension Officer, Sonagazi, Feni

1.2.54 Consultation with the Department of Fisheries, Mirsharai

Basic Details

Location: Upazila Fisheries Office, Mirsharai

District: Chattogram

Date: 28 August 2023

Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, impact of NSEZ on fishery resources and local fishery communities of EZ areas, etc.

Key Point discussed

Perception about the EZ

- The Senior Fisheries Officer, Department of Fisheries, Mirsharai, Chattogram was found informed about the NSEZ and he knew about the development activities under the NSEZ.

Overview of Local Fisheries Practices, Fisherman Communities, and Resources

- Currently, both capture and culture fishery are there.
- The culture fish yield rate is six tons/acre in Mirsharai Upazila.
- Number of registered fishermen in the Upazila is around 2,557. Fisherman mostly catches fish in the Sandwip Channel using light fiber boats with diesel engines. Few fishermen in the EZ region catch fish in the deep sea.
- Regular government bans on fishing are followed in the Upazila. The government provides 86 kg of rice per family for the 65-day ban. There are additional bans in different seasons.

- Shrimp larva harvesting is legally banned but local fishermen used to harvest it.
- Fishermen communities.

Fish Landing Station/Ghat

- Four fish landing station/ghat are situated in the EZ area and are such as:
  - Saherkhali Ghat
  - Domkhali Ghat
  - Muhuri Ghat
  - Bamonsundor Ghat
- These ghats are being shifted from their original locations.

Anticipated Impact on Fishery Resources and Fishermen Communities

- Fishermen are reportedly facing challenges due to the increased navigation of vessels and ships for the implementation and operation of the NSEZ such as damaging fishing nets, disturbance to fish species, changing of fish migration routes, etc.
- Relocation of fish landing stations/Ghat's location has also been considered as an adverse impact due to the long distance between the ghat and fishing communities, less facilities for boat parking during cyclones, etc.
- Aquacultural practice is also popular in the surrounding areas of NSEZ. The agricultural land practice will face challenges in the future. Since land value is rising, local people will be interested in selling it which will be replaced by business activities.

Disaster Preparedness

- Disaster: 23 boats were damaged in cycle 'Mokha' as fishermen were unable to bring the boats inland through Khals/Khals due to the construction of the sluice gate.

Threat to the Fishery Resources and Fishermen Communities

- Frequent navigation of vessels and ships will hamper fishing in surrounding areas by interrupting the movement of fishing boats, netting in the sea, etc.
- It will also decrease fish roaming and production to a great extent.

Suggestions/Recommendation

- Introduce training and make the community well-equipped (e.g., bigger boat) so that they can catch fish in the deep sea.
- Emphasize accessing alternative fishing areas.
- Emphasize alternative occupations for affected fishermen such as providing training and support on IGA and skill development.
- Introduce livelihood training for the youth of the fishermen community.
- If there is any scope for laboring activities, people from the fishermen community could be engaged as a temporary solution.
- Create road access to the new fisheries landing site.
- Create a safe place for boats, particularly for securing the boat during cyclone time.
- Use of ETP and other measures to reduce surface water pollution.
- Reduction of marine traffic and avoid fish roaming areas as maximum as possible.

Participant
Nasim Al Masud, Senior Fisheries Officer, Mirsharai Upazila, Chattogram

1.2.55 Consultation with the Department of Fisheries, Sonagazi

Basic Details
Location: Upazila Fisheries Office, Sonagazi
District: Feni

Date: 30 August 2023

Purpose of the Visit: To consult with a stakeholder about their perception regarding the development and operation activities, activities, and involvement of DOF, the impact of the NSEZ on fish breeding, fishing, fishermen, and aquaculture in the EZ areas, the future of fishermen and alternative livelihood, etc.

Key Point discussed

Perception about the EZ

- The Department of Fisheries, Sonagazi, Feni is informed about the NSEZ although they did not participate in any activities of the NSEZ.

Current Activities of DOF

- DOF enforces Bans on fishing multiple times throughout the year. There is a 65-day ban from May to July and a 20-day ban on fishing in October. There are additional fishing site-specific bans that last from 30 days to 90 days to increase production by ensuring the breeding and migration of fish.
- Support to fishermen during the fishing ban. Each family gets 40 kg of rice per month during the ban period.
- DOF also provides cattle (heifers) and provides cattle rearing training as an alternative livelihood.
- Additionally, the fisheries department arranges awareness programs and conducts operations/campaigns with police to enforce bans.

Current Fish Production

- Fishermen from the Sonagazi upazila capture over 1,000 metric tons in a fiscal year.
- Production of over 7,000 metric tons from aquaculture in the upazila.
- There is a fisheries zone in the Upazila near Muhuri project. This area has breeding farms and a large number of ponds supporting aquaculture throughout the year.

Impact of EZ

- Reduced fish yield.
- Disruption of fish migration routes.
- Destruction of fish habitats.
- Fishing net destruction by cargo vessel propellers.

Fishermen Community & Affected Population

- About 800 registered fishermen who capture fish from the sea. Additionally, around 300 seasonal fishermen catch fish during the Hilsa season. Moreover, hundreds of fishermen catch fish with casting nets near riverbanks, low areas, and near seashores.
- There are artisanal fisherman communities in the upazila those are traditional fishermen communities called ‘Jaldas’.

Suggestions/Recommendation

- Reduce environmental pollution.
- Use of ETP

Participant

Turjo Shaha, Upazila Fisheries Officer, Sonagazi Upazila, Feni

1.2.56 Consultation with Bangladesh Water Development Board, Feni

Basic Details

Location: BWDB, Feni

District: Feni

Date: 28 November 2023

Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, current situation and works undertaken by BWDB, recommendations regarding future demand of NSEZ, the impact of NSEZ, etc.

Key Point discussed

Perception about the EZ

- The RESA team conducted a consultation meeting with the Sub-divisional engineer and work assistant of the BWDB Feni office.
- NSEZ is a major development activity for Bangladesh and BWDB officials are well aware of the EZ.

Current situation

- BWDB has developed a plan to construct an embankment from Ekram Beribad (near the Muhuri regulator) to the Musapur regulator (Sonagazi end) to protect the community and crops from flood and tidal overflow.
- It was found that the BWDB Feni division office already conducted a survey and soil test as part of their feasibility study for the embarkment.
- The Muhuri water reservoir is under BWDB, and it is an important project for the office.
- BWDB plans to construct embankments and other infrastructure to protect crops and people from flood, river erosion, and saltwater intrusion and the above-mentioned embarkment will be constructed in line with BWDB's work.

Participant

Abul Kashem, SDE & Yasin Bhuiyan, Work Assistant, BWDB, Feni

1.2.57 Consultation with Bangladesh Water Development Board, Chattogram

Basic Details

Location: BWDB, Chattogram

District: Chattogram

Date: 28 November 2023

Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, current situation and works undertaken by BWDB, recommendations regarding future demand of NSEZ, the impact of NSEZ, etc.

Key Point Discussed

Perception about the EZ

- BWDB Chattogram is well-informed about the EZ and holds a positive view.
- NSEZ is a major development activity for Bangladesh and BWDB officials are taking part in different activities related to development such as dyke construction.

Current situation/Activities

- Currently, the BWDB Super Dyke spans 22.5 km, with plans to extend it by an additional 12.5 km towards Sitakunda. Within the existing 22.5 km, the BWDB-financed BFD has successfully planted 100 acres of vegetation along the seaside.
- Notably, no survey has been conducted for dredging in the area, which is susceptible to cyclones due to its proximity to the Bay of Bengal. Despite this, the drainage system inside the dyke is robust.

- Groundwater tables may be impacted if industries extract water from the ground.
- To manage khal and embankment systems, BWDB has constructed 6 regulators and excavated *khals*.
- The extension project may require a temporary jetty for efficient construction material mobilization. Safety protocols mandate a minimum of 1 km distance from the coastline, and BWDB permission is essential for adherence.
- For the management of khal regulators, local residents may be involved.
- The khal lining in the NSEZ area will mimic natural conditions. If any excavation becomes necessary, BWDB will take the required steps to excavate the khals while ensuring uninterrupted flow.
- Additionally, the Detailed Project Proposal (DPP) for extending the super dyke by 12.5 km towards the Sitakunda side is already with the Planning Ministry. BWDB aims to commence work on this extension shortly.
- There are plans to excavate the khal from the Muhuri regulator to Zone 6, ensuring permanent protection of the banks on both sides. BWDB intends to plant mangrove trees along the seaside and other necessary trees on the opposite side. Similar initiatives were planned for the 22.5 km super dyke.
- BWDB intends to construct a 25 km super dyke towards the Feni side, which is currently in the planning phase.

Recommendation

- BEZA should coordinate with BWDB in case of any further development of any khals and embankments.
- If any further addition or change in the plan embankment or super dyke, BWDB should be consulted.

Participant

Mr. K M Julfikar Tareq, Superintending Engineer, BWDB

Dr. Tanvir Saif Ahmed, Executive Engineer and Acting Project Director, BWDB

Proshanta Talukder, Sub-divisional Engineer, BWDB, Chattogram

1.2.58 Consultation with Bangladesh Inland Water Transportation Authority, Chattogram

Basic Details

Location: BIWTA

District: Chattogram

Date: 29 November 2023

Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, current situation, and works undertaken by BIWTA, recommendations regarding future demand of NSEZ, the impact of NSEZ, etc.

Key Point Discussed

Perception about the EZ

- BIWTA Chattogram is well-informed about the EZ and holds a positive view of NSEZ as it is expected to greatly contribute to the economic development of the country.
- BIWTA has already made plans and started executing the plans for NSEZ.

Current Situation/Activities

- BIWTA has proposed the establishment of a permanent jetty in the vicinity, with a planned distance of approximately 2.5 km.
- The structural design and plan for this jetty have already been submitted.

- Addressing the dredging issue, BEZA must seek permission from the Deputy Commissioner's office. As a member of the District Balumahal Management Committee BIWTA can support the committee in making decisions by undertaking a hydrographic survey through its Hydrography Department.
- The ongoing World Bank project for dredging the river channel from Dhaka to Chattogram [Bangladesh Regional Waterway Transport Project 1 (Chattogram-Dhaka-Ashuganj Corridor)], BEZA can coordinate with BIWTA for dredging activities.
- Emphasizes the importance of enhancing inter-departmental collaboration to ensure the success of the project.

Recommendation

- BEZA should coordinate with BIWTA in case of any further development relating to the Jetty.
- If any further dredging is required, BEZA should consult and seek support from BIWTA.

Participant

Md. Shariful Islam, Sub Assistant Engineer, BIWTA, Chattogram

1.2.59 Consultation with Bangladesh Inland Water Transport Authority (BIWTA)

Basic Details

Location: BIWTA Bhaban, Dhaka

District: Dhaka

Date: 6 March 2024

Purpose of the Visit: To consult with stakeholders about their perception regarding their plan in the NSEZ, current progress, impact of NSEZ in the region, concern issues, expectations, suggestions, etc.

Key Point discussed

- Bangladesh Inland Water Transport Authority (BIWTA) will construct one permanent jetty having a capacity of 2,500 to 3,000 tons in the Sandwip Channel in cooperation with the Bangladesh Economic Zones Authority (BEZA).
- BEZA is providing land to implement the jetty project in the NSEZ.
- Jetty operations will be under the jurisdiction of BIWTA.
- The jetty construction proposal was sent to the shipping ministry seeking consent. Later, it was sent to the planning commission for approval.
- In the jetty area, there will be a terminal building, parking yard, boundary wall, access road, etc.
- During the construction of the jetty land development and dredging will be required.
- The jetty will provide infrastructure facilities to carry the rising volume of goods and items for local people in Chattogram and they will contribute to the economic development in the region.
- An expert team of the Bureau of Research, Testing, and Consultation (BRTC) under the Bangladesh University of Engineering and Technology has prepared the design for the jetty and yards and carried out the feasibility study.
- A contract agreement between BIWTA and the Tumas-Innovate Joint Venture was signed on 3rd March 2024 for providing consultancy services to the BIWTA for the design review and construction supervision of ancillary facilities, including jetties at Mirsharai in Chattogram.
- During the operation, net profit will be shared between BEZA and BIWTA. BEZA will get 45% and BIWTA will get 55% of the net profit.

- For the dredging permission, the Deputy Commissioner (DC) will decide in consultation with the district Balumahal management committee and BIWTA can assist as a member of the committee.
- According to the Balumahal and Soil Management Act, 2010 an sits amendment in 2023, prior approval of the authorities (Ministry of Land) will be required in the case of extracting and using sand or soil for the implementation of government activities or development projects. The authority can ask BIWTA to conduct a hydrographic survey at the designated waterways outside the seaport limits, where there is sand or mud. If it is not possible to survey by the BIWTA, then BWDB or any other government body will complete the survey.

Recommendation

- BEZA should coordinate with BIWTA in case of any further development and operation relating to the Jetty.
- If any further dredging is required, BEZA should consult and seek support from BIWTA.
- BEZA should consult with BIWTA if any hydrographic survey is required in the future.

Participant

Engr. ASM Ashrafuzzaman, Project Director, Design review and construction supervision of ancillary facilities, including jetties at Mirsharai and Sandwip in Chattogram, Sonadia Island in Cox's Bazar, and Sabrang and Jaliar Island in Teknaf Project, BIWTA

1.2.60 Consultation with Power Grid Company of Bangladesh (PGCB), Chattogram

Basic Details

Location: Power Grid Company of Bangladesh (PGCB)

District: Chattogram

Date: 30 November 2023

Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, current situation, and works undertaken by PGCB, recommendations regarding future demand of NSEZ, the impact of NSEZ, etc.

Key Point Discussed

Perception about the EZ

- PGCB Chattogram is well-informed about the EZ details and holds a favorable perspective.

Current situation/Activities

- A substation with a capacity of 140 MW * 2 = 280 MW, directly connected to the national grid, is already established by PGCB in the area.
- Consulted representative of PGCB notes that Palli Biddut has communicated the area's electricity demand, and PGCB is committed to supplying power in accordance with this demand. However, specific details regarding the electricity demand of the MEZ are yet to be precisely determined.

Recommendation

- BEZA should coordinate with PGCB in case of any further expansion of the services of PGCB in NSEZ.

Participant

Mr. Monjur Morshed, Executive Engineer, PGCB, Chattogram

1.2.61 Consultation with Power Grid Company of Bangladesh (PGCB), Dhaka

Basic Details
Location: Power Grid Company of Bangladesh (PGCB)
District: Dhaka
Date: 25 March 2023
Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, current situation, and works undertaken by PGCB, recommendations regarding future demand of NSEZ, the impact of NSEZ, etc.
Key Point Discussed
Perception about the EZ • The consulted stakeholder PGCB Chattogram is well-informed about the EZ details and holds a favorable perspective. Current situation/Activities • A 400 KV double-circuit transmission line is being implemented to feed the substation. This project is expected to be completed by 2026. • PGCB has taken its project based on the demand analysis carried out by BEZA. • Some power plants will be connected with the Grid of PGCB. • PGCB prepared a master plan with the financial support of BEZA. Recommendation • PGCB would provide all relevant support if BEZA asked. • PGCB will increase its capacity in the future based on the future demand.
Participant
Ms. Nafisa Sher, Manager, Environment and Social Unit Didarul Islam, Executive Engineer, System Planning, PGCB, Dhaka

1.2.62 Consultation with Bangladesh Meteorological Department (BMD), Chattogram

Basic Details
Location: Bangladesh Meteorological Department, Chattogram
District: Chattogram
Date: 03 December 2023
Purpose of the Visit: To consult with a stakeholder about their perception regarding the development and operation activities, current preparation, and works undertaken by BMD, recommendations regarding future demand of services within NSEZ, etc.
Key Point discussed
Perception about the EZ • BMD is well-informed about the EZ details and holds a positive perception of NSEZ. The consulted representative opined that the EZ would bring a significant change in the local economy. Opinion Regarding BMD's Activities and Future Services • While he acknowledges that basic weather forecasting information for the area can be covered by the local station, he recommends the establishment of a dedicated station in this vast industrial zone.

- According to Dr. Alam, BEZA should allocate a minimum of 3 to 4 acres of land to the Bangladesh Meteorological Department (BMD) for the creation of a dedicated station.
- BMD would then take responsibility for the necessary facilities.
- Additionally, he suggests that if BEZA desires, BMD could assist in monitoring air quality and providing other meteorological data exclusive to the NSEZ area.

Recommendations

- This collaborative effort would ensure a specialized focus on the unique weather patterns and environmental factors relevant to the industrial operations in the region.

Participant

Dr. Md. Shadakul Alam, Deputy Director, BMD, Chattogram

1.2.63 Consultation with Upazila Education Officer, Sonagazi

Basic Details

Location: Upazila Education Office, Sonagazi Upazila

District: Feni

Date: 30 August 2023

Purpose of the Visit: To consult with stakeholders about their perception regarding the development and operation activities, scope of involvement of UEO, preparation of UEO regarding future demand of NSEZ, the potential impact of NSEZ on the schools and education programs, etc.

Key Point Discussed

Perception about the EZ

- The education officer expressed his positive perception of NSEZ.
- He also expected that there would be a great extent of development in the Sonagazi area once the implementation of all major works of NSEZ is completed.

Overview

- There are 110 government schools in the upazila. 18 of those schools were built as makeshift cyclone centers and 92 schools are in general layout. There are a total of 14,973 students in the upazila. Additionally, there are 43 private schools/kindergartens in the area.

Suggestions

- Since the community demand for educational services will also increase, the establishment of new educational institutes (schools, colleges) will be required.
- Skills and capacity of teachers and all staff need to be increased in future.
- Infrastructural development of schools would also be required.

Participant

Upazila Education Officer, Sonagazi Upazila, Feni

1.2.64 Consultation with Upazila Education Officer, Mirsharai

Basic Details

Location: Upazila Education Office, Mirsharai Upazila

District: Chattogram

Date: 30 August 2023

Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, scope of involvement of UEO, preparation of UEO regarding future demand of NSEZ, the potential impact of NSEZ on the schools and education programs, etc.

Key Point Discussed

Overview

- There are 191 govt primary schools in the upazila with 43 non govt primary schools/kindergartens with a total of 77,000 students. More than of these schools are situated in the EZ study region.
- Playgrounds are scarce/unavailable in most schools which hampers students' participation in games and co-curricular activities.

Suggestions

- Considering the demand in the future due to the influx as an impact of NSEZ, educational institutes, the education department's capacity, and plans will require to increase by phases.
- The capacity of teachers with modern teaching techniques should be increased.

Participant

Upazila Education Officer, Mirsharai Upazila, Chattogram

1.2.65 Consultation with Upazila Education Officer, Sitakunda

Basic Details

Location: Sitakunda Upazila Parishad

District: Chattogram

Date: 4 October 2024

Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, scope of involvement of UEO, preparation of UEO regarding future demand of NSEZ, the potential impact of NSEZ on the schools and education programs, etc.

Key Point Discussed

Perception

- The Upazila Education Officer opined that the establishment of NSEZ city would contribute to improving the educational sectors of Upazila.
- Since people with different backgrounds, including high-profile officers will come, there is a scope for establishing international quality educational institutes.

Overview

- There are 98 government primary schools, 76 Kindergartens, 19 Ibtedaye Madrasah, 5 NGO schools, schools with multimedia facilities 54.
- The literacy rate in the upazila is 64% and the dropout rate is 2.5%.

Recommendations

- Considering the demand in the future due to the influx as an impact of NSEZ, educational institutes, the education department's capacity, and plans will require to increase by phases.

Participant

Mohammed Nurucchofa, Upazila Education Officer, Sitakunda Upazila, Chattogram

1.2.66 Consultation with Member of Parliament, Mirsharai, Chattogram

Basic Details

Location: Dhaka

District: Dhaka

Date: 5 March 2024

Purpose of the Visit: To consult with stakeholders about their perception regarding the development and operation activities, impact of NSEZ in the region, concern issues, expectations, suggestions, etc.

Key Point discussed

- The Member of Parliament (MP), Mirsharai, Chattogram is aware of the progress and initiatives taking place as part of the NSEZ's development activities. He is familiar with the master plan of NSEZ prepared by BEZA.

Land acquisition, compensation, rehabilitation, and livelihood restoration

- BEZA has reclaimed land from the sea. No agricultural land was acquired for the EZ. Agriculture-dependent people should not be affected.
- It would be preferred if no agricultural/productive land is acquired for this EZ. Agricultural land having three cropped areas should not be acquired for the proposed development considering the further food security issue.
- For the rail line establishment, additional land acquisition will be required, and they are expecting that less amount of land will be required as it is a linear project. To implement the master plan of the EZ, local people will extend their possible cooperation in terms of land acquisition if the EZ authority ensures proper compensation as per government law.
- For the improvement of existing roads and construction of new roads land acquisition will be required including resettlement. In such cases, proper compensation and rehabilitation must be ensured as per government law.
- The most affected people are the buffalo owners, grazers, and fishing communities among others in the region. Proper capacity-building training and employment should be generated for them as well as their household members. A separate grazing area for livestock including access to water for buffalo can be searched.
- Due to the implementation of the NSEZ, the fish landing has already shifted, and access to the internal khals to move to the sea for fishing is restricted.

Township and accommodation development and controls

- Separate townships should be developed to manage the population influx considering the provision of schools, hospitals, markets, graveyards, mosques, playgrounds, sports complexes, recreational facilities, etc.
- Separate accommodation facilities for the workers and investors.
- Immediately it is needed to introduce an authority like RAJUK to govern the building construction and overall development in the region considering the further population influx in the region. Currently, houses, shops, and markets are being constructed beside the existing roads. Further expansion of existing roads will be required in the region. In that case, such types of structures will be a problem during land acquisition for road development.
- For the construction of the buildings, sustainable building materials should be preferred.

Energy and Water Resources

- Renewable energy, conservation of water, rainwater harvesting, etc. should be introduced in the NSEZ and be built as a planned city.
- NSEZ should install captive power plants or its own electricity production system so that it can avoid pressure on the surrounding region.
- Now NSEZ is using groundwater which is not a suitable option. Nowadays the salinity of groundwater in the region has already increased. The groundwater crisis in the region has already been observed and assuming a conflict with the local community in the future.

- CWASA has initiated a project to extract surface water from the Meghna River and supply it to the NSEZ. NSEZ also considered it as a surface water source in their planning. However, it is not a feasible option considering the unit price of water.
- A desalinization plan can be considered in the planning.
- The option of rainwater harvesting should also be considered.

Environment and natural resources

- Due to the activities of BEZA in the NSEZ and local community, an impact has already been made on the local mangrove forest in the region. Avoidance of deforestation should be ensured immediately to protect the environment.
- A plantation/green belt must be developed along the super dyke of the NSEZ to protect the area from cyclones and tidal surges.
- Wild animals in the NSEZ site forest area have been impacted. It needs to immediately capture the wild animals and send them to the forest/hilly area/wildlife sanctuary.
- Dredging activities in the sea are done by BEZA as well as outsiders. It should be controlled by deploying law enforcement agencies.

Waste management, and treatment

- The establishment and function of STP, ETP, WTP, and CETP must be ensured to protect the environment in the region.
- Proper solid waste management facilities must be ensured in the NSEZ.
- Wastewater recycling and reuse must be ensured in the NSEZ to avoid extra pressure on water resources.

Roads and communication

- Road widening will be required to accommodate the additional traffic in the region.

Fire safety and emergency response

- There are two fire stations in the area, however, the capacity of the station is inadequate. Dedicated fire stations having modern firefighting equipment will be needed in the industrial region.

Training, and employment generation

- A world-class vocational training center should be established for developing skilled manpower for the NSEZ and they can work outside of the country if required.
- The execution of the EZ will generate numerous job opportunities across various industries. Local people and affected people should be given priority.
- A 10% quota system could be introduced for the employment of local people.
- The implementation of the NSEZ is expected to lead to significant growth in various businesses. Consequently, there will be a substantial increase in the number of shops and markets, creating numerous job opportunities for many individuals.

Sports, recreation, and tourism development

- A sports complex could be established to facilitate sport and recreation of the young generation.
- Tourist activities will be increased if facilities like a wildlife sanctuary, hiking, bicycle tracks, riverine tourism, safari park, etc. can be introduced in the region.
- Guided tourism in waterfalls could be introduced to avoid accidents and incidents.
- Considering the natural beauty of the area, there is a scope for ecotourism development.

Law and order

- Strengthen law and order in the area. To ensure security, engage tourist police and coast guard in the NSEZ surrounding area.
- Risks of drugs/narcotics should be considered and take adequate measures to control them.
- The capacity of law enforcement agencies should be enhanced to

Participant
Mahbub-Ur Rahman Ruhel, Member of Parliament (MP), Mirsharai, Chattogram

1.2.67 Consultation with Member of Parliament, Sitakunda, Chattogram

Basic Details
Location: Dhaka
District: Dhaka
Date: 6 May 2024
Purpose of the Visit: To consult with stakeholders about the perception and observation of the stakeholder regarding the current activities under the implementation of the NSEZ in his area, his opinion regarding land acquisition and other impacts of NSEZ in the region, concerns issues, expectations, suggestions, etc.

Key Point discussed

- The member of parliament discussed his perception regarding the negative and positive impacts of the NSEZ in the Sitakunda area. While he expressed his willingness to cooperate with the project implementation for economic development, he also emphasized adopting proper mitigation measures to reduce the negative impacts on the community and natural resources.

Roads and communication

- Currently, the internal roads and communication inside the Sitakunda particularly in Saidpur and Muradpur are sufficient.
- If any further population pressure is made, the expansion of the roads will be required.
- There are some roads that connect Muradpur and Saidpur to the Dhaka-Chattogram Highway such as Mirer Hat bound roads, Saidpur Ferryghat Roads, etc.

Education, Training

- Educational institutes are sufficient considering the current demand in Saidpur but insufficient in the Muradpur area.
- Several schools, colleges, and technical educational institutes should be established in Muradpur, Saidpur, Baroirdala, and Sitakunda Paurashava.

Livelihood Restoration

- There are two Jele Para (fishermen community) in Uttar Borag Char. They are artisanal and have practiced fishing over the generations.
- They will be impacted greatly. Although it will be difficult to restore their livelihood, it should be done anyhow.
- Their new generation is achieving educational qualifications who could be considered for jobs as per their level of qualifications.

Other Facilities Development

- The MP has already taken the initiative to develop healthcare facilities in Sitakunda. As a part of his attempts, Sitakunda Upazila Health Complex is going to enhance its capacity from 50 beds to 100 beds.
- There is also a plan to build a 20-storied building to increase its infrastructural capacity.

Tourism

- There will be a scope of tourism development in Sitakunda.
- Guliakhali Sea beach, Marine drive could attract visitors to its beauty.

Participant

S M Al Mamun, Member of Parliamen, Chattogram-4 (Sitakunda), Chattogram

1.2.68 Consultation with Member of Parliament, Sonagazi, Feni

Basic Details

Location: Sonagazi

District: Feni

Date: 28 January 2024

Purpose of the Visit: To consult with stakeholders about their perception regarding the development and operation activities, scope of involvement of public representative/member of parliament, impact of NSEZ in the locality, perception & attitude of the community regarding NSEZ, land acquisition, and grievance mechanism, preparation of local government regarding future demand of NSEZ, recommendation, etc.

Key Point discussed

Perception about the EZ

- The member of parliament (MP) is aware of the implementation of the NSEZ. He also expressed his willingness to extend all his cooperation to the NSEZ.
- He is also informed about the planned accommodation, educational facilities, and other city facilities according to the master plan of NSEZ.

Opinion Regarding the Implementation of NSEZ

- Lands are mostly reclaimed and around 5,000 acres of land are from 1 no. Khash Khatian. Some portions of land at the Sonagazi end are unused by any party.
- The MP observed that the overall progress is slow and there is no visible progress at the Sonagazi end.
- BEZA should start work in the Sonagazi part as soon as possible otherwise people's perceptions may change, and it could be difficult to ensure the cooperation of the local community.
- Sonagazi could be a major source to meet the labor demand once most of the factories start their operation.
- In addition to the employment opportunities in NSEZ directly, numerous scopes for new businesses and services would be created in the area.
- Occupational shifting would take place at Sonagazi and other nearby areas. People of other occupations like fishing, day laboring, etc. would get interested in industry work.

Opinion Regarding Readiness of Sonagazi Upazila (road network, housing structure, services, etc.)

- The MP opined that the Upazila is not ready yet to handle any influx of population in terms of its road connectivity.
- The service facilities (healthcare, social services) are inadequate for any future demand.
- Roads are inadequate in number, size, and carrying capacity.
- Residential structures are not sufficient within the community to house any.
- Union Parishad like 6,7,8 are the most potential for future accommodation.

Concern

- Although Land acquisition and EZ activity started in 2016, the MP observed no progress in Sonagazi end.
- The land grabbers are illegally establishing fishery projects in the Char area within NSEZ's boundary, which would be resource and time-consuming for BEZA when they delay more to start work in the area.

- The fishing community is likely to change their occupation considering the other paid works are more profitable. They are already experiencing a declining trend in fish amounts.

Issues regarding Employment, Grazing, etc.

- Although NSEZ would impact grazing land, the grazer would move to other areas gradually.
- Agricultural land would also be reduced day by day. People will prefer to build structures for business purposes.
- To support the NSEZ, many informal feeder industries will be established outside NSEZ. Sonagazi would be one of the suitable locations for such industries.

Suggestions/Recommendation

- BEZA should immediately start fencing and demarking their boundary to keep it safe from the grabbers.
- Establish the following institutes/facilities to meet the future demand of the area:
    - Medical Institute/Medical College
    - College and University
    - Reserve quota for local eligible students in NSEZ's international educational institutes.
    - Engineering College/Technical Institute to prepare local youth as skilled manpower to meet the demand of NSEZ.
- More fire services are required to respond to future emergencies.
- Existing disaster management activities should be strengthened and expanded in the future.
- Buffalo grazers and fishing community members will require livelihood restoration training.
- Develop road connectivity from Koshka to Muhuri Project via Nobabpur and Kodomtali.
- Develop more road connectivity by assessing the most feasible ones. There are some roads that could be faster routes to connect the NSEZ residential area to the Dhaka – Chattogram Highway.
- Avoid all forms of pollution.
- Establish adequate drainage to avoid unexpected waterlogging and environmental pollution.

Participant

Lt General Masud Uddin Chowdhury (Retd), Member of Parliament, Sonagazi, Feni

1.2.69 Consultation with Nearby Municipality – Sitakunda Paurashava

Basic Details

Location: Sitakunda Paurashava

District: Chattogram

Date: 16 January 2024

Purpose of the Visit: To consult with a stakeholder about their perception regarding the development and operation activities, the impact of NSEZ on his municipality, the scope and need of future development in his area, suggestions and recommendations, etc.

Key Point discussed

Perception about NSEZ

- The Mayor of Sitakunda Paurashava was well-informed about the EZ and he expressed a positive perception about the NSEZ. Considering the future influx and population pressure in his area and, the impact on local infrastructures, road connectivity, and tourist posts, he emphasized developing some facilities in his municipality and adjacent areas.

Opinions about Roads, Housing, and other Local infrastructure

- The mayor emphasized developing road connectivity within and surrounding the Paurashava.
- The municipality is not developed enough in terms of infrastructural facilities. It would be challenging to provide residential and utility support to the increased population in the future. He opined that there is a great need for allocation of the budget for their infrastructural development.
- The condition of the present drainage system is not adequate. It needs to be developed to meet any future demand.
- The housing facilities are insufficient to tackle any future demand. If any influx takes place, we have to develop in this sector. For housing development, he proposed some areas as follows:
    - Dakshin Edilpur
    - Shibpur

Service Facilities (utilities, waste management, and others)

- He also mentioned the need for a waste management system within the Paurashava. Currently, there is no waste management system in the Paurashava. There is some potential space for developing waste dumping stations near hills.
- The mayor suggested assessing if there is any scope for water supply facilities from CWASA. He stated:

    "I have come to know that CWASA will supply water to NSEZ. My request is to consider if there is any way to connect my Paurashava with their lines. I think it would be possible."
- The existing market is sufficient for current demand, and it will require development in case of any increased demand in the future.
- At least one (1) central graveyard will be required at each ward. There is a Mohashoshman (crematorium) that would also require development with modern facilities.

Opinion about Tourist Spot Development

- The mayor realized that there would be a demand for recreational facilities and tourism if a city developed at NSEZ. The existing tourist spots such as Sitakunda Botanical Garden and Eco-Park, Laldighi need to be developed. Some other tourist spots outside the Paurashava could also have potential for tourism development.
- The mayor also raised concern that the opportunity for tourism development could be missed and a negative impact on the environment of tourist spots may be made if there is no development plan targeting the attractive spots of the areas.
- The Hindu community of Sitakunda organizes the *Shib Chaturdashi Mela* (a religious fair of the Hindu community) at Sitakunda every year where more than a hundred thousand Hindu people join. This event could also be supported to develop 'religious tourism' in the area.

Recommendation

- Multi-departmental coordination and funds need to be allocated for development in the Paurashava area.
- Link water supply with CWASA supply line to NSEZ.
- Establish foot overbridge.
- Build service lanes along the highway.
- A drainage system should be established on a priority basis.

Participant
Badiul Alam, Mayor, Sitakunda Paurashava, Chattogram

1.2.70 Consultation with Nearby Municipality – Mirsharai Paurashava

Basic Details

Location: Mirsharai Paurashava

District: Chattogram

Date: 16 January 2024

Purpose of the Visit: To consult with a stakeholder about their perception regarding the development and operation activities, the impact of NSEZ on his municipality, the scope and need of future development in his area, suggestions and recommendations, etc.

Key Point discussed

Perception about NSEZ

- The Mayor of Mirsharai Paurashava was well-informed about the EZ and he expressed a positive perception of the NSEZ.
- He discussed the future influx and population pressure in his area and the anticipated impact on local infrastructures, and road connectivity. He also opined that NSEZ will be the third biggest city in the country.
- NSEZ authority had consulted with the mayor about their master plan.

Opinions about Roads, Housing, and other Local infrastructure

- At present, a World Bank-supported project is being conducted named RUTDP to develop different selected Paurashavas to make them model cities. Mirsharai is one of those selected paurashavas. The project is aligned with the Mirsharai development plan.
- The roads are not adequately developed in terms of width and numbers. The mayor emphasized developing road connectivity within and surrounding the Paurashava.
- The mayor mentioned that they have a plan to widen the local roads (18 feet) for the easy movement of local people and the upcoming flow of population and already LGED has allocated 28 crores for it.
- The mayor suggested constructing a road from Mirsharai to the NSEZ site. It will take 15 minutes to go to the EZ area from Mirsharai by road. It will be timesaving for the transportation of local people and the upcoming population.
- As a lot of people will reside in the Paurashava area during the operation phase of the NSEZ, it will create huge pressure on the current infrastructure.
- The upcoming population could reside at Narayanhat and Fatikchari. There is a scope of constructing a 30 ft width two-lane road named Narayanhat – Fatichari Sarak.
- The Paurashava is assuming that around one million people will come to the NSEZ surrounding area and a major number of them will look for houses in the Mirsharai Paurashava area.
- It would be a great opportunity for local people for business and other types of occupations.
- There will be a great demand for housing facilities. Many real estate companies will invest in the area.
- The mayor mentioned that some development initiatives will be taken soon as a part of the Mirsharai development plan.
- The mayor suggested an area named Mahasimpur for developing the residence and market facilities of the upcoming population flow. A mentionable amount of land is available there to serve this purpose.

Service Facilities (utilities, waste management, and others)

- The manpower and logistics of Paurashava will be increased with the uprising demand for its services.
- A rubber dump at the starting point of Gobania waterfall is required to provide fresh water to the Bamansundar khal.
- The number of educational institutions needs to be increased to meet the pressure of the upcoming population.

- At present, there is no waste management system available in the paurashava due to lack of enough land/ area.
- Local people usually use groundwater for their drinking purposes. DPHE extracts groundwater and supplies it to the whole area. They do not get any water from Mahamaya Lake.

Recommendation

- Agricultural land should be protected from any infrastructural development.
- Construct new roads towards NSEZ and connect nearby areas with the Paurashava.
- Establish a waste management system as soon as possible.
- A functional drainage system is required.

Participant

Md. Gias Uddin, Mayor, Mirsharai Paurashava, Chattogram

1.2.71 Consultation with Nearby Municipality – Sonagazi Paurashava

Basic Details

Location: Sonagazi Municipality

District: Feni

Date: 17 January 2024

Purpose of the Visit: To consult with a stakeholder about their perception regarding the development and operation activities, the impact of NSEZ on his municipality, the scope and need of future development in his area, suggestions and recommendations, etc.

Key Point Discussed

The Mayor of Sonagazi Paurashava was well-informed about the EZ and he showed a positive perception about the NSEZ. Considering the future influx and population pressure in his area, he demands some facilities.

Opinions about Roads and other Local infrastructure

- The municipality is not developed enough in terms of infrastructural facilities. It would be challenging to provide residential and utility support to the increased population in the future. They opined that there is a great need for allocation of the budget for their infrastructural development.
- The condition of the present drainage system is too low. It needs to be developed to assess and target current and future needs.
- The local roads are narrow and inadequate. In some areas, roads are damaged. The mayor mentioned,

"As BEZA has planned to build the residential facilities in NSEZ's Sonagazi end, there will be a lot of population pressure due to labor influx and their follows. These people would mainly use the local roads for their transportation, houses to reside, and generate waste in the area. All these services are not adequate till now."

Service Facilities (utilities and others)

- Local people generally use LPG gas for their cooking purposes. The mayor demanded a natural gas supply for the local people and the upcoming flow of the population.
- At present, the Bangladesh Rural Electrification Board supplies electricity in this area. They would need to increase their capacity to supply more to meet the demand of the huge population.
- There is no supply of fresh water in the area. Local people depend on deep tube wells (DTW) and collect water from there.

- They use the water for their cooking and drinking purposes. Salinity and arsenic contamination are common in groundwater.
- The Paurashava mayor mentioned that medical facilities are low in the Paurashava area.
- The existing market is sufficient for current demand, and it will require development in case of any increased demand in the future.

Recommendation

- Employ local people in the industries of NSEZ.
- The mayor recommended to ensure uninterrupted electricity facilities in the area.
- There is a need for a waste management system and drainage system.
- The mayor demanded fresh water supply for the area.
- Ensure natural gas in the area.

Participant

Adv. Md. Rafiqul Islam (Khokon), Mayor, Sonagazi Paurashava, Feni

Tasmim Akter, Ward no – 4,5,6 (Reserved), Sonagazi, Feni

Sheikh Kalimullah, Panel Mayor 1, Ward – 8, Sonagazi, Feni

Sheikh Abdul Halim, Ex-Counselor, Sonagazi, Feni

1.2.72 Consultation with Upazila Chairman – Mirsharai Upazila

Basic Details

Location: Mirsharai Upazila Parishad

District: Chattogram

Date: 15 January 2024

Purpose of the Visit: To consult with a stakeholder about their perception regarding the development and operation activities, the impact of NSEZ on his upazila, the scope and need of future development in his area, suggestions, recommendations, etc.

Key Point Discussed

Perception about NSEZ

- The Upazila Chairman was well-informed about the EZ, and he expressed a positive perception of the NSEZ. He also discussed the progress of the implementation, local infrastructure, future needs, etc.
- He opined that the NSEZ will contribute greatly to creating employment of around one million people in the greater Chattogram region and the Mirsharai area will be the heart of the development.

Opinions about Roads, Housing, and other Local infrastructure

- As a result of future influx, the agricultural land will be decreased day by day, therefore proper planning is required to ensure the better utilization of the land.
- If NSEZ authority acquires the rest of the lands for residential purposes or residential buildings are established by individual entities, the agricultural production of the area will be affected greatly.
- The hillside fallow lands shall be used to protect the agricultural lands.

Service Facilities (utilities, waste management, and others)

- To face the challenge of the upcoming influx the capacity of the social infrastructure should be enhanced.

- The capacity of the relevant government departments should be enhanced as per the need assessment.

Opinions about Environment and Forest

- A mentionable extent of the forest area of Mirsharai has been impacted due to the implementation of NSEZ. The tree plantation and green belt development is expected to mitigate that impact.
- New Chars have been raised in different sides of the EZ area, and the chairman asked for increasing forestry in these chars.
- Though local people used to graze their buffaloes in those areas, the chairman requested to use those lands for forestry instead of grazing purposes.

Recommendation

- Water facilities need to be improved for the community areas and water pollution should be avoided during the development and operation of the NSEZ.
- For the further development of NSEZ agricultural land shall be avoided.
- The implementation of NSEZ including other facilities like housing and infrastructure should be completed in the stipulated timeframe.
- Introduce livelihood training for buffalo grazers and fishing communities so that they can seek their livelihood through their choices.
- Potential sources of air pollution should be identified clearly, and mitigation measures should be confirmed. Air, water, and sound pollution should be prevented as much as possible.

Participant

Md. Jashim Uddin, Upazila Chairman, Mirsharai, Chattogram

1.2.73 Consultation with UP Chairman, Ichhakhali Union

Basic Details

Location: Mirsharai

District: Chattogram

Date: 09 November 2023

Purpose of the Visit: To consult with stakeholders about their perception regarding the development and operation activities, scope of involvement of local government (Union Parishad), effect of NSEZ in the locality, perception & attitude of the community regarding NSEZ, land acquisition, and grievance mechanism, preparation of local government regarding future demand of NSEZ, the impact of NSEZ on union parishad, recommendation of representatives of local government, etc.

Key Point discussed

Perception about the EZ

- The UP chairman is aware of the implementation of NSEZ, and he played the role of resolving some land-related issues.

Current Situation

- Land acquisition and EZ activity started in 2016.
- Private land and even the Khash lands were the most important assets for the local people. Those who have faced an impact on such assets expected assistance from the BEZA.
- Compensation for squatters has been provided accordingly. Most of the squatters have already been relocated to the Gucchha Gram EZ area developed by the Government of Bangladesh. However, the alternative livelihood arrangement should be ensured for all the EZ-affected families.

Concern

- UP Chairman has already prepared and provided a list of 150 impacted households to BEZA for livelihood training, and BEZA is taking the initiative accordingly.
- There is a risk of drug addiction in these areas. The administration should take steps now otherwise it will destroy the local young generation and crime may increase.
- Fish landing stations have been relocated, which has been a problem for local fishery communities. It takes time to reach the ghat from the fishery community area.
- There are many tourist spots and natural resources surrounding the NSEZ area. Although there will be a very positive impact, environmental pollution may also take place if proper maintenance is not done.

Issues regarding Employment, Grazing Land, etc.

- Buffalo grazing was an important employment source for local people, but the grazing land was reduced greatly. The list of grazers should be developed by BEZA, and the alternative livelihood arrangement should be ensured.
- Agricultural land will be reduced day by day thus a shift in the occupational pattern is expected. Presently, a Trade license is issued by the BEZA. The UP chairman specifically mentioned that Union Parishad should have the authority to issue trade licenses.

Suggestions/Recommendation

- To include the Chairman in the grievance resolution committee (if any).
- Take steps to control drug addiction issues.
- Speed up the compensation disbursement process.
- Take steps to save wild animals and biodiversity and natural resources like forest areas. These are the unique assets of the areas.
- Need more presence of law enforcement agencies to maintain law and order in the areas. Due to the influx, it will be another challenge.
- To support agricultural practices in the areas, a plan should be taken to increase access to surface water, if possible.
- No pollution should be allowed. Air, noise, and water pollution should be prevented as maximum as possible.
- Ensure drainage system to avoid future water logging and drainage congestion.

Participant

Nurul Mostafa, Union Parishad Chairman, Ichhakhali Union, Mirsharai, Chattogram

1.2.74 Consultation with UP Chairman, Saidpur Union

Basic Details

Location: Mirer hat, Sitakunda

District: Chattogram

Date: 8 November 2023

Purpose of the Visit: To consult with stakeholders about their perception regarding the development and operation activities, scope of involvement of local government (Union Parishad), effect of NSEZ in the locality, perception & attitude of the community regarding NSEZ, land acquisition, and grievance mechanism, preparation of local government regarding future demand of NSEZ, the impact of NSEZ on community, union, recommendation of representatives of local government, etc.

Key Point discussed

Perception about the EZ

- The UP chairman is aware of the EZ.

- No land is acquired by the government presently.
- The UP chairman is not involved in GRC.

Current Socioeconomic status

- According to consultation, the number of markets is sufficient for the current demand. It will require development to meet future demand if the labour influx occurs.
- The area has potential for growth.
- Roads are narrow and need to be widened to meet the present requirements of the community and increase traffic.
- The area is peaceful, with no apparent threat or security risk in the union. People are hardworking. The majority are involved in agriculture and small-scale businesses/shops in markets.
- Most of the residents are dependent on fisheries, agriculture, and buffalo grazing. Some own shops. There are not many opportunities or options available for community people as employment. Fishing areas and grazing land have already faced the impact of the development.
- Agricultural land will face a great impact in the future if the community houses a great number of migrated people. People may replace their agricultural land with business structures such as rental housing, shops/markets, etc.
- This area is rich in fishery resources. Preparation needs to avoid any harmful impact on fishery resources and fishing communities. They will require livelihood support.

Impact of the EZ on People, Economy & Environment

- NSEZ will create employment opportunities for community people.
- Infrastructure will develop as a result of NSEZ.
- Labor and population influx may occur. The respondents suggest majority of workers will choose the Saidpur area for residence as communication with NSEZ will be convenient for the factory workers and they can avail of cheap accommodation with access to commodities from the local market. At present, local structures like housing and service facilities are not adequate to meet that potential demand. It requires development in response to time-to-time demand.
- Subsequently, the chairman expects an economic boom as the demand will increase, and the volume of business will increase in the local market.
- The potential of a tourist zone, there are multiple beaches that attract tourists. A huge influx may impact these places if no plan and protection are followed.
- Potential environmental degradation. There are wild deer in the coastal mangrove area, they will lose their habitat once the EZ activity commences. Other animals (foxes, and fishing cats) will also lose their habitat.

Suggestions/Recommendation

- Need a police station in the area.
- The government can develop tourist zones in the area.
- Fish landing stations/Ghat should be more accessible for fishery communities.
- Need more presence of law enforcement agencies to maintain law and order in the areas. Due to the influx, it will be another challenge.
- Reduce dependency on groundwater.
- Increase the number of schools, clinics/health services, community infrastructure, etc.
- Protect natural resources like forests, wild animals, water, hills, etc.

Participant
HM Tajul Islam, Union Parishad Chairman, Saidpur Union, Sitakunda, Chattogram

1.2.75 Consultation with Union Parishad Chairman - Sonagazi

Basic Details
Location: Songazi Union Parishad, Sonagazi
District: Feni
Date: 17 January 2024
Purpose of the Visit: To consult with stakeholders about their perception regarding the development and operation activities, scope of involvement of local government (Union Parishad), effect of NSEZ in the locality, perception & attitude of the community regarding NSEZ, land acquisition, and grievance mechanism, preparation of local government regarding future demand of NSEZ, the impact of NSEZ on union parishad, recommendation of representatives of local government, etc.

Key Point Discussed

Perception about the EZ

- The UP chairman is aware of the implementation of NSEZ.
- Local people still lack adequate information regarding the development in the Sonagazi end. They ask the UP Chairman about the development and operation activities, and the chairman tries to describe as per her knowledge about the EZ.
- The chairman is expecting a great extent of employment in the NSEZ from her area.

Current Situation

- There is a mixed perception regarding land acquisition, reduction of fishing areas, etc.
- Fishermen are interested in knowing more if there is any possible impact on fishing.
- The young generation, particularly local laborers are expecting job opportunities in the NSEZ area.

Existing Community Structure and Institute in the UP

- Four cremations require development.
- Community Clinic: 5 nos.
- Temple: 7 nos.
- Several mosques
- Cyclone shelters
- Madrasah
- Primary and Secondary School
- There is a need for a playground in the UP area

Suggestions/Recommendation

- Employ local laborers as much as possible.
- Increase law enforcement in the local areas.
- Take steps to control drug issues in the future.
- Prevent water pollution by both industries and the community in the future.
- Take steps to save biodiversity and natural resources like forest areas.
- Need more presence of law enforcement agencies to maintain law and order in the areas. Due to the population influx, it will be another challenge.

Participant

Umme Ruma, Union Parishad Chairman, Sonagazi Union Parishad, Sonagazi, Feni

Khadiza Akhter Nazma, Women ward member (reserved), ward no. 4,5.6, Sonagazi Union Parishad, Sonagazi, Feni

Imam Hossen, Ward Member, Ward no. 6, Sonagazi Union Parishad, Sonagazi, Feni

1.2.76 Consultation with Officer in Charge, Police Station, Mirsharai

Basic Details
Location: Police Station, Mirsharai Upazila
District: Chattogram
Date: 09 November 2023
Purpose of the Visit: To consult with stakeholder about their perception regarding the EZ activities, the current situation regarding security, the scope of involvement of police, preparation recommendation of police regarding future demand of NSEZ, the impact of NSEZ on the security of EZ areas, etc.

Key Point Discussed

Perception about the project

- The officer in charge of Mirsharai Police Station, Chattogram is informed about the NSEZ. They are actively providing security in the EZ area. The current OC has been in the post for the last 20 months. According to respondents, the NSEZ will represent Bangladesh in the future and will create a positive perception of the country among foreign investors & visitors.

Impact of the NSEZ Implementation

- Implementation of NSEZ will result in great social and economic development in the region.
- Thousands of job opportunities will be created, and the livelihood options will be increased. Since the EZ will directly contribute to the livelihood creation of the people both in industry and community level, the socioeconomic life will be changed greatly.
- Along with the positive impacts, crimes will also increase due to the influx of people in the areas.

Current Security Situation & Activities in the Area.

- High population density and low morale are the major reasons behind the deteriorating safety and security in society. Enforcement of the law is keeping people with criminal intent in check and preventing crimes.
- Pirates are the main threat in the coastal areas of Sandwip, Urir Char, and Noakhali coastal area.
- The highway is used by a large number of vehicles and private cars are used in the highway to commit crime sometimes as the station has to provide security of 20 KM national highway with a minimal force of 3 vehicles and total manpower below 80.
- Current Force Capacity: SI 18, ASI 12, Constable 45.

GBV & Social Issues

- The majority of the issues related to GBV are based on ICT use and associated implications. Parents can control the use of mobile phones and supervise their children.
- Reported cases of GBV and domestic violence are very low.

Requirement to Meet the Future Demand & Recommendation

- The area needs a new Police line to maintain law and order considering the future demand.
- Three new police stations in the NSEZ area. Namely, Muhuri Police Station, Ichhakhali Station, and Saherkhali Police Station are proposed by the OC to meet future demand. A separate structure with DIG in the chair should be created for the NSEZ zone.
- Tourist spots are very important resources of the area particularly for Mirsharai and Sitakunda. These areas need to be protected and plan development for tourist attraction. Tourist police for the tourist zone of NSEZ will also be required.
- Specialized economic police for the economic zone.
- Needs to be well-equipped with equipment and vehicles.
- Need River police for the coastal area with proper boats and equipment.

- Cooperation with the Coast Guard to increase efficiency.
- Police units posted in the zone require specialized training to improve situational awareness and polite and cordial service delivery.
- Force deployment and duty hours should be fixed.
- Police need to be equipped with spray, riot shields, and riot suits.
- Behavior and gender training.
- Screening the police members before deploying in economic zones to create a corruption-free force.
- Dedicated medical center and ambulance for the police members and their families.
- Allocation of fuel for vehicles.
- Allocation of driver, boatsman, etc.
- Unique ID card for every employee/factory worker in the economic zone.
- Different uniforms for the police in the economic zone.

Participant

Kobir Hossain, Officer in Charge, Mirsharai Police Station, Chattogram

1.2.77 Consultation with Officer in Charge, Police Station, Sitakunda

Basic Details

Location: Police Station, Sitakunda

District: Chattogram

Date: 09 November 2023

Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, current situation regarding security, the scope of involvement of police, preparation recommendation of police regarding future demand of NSEZ, the impact of NSEZ on the security of EZ areas, etc.

Key Point discussed

Perception about the EZ

- The RESA study team conducted a consultation meeting with the officer in charge of Sitakunda Police Station. The officer in charge provided his valuable time instead of having a busy schedule during a nationwide lockdown. The respondent provided detailed insight into the current security situation of the upazila, the future impact on the area with the establishment of the NSEZ, and the requirements of the Police department to meet future demand. He also provided a list of recommendations that will provide important insight into ensuring the security of the NSEZ.

Current situation

- There is a 52 km highway under Sitakunda police station.
- Local roads and communication are adequate, but it will face huge pressure due to the potential influx. Road development is a must to meet future demand. If adequate roads are not available, it will also be difficult for police to reach any crime spot.
- According to the officer in charge, the crime rate is low as the police are able to enforce the law and create deterrence against criminals. Police were able to solve major kidnapping and murder cases with dedication and adaptive techniques.
- Presently, the station has three vehicles which is insufficient to effectively patrol the areas under its responsibility. Additionally, there is a shortage of fuel, the allocation for maintenance is insufficient, and additional paperwork and tendering cause delays in the required maintenance and repair of vehicles very lengthy.

Perceived Risk

- Due to rapid urbanization and industrialization, incidents related to crime may increase as it is a general trend in society.
- Rapid influx of workers may decrease social cohesion which may lead to an increased number of crimes in society as outsiders have less integration in the local community and lack empathy for the community and surroundings. Social bonding and community cohesion are the most important assets for a society. If required, the initiative could be taken to maintain social cohesion, law, and order in the area. Strong social cohesion may also contribute to the control of crime at the community level.
- The prevalence of GBV may increase with the influx of workers, industrialization, and urbanization.

Requirement to Meet the Future Demand

- As per consultation data, one police station is proposed for the area and has already been approved by the ministry. The name of the proposed station is 'Mirsharai economic zone police station'.
- The physical fitness of the police personnel needs to be ensured to provide quality services in different conditions.
- Allocation of proper equipment and logistics. A well-equipped and supported small unit can maintain security properly compared to a dispersed ill equipped larger force.

Suggestions/Recommendation

- Establishment of a Police Fari/beat in Saidpur Union to meet the future demand and to ensure security in the area.
- Need at least 10 vehicles to patrol the 52 km Highway in the upazila.
- Specific duty hours and rotation-based duty.
- Different salary scales for the police unit involved in the economic zone.
- The creation of deterrence and show of force will create fear among the potential criminals, hence police should enforce the law and the judicial should provide strict punishment according to law.
- Vigilance and determination are key to upholding the law.
- Requirement of proper training.
- Emphasizing practical experience with qualification while selecting members for the units in the NSEZ area.

Participant

Tofail Ahmed, Officer in Charge, Sitakunda Police Station, Chattogram

1.2.78 Consultation with Police Station, Sonagazi, Feni

Basic Details

Location: Police Station, Sonagazi

District: Chattogram

Date: 16 January 2024

Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, current situation regarding security, the scope of involvement of police, preparation recommendation of police regarding future demand of NSEZ, the impact of NSEZ on the security of EZ areas and adjacent area, etc.

Key Point Discussed

Perception about the EZ

- The representative provides valuable insight into the current security situation of the upazila, the future impact on the area with the establishment of the NSEZ, and the requirement of the Police department to meet future demand. He also provided a list of recommendations that will provide important insight into ensuring the security of the NSEZ.

Current situation

- The Police department has a very active force at Sonagazi to maintain law and order in the area.
- According to the representative of PS, the common crimes are theft, gender-based violence, snatching, land-related disputes, etc. Some serious crimes like murder, rape, etc. are also reported sometimes in the area. If any crime is reported to the PS, they take prompt action as per the country's law.

Establishment of a New Police Station

- Within the boundary of NSEZ, a dedicated police station is being established to ensure law and order.
- According to the opinion of the police station's representative, the *NSEZ Thana* will be established at Sonagazi end.

Current Capacity of PS

- There is a Police Box (Police Fari) under the Sonagazi PS.
- The police force of Sonagazi includes:
    a. OC: 1 No.
    b. OC Investigation: 1 No.
    c. Sub Inspectors (SI): 18 Nos (PS: 16 and Police Box: 2)
    d. Vehicles: 2 Nos.
- According to the opinion of the respondent, there is a scope for improvement of the capacity of PS by increasing vehicles (at least one more), manpower, and equipment.

Perceived Risk

- Due to rapid urbanization and industrialization, incidents related to crime may increase as it is a general trend in society.
- Conflict between outsiders and locals may occur for some common resources like livelihood, business, housing, etc.
- Since the residential area of NSEZ will be established near Sonagazi and the movement of outside people will increase in Sonagazi, the rate of crime is also likely to increase.
- The prevalence of GBV, false marriage, and women trafficking may increase with the influx of workers, industrialization, and urbanization.

Suggestions/Recommendation

- Increase manpower of police stations based on the need.
- Need at least 1 more vehicle.
- Increase training.
- Engage tourist and industrial police units to ensure more sector-specific services.

Participant
Jahangir Alam, Sub-Inspector, Sonagazi Police Station, Feni Wali Ullah, Sub-Inspector, Sonagazi Police Station, Feni

1.2.79 Consultation with Chattogram Chamber of Commerce & Industries Ltd., Chattogram

Basic Details
Location: Chattogram Chamber of Commerce & Industries Ltd, Chattogram

District: Chattogram

Date: 4 December 2023

Purpose of the Visit: To consult with the stakeholder about their perception regarding the development and operation activities, current status regarding road connectivity, future plans & preparation, recommendation of Chamber of Commerce, etc.

Key Point discussed

Perception about the EZ

- The RESA team conducted a consultation meeting with the Assistant Secretary, Chattogram Chamber of Commerce & Industries Ltd, Chattogram, Chattogram. He provided his insight on their activities, membership type, etc.

Current Status and Plan

- The chamber played a vital role as a bridge between BEZA and Investors for the establishment of NSEZ.
- The Chamber offers two types of memberships – ordinary membership and associate membership.
- The organization plays an important role in facilitating export and import activities for industries, assisting with visa processes for industry personnel, and providing support in cases where Letters of Credit (LC) encounter delays or issues.
- Additionally, the Chamber extends its services to include the issuance of Certificates of Origin, which prove beneficial for industries in their respective business sectors.
- Furthermore, the Chamber engages in advocacy efforts related to port release matters, contributing to the smooth operation of industrial activities.
- If the investors of NSEZ take membership of the Chamber, the Chamber would provide all the support as their regular services.

Suggestions

- Investors/industries are suggested to register as their members to avail maximum support of the Chamber.

Participant

Md. Abu Sayem, Assistant Secretary, Chattogram Chamber of Commerce and Industries Ltd, Chattogram

1.2.80 Consultation with Press Club, Feni

Basic Details

Location: Feni Press Club

District: Chattogram

Date: 17 January 2024

Purpose of the Visit: To consult with the stakeholder about their perception regarding the development and operation activities, current views of local media about the EZ, and impact of NSEZ, etc.

Key Point Discussed

Perception about the NSEZ

- Different media correspondents showed their positive perceptions regarding the implementation of NSEZ.
- They opined that it would be a ‘game changer’ for the economic and social development of the EZ-surrounding areas.

- They also stated that the progress in the Sonagazi end is very slow and emphasized accelerating the activities.
- The NSEZ has multifaceted impacts, including environmental consequences on wild animals, disruptions to natural habitats, and variation in compensation for land acquisition (due to different mouza rates).
- Besides, specific geographic areas (chars) and their unique characteristics are likely to be impacted due to the EZ.

Opinion about Impact

- The consulted representatives of the press club discussed several impacts regarding lands, environments, chars, etc.
- Wild animals in the neighboring char areas, such as deer, foxes, and various bird species, are at risk of losing habitat for the implementation of NSEZ.
  - This has resulted in a gradual decline in the populations of these animals in the area.
  - The construction activities associated with the EZ generate noise that is also likely to affect wild animals in the char area.
  - However, these impacts are likely to be made in the following areas:
    - Char Abdullah:
      - Located close to the 16 no switch gate.
      - Reserved by the forest department.
      - Some residents have fish enclosures (Gher) in this area.
    - Char Nasreen:
      - Situated beyond the Kewra Bagan.
    - Namar Char:
      - Extending from the Muhuri reservoir to Musapur.
      - Designated for a Naval Base covering an 11.6 km area.
      - Plans include the construction of a Coast Guard Camp in this region.

  Legal Notices and Land Sale in Char Khandakar and Sonagazi:

    - Residents of Char Khandakar received legal notices under Section 4.
    - Their lands have been acquired as per government land acquisition rules.
    - Received three times higher rate than the current mouza rate of their land as the land price.
    - Residents of Sonagazi also followed a similar process for land acquisition by BEZA.
    - The residents of Sonagazi received significantly less money compared to those in Char Khandakar, mainly due to the lower Mouza rate in Sonagazi, which is approximately one-tenth of the rate in Char Khandakar.

Impacts on Grazers

- Buffalo grazers at Mirsharai are experiencing a great reduction of grazing land. Although they are now moving towards the Char areas near the periphery of NSEZ, they will not graze in the Char as most of the areas are protected by the forest department.

Suggestions

- Speed up the progress of implementation in Sonagazi end.
- Emphasis should be given to increasing road connectivity and utility facilities in Sonagazi areas.
- Young people in these areas have potential and should be employed by the investors.
- Consider the protection of the habitat of animals, fishery resources, and biodiversity of the areas.
- Prevent water, air, and sound pollution from all types of industrial and community-level interventions. No waste should be drained into the khals and open space to avoid environmental pollution.
- Keep the media informed about the progress of NSEZ.
- A drainage system should be introduced.

Participant

Md. Kamal Uddin Bhuiyan, Vice President, Feni Press Club
Syed Monir Ahmed, Former Vice President, Feni Press Club
Amzadur Rahman, Editor of the Ajker Feni
Dulal Talukder, Reporter, the DBC News
Solaiman Hazary Dalim, Correspondent, GTV

1.2.81 Consultation with the Raw Materials Supplier

Basic Details

Location: Mirsarai

District: Chattogram

Date: 01 May 2024

Purpose of the Visit: To consult with stakeholders about their current scope of services within NSEZ, current business type, capacity and resources, occupational changes, current challenges, suggestions, etc.

Key Point Discussed

Overview

- There are several types of material suppliers for NSEZ such as local small suppliers, local medium suppliers, regional big suppliers, etc. Nearly 30-40 suppliers are working within the NSEZ.
- Suppliers directly provide materials to the different investors of NSEZ for their construction works.
- Some local suppliers are working in collaboration with some Chattogram-based big companies.
- The supplier provides raw materials such as steel rods, cement, sand, bricks, metallic sheets, unskilled, semi-skilled and skilled manpower, etc.
- There are several types of people they have employed in their business such as daily labors, helpers, masons, diploma engineers, supervisors, engineers, etc.
- Usually, they transport the materials from Chattogram, Daudkandi, Sylhet, and Habiganj to NSEZ.

Current Challenges

- There is a security concern for storing the raw materials within the NSEZ area. Currently, they cannot keep any additional materials in the area.
- Since they cannot store additional materials on the sites, it is often challenging for them to timely deliver the ordered materials to their clients.
- There is no association for local suppliers.
- Labors/workers do not want to stay at NSEZ due to its distance, lack of shelters, and other facilities.

Suggestions

- There should be a vendor enlistment system to maintain the quality of work. In that case, the following criteria should be considered:
    - Experience of suppliers (Minimum 5-7 years of experience).
    - Resources and capacities (such as adequate manpower).
    - Logistics and other equipment should be available (such as transportation ability).
- Provide access to the Jetty. It will help the suppliers timely deliver the materials.
- Access to the bank loan with special conditions and interest.
- Provide training to the local educated youth so that suppliers and contractors can employ them in their construction sites.

Participant
Engr. Md. Fazlul Karim, Proprietor, Chattogram Traders and Suppliers

1.2.82 Consultation with Bangladesh Technical Education Board (BTEB)

Basic Details

Location: Sher-E-Bangla Nagar, Agargaon, Dhaka

District: Dhaka

Date: 03 April 2024

Purpose of the Visit: To consult with stakeholder about their perception regarding the development and operation activities, impact of NSEZ, etc.

Key Point Discussed

Involvement with NSEZ:

- Not directly involved with NSEZ till now.

BTEB's Contribution to Bangladesh's Development:

- The Bangladesh Technical Education Board (BTEB) plays an important role in contributing to the nation building particularly to create skilled manpower for the country's development.
- Since the country's development is being greatly marked by the rising industrialization and adoption of technology in different productive sectors, the need for a skill-based workforce has been increasing over time.
- BTEB is working to meet such an increasing demand by providing training and certification by different institutes.
- BTEB collaborates closely with government agencies (National Skill Development Authority) to provide the necessary skilled manpower required for the EZ's successful implementation.
- The BTEB offers its courses under different levels such as:
  - Diploma Level
  - HSC Level
  - SSC Level
  - Short and other courses

Opinion Regarding NSEZ:

- BTEB has not yet designed any project or taken any initiatives targeting NSEZ.
- BTEB realized the importance of its services to meet the demand for a skilled workforce that is going to be created by NSEZ; therefore, it emphasizes enhancing the capacities of local technical institutes.
- BTEB boasts a considerable pool of skilled workers, ready to meet the government's requirements promptly.
- It caters to various levels of expertise, including diploma graduates, HSC vocational, SSC vocational, and basic workers, to address the diverse needs of different sectors.
- Understanding the specific skill sets required by the "National Special Economic Zone ", BTEB has a provision to update its curriculum to align with these needs.
- This alignment will ensure that graduates from BTEB are not only technically proficient but also well-prepared to contribute effectively to the industry-specific skill requirements.

Addressing Skill Gaps and Industry Needs:

- BTEB conducts comprehensive gap analyses to identify specific skill gaps within industries in Bangladesh.
- Based on the findings, BTEB will develop a curriculum aimed at addressing these gaps, thereby enhancing the overall skill level of the workforce involved in the EZ.

Promoting Technological Advancement and Innovation:

- As technology plays a crucial role in modern industrial practices, BTEB integrates relevant technological advancements into its training curriculum.
- By equipping students with up-to-date technical skills and knowledge, BTEB expects to keep its graduates capable of working in technologically advanced industry environments.

ASSET Project:

- The objective of the ASSET project is to equip Bangladeshi youth and workers, including women and the disadvantaged, with skills demanded for the future of work and improved employment prospects.

Flexibility and Responsiveness:

- While BTEB typically offers curriculums with a minimum duration of one year, it remains flexible to adapt quickly to changing market demands.
- The dedicated experts work on developing a curriculum of BTEB and the affiliated institutes follow that.

Recommendation

- Local technical educational institutes should emphasize contemporary trades based on the NSEZ's requirement.
- BEZA should coordinate with BTEB in case of any support to develop skilled manpower for their investors.

Participant

Md. Ali Akbar Khan, Chairman, Bangladesh Technical Education Board, Dhaka

S M Shahjahan, Deputy Director (Course Accreditation), Bangladesh Technical Education Board

1.2.83 Consultation with National Skill Development Authority (NSDA)

Basic Details

Location: NSDA Office, Agargaon, Dhaka

District: Dhaka

Date: 2 April 2024

Purpose of the Visit: To consult with the stakeholders about their perception regarding the development and operation activities, status, plans & preparation, recommendation of NSDA, the impact of NSEZ in the area, etc.

Key Point discussed

Perception about the EZ

- The consulted representative of NSDA expressed a positive perception of the establishment of NSEZ and discussed the potential scope of NSDA's services to create skilled manpower for NSEZ.
- The mission of NSDA is to create skilled human resources and the vision is to create skilled human resources through planning and coordination of all skills development activities on the basis of national and international labor market demand.

Current Status, Allocations, and Plan

- NSDA primarily works with the technical education services providers as an apex monitoring and certification authority. NSDA itself does not provide training.
- NSDA only deals with the institutes which provide 360 hours-long courses. This duration separates NSDA-affiliated institutes' courses from those of other institutes such as the

Department of Youth Development and Bangladesh Technical Education Board-affiliated institutes.

- NSDA assesses the demand from all over the country. Demand is mainly assessed by the local institutions as they know their local demand.
- SNDA has an Industry Skill Council (IST) consisting of relevant experts and stakeholders. IST is responsible for reviewing the approval application from local training providers, contributing to updating the curriculum, etc.

NSDA's Activity and Plan for NSEZ

- NSDA has not yet signed any contract or prepared any plan targeting NSEZ.
- Although NSDA assesses skill demand by reviewing demand at local training providers, they have not yet conducted any skill assessment in NSEZ adjacent areas.

Recommendation

- BEZA and NSDA could make collaborative efforts to develop skilled manpower for their investors.

Participant

MD. Assadek Jaman, PS to Executive Chairman (Secretary), NSDA

1.2.84 Consultation with Upazila Chairman, Sonagazi, Feni

Basic Details

Location: Sonagazi Upazila Parishad

District: Feni

Date: 28 April 2024

Purpose of the Visit: To consult with stakeholders about the perception and observation of the stakeholder regarding the current activities under the implementation of the NSEZ in his area, his opinion regarding land acquisition and other impacts of NSEZ in the region, concerns issues, expectations, suggestions, etc.

Key Point discussed

- The Upazila Chairman, Sonagazi, Feni is aware of the progress and initiatives taking place as a part of the NSEZ's development activities. He expressed his opinion and suggestions.
- People are mostly dependent on agriculture and fishing.

Land acquisition, compensation, rehabilitation, and livelihood restoration.

- BEZA covers 10,000 acres of land in Sonagazi Upazila. Land acquisition is in progress.
- Most of the land is government-owned under 1 no. Khash Khatian.
- Before 2019, the Sonagazi end was erosion-prone. In 2019, a project was undertaken to protect the Feni reservoir and prevent erosion, which resulted in a recovery of nearly 1000 acres of land that was listed as 1 no. Khash Khatian.
- BEZA has reclaimed land from the sea. Land filling is being done with the sand collected from the sea. No soil is being used for landfilling.

Roads and communication

- There is a scope for developing a road network from Sonagazi to the Economic Zone to facilitate communication from NSEZ to the different locations of the region. The roads such as:
    - Muhuri Project to NSEZ (7.8 km)
    - Jorarganj to Sonapur Road
    - Badamtali – Raghunathpur (this road will connect NSEZ to Dhaka-Chattogram Highway (via Koshka).

- Road widening will be required to accommodate the additional traffic in the region.

Education, Training, and Employment Generation

- Educational institutes are insufficient regarding the present and future demand in the region. The following educational institutes are recommended in the area:
  - 1 Technical college/Technical and Vocational Education and Training (TVET) center should be established at Sonagazi to develop skilled manpower for the NSEZ and they can work outside of the country if required.
  - 1 Girls School
  - 1 Girls College
  - 1 High school preferably in 7 No. Union Parishad.

Drainage Facilities

- A drainage system should be developed in the area. There is a high chance of water logging in the future.
- Main roads should have drainage channels with them, and a long-term plan should be made for functional drainage in the area.

Environmental and Pollution Control

- To prevent water pollution proper mitigation measures should be undertaken.

Other Facilities Development

- Healthcare and medical facilities should be developed.
- EPZ Than/BEZA Than should be well-equipped and progress should be made.
- Public representatives need to be involved in the development work.
- Roadside afforestation could be done for environmental considerations.

Participant
Jahir Uddin Lipton, Upazila Chairman, Sonagazi, Feni

1.3 Disadvantaged/Vulnerable Individuals or Groups

1.3.1 Consultation/FGD with Elderly members of the community

Basic Details
Location: Mirer Hat, Saidpur Union, Sitakunda Upazila
District: Chattogram
Date: 8 November 2023
Purpose of the Visit: To consult with the Community about their perception regarding the development and operation activities, the potential impact of NSEZ on the community (especially among the elderly and disadvantaged persons), in the livelihood, health, traditions & culture, etc.
Key Point Discussed
Overview • FGD was conducted with the elderly members of the community in the Saidpur union of Sitakunda Upazila. During the FGD, the males aged between 55-75 were present and expressed their views regarding the NSEZ. One of the respondents stated that their voices and opinions are not counted by the government while implementing different development initiatives in the union such as road construction. Some of the respondents were already aware of the NSEZ. The RESA team informed the rest of the respondents and the restaurant owner about the NSEZ. Respondents were from diverse socio-economic backgrounds. Perceived Impact

- The potential influx of workers and population will be beneficial for the locality in the eyes of elderly people.
- Subsequently, business will increase.
- They expect infrastructure development in the locality, especially the construction of wider roads, schools, and medical facilities to be a top priority for them.
- Respondents reported that no land has been acquired till now by the government for the EZ.

Recommendation:

- The government should upgrade utility supplies like electricity, gas, etc.
- Roads in to be widened.
- Construction of additional local infrastructure including community health centers in the area. The current infrastructure and service facilities are not adequate to meet the future demand.

Expectation

- Increased employment opportunities for community people.
- Availability of health and other services.
- Introduce health facilities for elderly people.
- Save natural resources such as habitat of natural species and wild animals.
- Protect groundwater as it is the only source of drinking water for local people.

Participant

Elderly Male members of the community, Mirer hat, Saidpur Union, Sitakunda

1.3.2 Consultation with the landless/Economically Vulnerable

Basic Details

Location: Bangla Bazar, Icchakhali

District: Chattogram

Date: 01 May 2024

Purpose of the Visit: To consult with stakeholders about their current socioeconomic condition, the status of received compensation, occupational changes, type of vulnerabilities, any initiative of income and livelihood, current challenges, suggestions, etc.

Key Point Discussed

Community Overview

- Around 36 households (HHs) have been given semi-pucca houses in the Bangla Bazar area of Icchakhali Union.
- Each HH received one house.
- Most of the people were farmers and some of them occasionally practiced fishing in the nearby khal before the NSEZ started its construction.
- The young people among them are now being employed in different construction works in NSEZ and earning an average amount of BDT 500-BDT 700 for various works.

Current Challenges

- They are now facing several challenges.
- During the rainy season, waterlogging occurred in the settlement area due to the low level of ground.
- Rainwater also entered the houses due to the low-quality construction works.
- Before the EZ, people of all ages could work in agriculture and fishing, and after the EZ old people started struggling to find work. They are not encouraged to do construction work.

Suggestions

- They demanded regular work during both the construction and operation phases of NSEZ.

- Repairing their houses to prevent the entrance of water.
- Job in NSEZ for their educated household members.
- Provide training on income-generating activities so that they can enhance their skill and find employment in other works.

Participant

People of landless/economically vulnerable communities

1.3.3 Consultation with "Jaldas Community" Fishermen - Saherkhali

Basic Details

Location: Saherkhali Fish landing Ghat, Saherkhali, Mirsharai

District: Chattogram

Date: 30 August 2023

Purpose of the Visit: To consult with the Community about their perception regarding the development and operation activities, and the potential impact of NSEZ on the community, in the livelihood, health, traditions & culture, etc.

Key Point discussed

Overview:

Four main fisheries are landing Ghat according to the local fisherman community. These are:

1. Domkhali Ghat
2. Mithachora Ghat
3. Saherkhali Ghat
4. Bamonsundor ghat

Usually, fishermen from 3 villages use one fishery landing ghat/site. They collect necessary items like string bought from Chaktai, Chattogram, and diesel acquired from local shops. Fishermen stated that Bulk carriers and other cargo ships destroy their fishing nets while they cross the Sandwip channel. Nets are destroyed by the propellers of the boat and these nets are costly, with prices reaching up to 50,000 BDT per net.

Boat and Equipment

There are different types of fishing nets used by the *Jaldas/fishermen* community to catch fish. "Ton", "Binti", and 'Chandi" are the most common type of fishing nets used by the fishermen in Saherkhali. Boats are typically light-fiber boats with diesel engines. A boat costs between 200,000 to 400,000 taka depending on the size and condition of the boat, these are collected from the shipbreaking yard. Fuel capacity, boat type, and endurance restrict the fisherman from endeavoring into the deep sea. They usually catch fish within 5-6 km of the shoreline. They make two trips every day. Per trip requires 5 liters of diesel fuel. It requires Three/Four fishermen per boat for every trip to sea.

Fish Yield and Value Chain

Fish yield varies by season and depends on other factors like rain, salinity, marine traffic, etc. In recent times, fish have become scarce. On average 15-20kg of fish is caught by every boat per day. They sell the fish immediately after landing and they do not carry ice or anything to preserve the fish. Usually, the "Bepari" or the vendors buy those fish from the fisherman, preserve them, and sell them to the market. Additionally, some shops sell food and beverage items to the fisherman and their sales depend on the fisherman's purchase.

In addition to the fisherman, there are 400-550 crab catchers who catch crabs near the shore and in the adjunct vegetation with hooks and bags.

Impact

- Risk of reducing fish yield
- Risk of loss of occupation or occupational shifting
- Difficulty in access to boats in the newly relocated boat parking station

- Low income as a result of low fish yield
- Impact on the living and culture of the artisanal fisherman community as they are fishermen not only by profession but also by tradition and inherited the skills from previous generations.

Recommendation

- Alternative Livelihood.
- Reduction of marine traffic from fishing areas. Marking routes for cargo ships so that fishermen could change their fishing area. Pollution that could impact fish breeding should be avoided.

Participant

Artisanal Fishermen community members

1.3.4 Consultation with Fisherman at Choto Kumira

Basic Details

Location: Choto Kumira Fish Landing ghat, Sitakunda

District: Chattogram

Date: 30 August 2023

Purpose of the Visit: To consult with the stakeholder about their experience and suggestions regarding the impacts of NSEZ on their community, potential mitigations, any vulnerabilities, etc.

Key Point discussed

Challenges and Impacts

- Before the start of NSEZ, there was no limitation of netting in any route or khal for the fishermen. Once the NSEZ's activities started, cargo ships' navigation increased which destroyed the nets of fishermen.
- Since they are neither habitual to catch fish in the deep sea nor have adequate equipment for that, they will be vulnerable if fishing in the near sea is interrupted or restricted.
- Some people are dependent on both fishing and agriculture. Agricultural practices are often challenged by the shortage of irrigation water. Neither ground water nor fresh surface water is adequately available for irrigation.
- Drinking water is also limited and during the dry season, the crisis surges.

Recommendation

- Specify and mark routes for marine traffic.
- Introduce alternative livelihood options/occupations for fishermen and small farmers to reduce the impact.
- Provide training for the fishermen community.
- Protect natural resources to reduce the impact on wild animals and other dependent groups.
- Increase health facilities for local people.

Participant

Fishermen, Choto Kumira Fisheries Landing Ghat

1.3.5 Consultation with "Jaldas Community" Fishermen - Domkhali

Basic Details

Location: Domkhali, Mirsharai

District: Chattogram

Date: 30 August 2023

Purpose of the Visit: To consult with the community about their perception regarding the development and operation activities, and the potential impact of NSEZ on the community, in the livelihood, health, traditions & culture, etc.

Key Point discussed

Overview

- There 75 boats with are based on Domkhali ghat with 25 boats from the Domkhali area and the rest are from other areas. Low-income households belonging to artisanal fisherman communities with male-dominant households.
- Although fishing is their community occupation and they started to be engaged in it at the early age of their life, their children are now attending school and colleges to obtain institutional education and getting involved in other occupations.
- Most of the households have electricity and have access to safe drinking water. Fishermen take loans from the "*bepari*" (boatowners) and sell fish to the '*bepari'* in the majority of the cases.

Anticipated Impact

- The local community reported observing a lower fish rate during the last few years. Although they are not sure about the reason, they assume that increased navigation of cargo ships may interrupt fish which may result in a lower fish rate.
- Since fish landing stations have been relocated from the previous places, it causes additional costs to reach them.
- Some fish species are now being scarce like sharks, Lakkhya fish, etc.

Concerns Regarding the Impacts

- The fishermen from Domkhali informed the UP chairman and UNO about their problems, especially the problem of cargo ships cutting/destroying their fishing nets with propellers.
- One fisherman argued *"The government restricted us from fishing saying even our boat harms ilish (hilsa Fish) breeding, so they forced us to stop fishing, but they never enforced a ban on the cargo ship, What about cargo ship propeller? Do not the propellers destroy the fish larva or eggs?"*

Recommendation

- Alternative IGA activity and skill development training.
- Job opportunities in nearby factories.
- Cash compensation to start other businesses.
- Loan facilities at lower interest.
- Employment for women.

Participant

Males and Females from 'Jaldas' community, Domkhali village

Appendix C-4: Validation Workshop

Appendix C-4.1: Summary of Workshops – Sonagazi Union

The validation workshop was held in Sonagazi Union Parishad Complex on the 28th of April 2024. The event commenced at 11:00 AM, with an attendance of a total of 30 participants (26 male and 4 female), including the Union Parishad Chairman, ward members, Union Parishad Secretary, teacher, farmers, fishermen, grazers, female members, village police, and others. Appendix-C (Vol-III) includes a full list of participants for the validation workshop at Sonagazi Union. Photographs of the participants in the validation workshop at Sonagazi Union are given in Figure C-1.

Figure C-1: Photographs of the Participants in the Workshop at Sonagazi Union

Glimpses of the Workshop at Sonagazi Union

Glimpses of the Workshop at Sonagazi Union

Source: EQMS, April 2024

The RESA team inaugurated the session with a welcome statement to all participants. They made a presentation including EZ background and location, objectives of the study, reference framework, study area, approach and methodology, description of the NSEZ (phasing plan, related facilities, utility requirements, benefits, etc.), environment and social baseline conditions, stakeholder engagement, potential environmental and social risks and impacts on the region and identified valued environmental components for Cumulative Impact Assessment.

Main Issues and Concerns Raised

Table C-1 presents a summary of the main outputs of the validation workshop at Sonagazi Union.

Table C-1: Summary of the Workshop at Sonagazi Union

Issue Raised	Comments/Concerns/Expectations
Impact on Different Occupational Groups	● Farmers and fishermen community would be impacted by the NSEZ's development in the Sonagazi end. ● There are approximately 560 registered fishermen and many other non-registered and irregular fishermen. Fishermen who catch Hilsha fish only get a ration during banned periods. ● Fishermen of Sonagazi mostly catch fish in near-shore areas and only 14-20 fishermen go to the deep sea for fishing. ● To restore and enhance the livelihood of affected household a livelihood restoration plan and the provision of training and assistance is expected. ● Industries should recruit from affected households. ● Expecting that compensation should be ensured for land acquisition and resettlement following applicable national legislation prior to starting construction activities.

Issue Raised	Comments/Concerns/Expectations
	● Fish in the Sandwip Channel are reducing day by day. Sedimentation in the channel is one of the causes behind this and they have been observing the trend for the last 4 years. ● The fishing community expects training, modern equipment, and vessels for fishing in the deep sea.
Social Infrastructure	● Educational facilities/institutes required in Sonagazi Union. Chairman and other participants emphasized the need for: - At least one (1) high school. Currently, there is no high school. - Increase community clinics and their scope of services. - Need a government hospital considering the future demand. Currently, they have to go to Sonagazi Upazila or Feni Sadar Hospital. - One (1) playground. Currently, there is no playground in the union. ● Road improvement is required in terms of roads' carrying capacity and width. ● Solar power plants could be established to ensure uninterrupted electricity supply to the area. ● Cyclone shelters should increase their capacity like spaces, animal shelters, etc.
Social Cohesion and Safety	● If any influx happens to the Sonagazi, people will welcome outsiders although initially, it will take time to build integration between outsiders and locals. ● Outsiders could be a threat for locals at some points like gender-based violence and other crimes.
Biodiversity and Wildlife	● There is a need for wildlife conservation. Wildlife is at risk due to increased human intervention near the forest and char areas.

Appendix C-4.2: Summary of Workshops – Maghadia Union

The validation workshop was held in Maghadia Union Parishad Complex on the 29th of April 2024. The event commenced at 11:00 AM, with an attendance of a total of 50 participants (44 male and 6 female), including the Union Parishad Chairman, ward members, Union Parishad Secretary, farmers, fishermen, students, female members, teacher, village police, and others. Appendix-C (Vol-III) includes a full list of participants for the validation workshop at Maghadia Union. Photographs of the participants in the validation workshop at Maghadia Union are given in Figure C-2.

Figure C-2: Photographs of the Participants in the Workshop at Maghadia Union

Glimpses of the Workshop at Maghadia Union

Glimpses of the Workshop at Maghadia Union

Source: EQMS, April 2024

The RESA team inaugurated the session with a welcome statement to all participants. They made a presentation including EZ background and location, objectives of the study, reference framework , study area, approach and methodology, description of the NSEZ (phasing plan, related facilities, utility requirements, benefits, etc.), environment and social baseline conditions, stakeholder engagement, potential environmental and social risks and impacts on the region and identified valued environmental components for Cumulative Impact Assessment.

Main Issues and Concerns Raised

Table C-2 presents a summary of the main outputs of the validation workshop at Maghadia Union.

Table C-2: Summary of the Workshop at Maghadia Union

Issue Raised	Comments/Concerns/Expectations
Resettlements, Compensation, and Livelihood Restoration	● Employment preference should be given to the affected people. ● Currently, industries are not recruiting employees above the age of 30-35 years which is challenging others to find alternative ways for earning. ● Chairman of the Union Parishad is not included in the Grievance Mechanism of BEZA. Therefore, requested to include them in the grievance committee. ● Local people demanded employment opportunities for their household members not only as workers but also in other skilled sectors as per their qualifications. ● In addition to that, they also demanded priority for jobs in other service sectors such as banks, hospitals, etc. ● Local people requested to ensure compensation according to the government's law before the commencement of any project.
Social Infrastructure	● Participants validated the need for more health complex, particularly in the Maghadia Union. ● Educational facilities/institutes required in Maghadia Union. Chairman and other participants emphasized the need for: - Currently, there is one (1) high school. Expecting at least an additional one (1) high school in the Union. - One (1) playground. - One (1) medical center/hospital. - Police camp (increased number of police and security personnel). - Growth centers should be more developed with improved communication facilities. ● Fish landing stations have been relocated and it creates a challenge for fishermen to access the sea.
Drainage	● Some participants focused on drainage improvement, and they mentioned that there is no provision for drainage culverts in the existing 4-lane road (NSEZ Saroni). ● Currently, rainwater drains out naturally through the khals to the sea. Unplanned development in the community could lead to drainage congestion and long-time water logging in the future. ● Major khals in the NSEZ should not be closed.
Waste Management	● Currently, there are no waste management facilities at the Union Parishad level. ● As an existing practice, people dump their household waste on their land.

Appendix C-4.3: Summary of Workshops – Mirsharai Upazila

The validation workshop was held at Mirsharai Upazila Parishad Complex on the 30th of April 2024. The event commenced at 2:00 PM, with an attendance of a total of 51 participants (48 male and 3 female), including NSEZ authority, individuals affected by the EZ, members of the local community, elected

public representatives, non-governmental organizations, civil society organizations/community-based organizations, representatives from various government departments, business community, investors, utility providers, teacher, and print media. Appendix-C (Vol-III) includes a full list of participants for the validation workshop at Mirsharai Upazila. Photographs of the participants in the workshop at Mirsharai Upazila are given in Figure C-3.

Figure C-3: Photographs of the Participants in the Workshop at Mirsharai Upazila

Glimpses of the Workshop at Mirsharai Upazila

Glimpses of the Workshop at Mirsharai Upazila

Source: EQMS, April 2024

Mr. Md. Abdul Quader Khan from BEZA inaugurated the session with a welcome statement to all participants and the RESA team. Member of the Parliament (MP) of Mirsharai (Chattogram 1) was present as Chief Guest and the Upazila Nirbahi Officer (UNO) of Mirsharai Upazila was present as Chair of the workshop.

RESA team made a PowerPoint presentation including EZ background and location, objectives of the study, reference framework, study area, approach and methodology, description of the NSEZ (phasing plan, related facilities, utility requirements, benefits, etc.), environment and social baseline conditions, stakeholder engagement, potential environmental and social risks and impacts on the region and identified valued environmental components for Cumulative Impact Assessment.

Main Issues and Concerns Raised

Table C-3 presents a summary of the main outputs of the validation workshop at Mirsharai Upazila.

Table C-3: Summary of the Workshop at Mirsharai Upazila

Issue Raised	Comments/Concerns/Expectations
Water Resources	• Emphasize the importance of groundwater currently used by the local community as the main source of drinking water. They opined to reduce the withdrawal of groundwater as early as possible and only use it for the construction phase activities. • The extensive extraction of groundwater by the NSEZ for industry operations may result in a severe water crisis for the local community and the natural ecosystem. • Water supply from other sources (e.g., Meghna River) needs to be ensured as early as possible otherwise investors will be demotivated and could leave NSEZ. • Rainwater harvesting should be introduced in NSEZ to reduce the pressure on water resources.

Issue Raised	Comments/Concerns/Expectations
Agriculture	● Impact on agricultural practices and production has been anticipated due to the future availability of irrigation water, reduction of agricultural land, and infrastructural development. ● If local food production is impacted, it will trigger the food price and impact on the local community. ● Agriculture-based entrepreneurship should be created and encouraged.
Resettlement, Compensation, and Livelihood Restoration	● Affected households should be given priority for the restoration of their livelihoods. ● Compensation should be ensured for land acquisition and resettlement following applicable national legislation prior to starting construction activities. ● Buffalo owners, fishermen, and other involved people have almost lost their livelihoods. There is an immense need for a livelihood restoration plan for them. ● Some local investors (fishery project) of Ichakhali Union were affected.
Employment	● Approximately 1.4 million employment opportunities will be created in different phases of NSEZ implementation. It is needed to know phase-by-phase numbers to prepare plans for government departments/service providers. ● Job placement should be prioritized with skill-developing training. ● Industry should prefer local employees during recruitment.
Transportation and Communication	● Industries are facing a labor crisis due to insufficient transport and accommodation facilities in the NSEZ region. ● There is a gap between the need and existing facilities in terms of transportation services. ● BRTC has already launched a service, but it is insufficient in terms of frequency of services, number of buses, etc. ● Transport cost for labor is also high. Steps need to be taken to reduce it otherwise it will demotivate the workers to work in NSEZ. ● There is another road from Mirsharai to NSEZ besides Mirsharai Upazila Parishad that could be developed to reduce pressure on NSEZ Saroni.
Social Infrastructure	● Housing and accommodation for workers and outsiders should be constructed with other facilities. Already 12,000 workers are working in NSEZ, and they are struggling for housing and transportation. ● Housing loan facilities should also be introduced. ● Unplanned housing should not be allowed. It will create hurdles in the future specifically for road and drainage improvement. ● Educational institutes are required to meet future demand. Local technical educational institutes should enhance their capacity and new institutes should be established to supply skilled manpower to the industries. ● Foot overbridge near Nurul Absar school to reduce the accident risk for students and villagers. ● Clinics/hospitals and other medical facilities should need to be established. ● Hat bazar/growth centers are mostly in a traditional way, those should be developed in a planned way. ● There is a high opportunity for tourism development in the NSEZ region.
Fish Landing Station/Boat parking	● Fish landing stations have been relocated and the current distance creates a challenge for fishermen to access them. There is no sanitation, drinking water, and recreation/resting facilities at the boat parking area. ● Boats are being vulnerable during cyclones or storms in the newly shifted boat parking area.

Issue Raised	Comments/Concerns/Expectations
Wildlife/ Biodiversity/ Ecosystem	• Wildlife restoration should be given priority as they are losing their habitat. It can be transferred to hills and Mohamaya lake areas. • Impact on biodiversity should be avoided and proper mitigation should be followed. • Plantation should be prioritized outside of the NSEZ.
Environment	• Ecofriendly building/construction materials should be preferred to use in NSEZ to avoid the environmental impact as much as possible. • Topsoil management should be prioritized, and no agricultural land should be damaged in the future.
Drainage	• Khals should not be closed. • Proper planning and implementation of drainage systems should be ensured to avoid waterlogging/flooding in the surrounding areas. • If a proper plan is not considered, drainage congestion will be another big challenge in the future. Roadside drainage should also be considered.
Waste Management	• Waste management facilities need to be established for the community considering the workers influx in the region. • Waste treatment and recycling should be preferred as a huge volume of waste will be generated. If it is not managed properly, it will greatly cause pollution.
Other Services	• The service facilities of other service providers need to be increased particularly in Mirsharai areas. • Safety and security for both the community and industries/investors should need to be ensured. • Security personnel should be increased.

Appendix C-4.4: Summary of Workshops – Sonagazi Upazila

The validation workshop was held at Sonagazi Upazila Parishad Complex on the 21st of May 2024. The event commenced at 11:00 AM, with an attendance of a total of 54 participants (46 male and 8 female), including NSEZ authority, individuals affected by the EZ, members of the local community, elected public representatives, non-governmental organizations, civil society organizations/community-based organizations, representatives from various government departments, business community, and print media. Appendix-C (Vol-III) includes a full list of participants for the validation workshop at Sonagazi Upazila. Photographs of the participants in the workshop at Sonagazi Upazila are given in Figure C-4.

Figure C-4: Photographs of the Participants in the Workshop at Sonagazi Upazila

Glimpses of the Workshop at Sonagazi Upazila

Glimpses of the Workshop at Sonagazi Upazila

Source: EQMS, May 2024

Mr. Md. Abdul Quader Khan from BEZA inaugurated the session with a welcome statement to all participants and the RESA team. Upazila Nirbahi Officer (UNO) of Sonagazi Upazila was present as Chair of the workshop.

RESA team made a PowerPoint presentation including EZ background and location, objectives of the study, reference framework, study area, approach and methodology, description of the NSEZ (phasing plan, related facilities, utility requirements, benefits, etc.), environment and social baseline conditions, stakeholder engagement, potential environmental and social risks and impacts on the region and identified valued environmental components for Cumulative Impact Assessment.

Main Issues and Concerns Raised

Table C-4 presents a summary of the main outputs of the validation workshop at Sonagazi Upazila.

Table C-4: Summary of the Workshop at Sonagazi Upazila

Issue Raised	Comments/Concerns/Expectations
Resettlement, Compensation, and Livelihood Restoration	● Affected households should be given priority for the restoration of their livelihoods specifically for the livelihoods relevant to fisherman and livestock rearing. ● Compensation should be ensured for land acquisition and resettlement following applicable national legislation prior to starting construction activities. ● Currently, there are fishery projects in the proposed EZ site and people related to this sector will be impacted.
Employment	● Participants emphasized the employment opportunities for the local people. ● Worker's movement will be increased from the Feni side if the road network is developed it will reduce the transportation cost.
Transportation and Communication	● Due to insufficient road networks on the Feni side, workers from Sonagazi are not interested in going to NSEZ at present. ● A bridge on the Feni River has been initiated by LGED and it must be implemented on a priority basis to connect both the Feni and Mirsharai economic zones. ● Transport costs for the workers are very high compared with their daily income. Currently, a few workers are moving via Mirsharai. ● A road from the Muhuri project to NSEZ following the bank of the Feni River could be an option.
Social Infrastructure	● Unplanned urbanization will be an issue. ● Existing social infrastructures need to be improved.
Drainage	● Feni River is the main drainage system in the area. It carries water from the upstream area and finally falls to the Sandwip Channel.
Erosion/ Sedimentation	● After the implementation of the river straightening program in 2011, it reduced the riverbank erosion activities in the area.
Miscellaneous	● About 8,000 acres of land have been considered for the NSEZ. ● Mainly residential areas will be developed in the Sonagazi, Feni side. An initial site selection study is ongoing. ● Only two industries are established under the jurisdiction of Feni district. No other physical progress is observed at the Feni site. ● Land grabbers are more active now at the Feni side and grabbing lands. They are excavating ponds for aquaculture. Participants requested to secure the land as early as possible otherwise the landfill requirements will be increased in the future. ● Proper pollution prevention mechanisms and waste management systems should be established.

Issue Raised	Comments/Concerns/Expectations
	● Although the development of NSEZ is being carried out in different phases, it should make some visible progress at the Sonagazi end as soon as possible.

Appendix C-4.5: Summary of Workshops – Sitakunda Upazila

The validation workshop was held at Sitakunda Upazila Parishad Complex on the 23rd of May 2024. The event commenced at 12:00 PM, with an attendance of a total of 67 participants (57 male and 10 female), including NSEZ authority, individuals affected by the EZ, members of the local community, elected public representatives, non-governmental organizations, representatives from various government departments, business community, and print media. Appendix-C (Vol-III) includes a full list of participants for the validation workshop at Sitakunda Upazila. Photographs of the participants in the workshop at Sitakunda Upazila are given in Figure C-5.

Figure C-5: Photographs of the Participants in the Workshop at Sitakunda Upazila

Glimpses of the Workshop at Sitakunda Upazila

Glimpses of the Workshop at Sitakunda Upazila

Source: EQMS, May 2024

Mr. Md. Abdul Quader Khan from BEZA inaugurated the session with a welcome statement to all participants and the RESA team. Member of the Parliament (MP) of Sitakunda (Chattogram-4) was present as Chief Guest and the Upazila Nirbahi Officer (UNO) of Sitakunda Upazila was present as Chair of the workshop.

RESA team made a PowerPoint presentation including EZ background and location, objectives of the study, reference framework, study area, approach and methodology, description of the NSEZ (phasing plan, related facilities, utility requirements, benefits, etc.), environment and social baseline conditions, stakeholder engagement, potential environmental and social risks and impacts on the region and identified valued environmental components for Cumulative Impact Assessment.

Main Issues and Concerns Raised

Table C-5 presents a summary of the main outputs of the validation workshop at Sitakunda Upazila.

Table C-5: Summary of the Workshop at Sitakunda Upazila

Issue Raised	Comments/Concerns/Expectations
Water Resources	● Groundwater crisis already exists in the Sitakunda area, putting local life in immense trouble. ● NSEZ should focus on surface water resources to avoid conflicts between different water users.
Agriculture	● No agricultural land should be acquired. ● The land acquired for the NSEZ in the Sitakunda area is government land and located outside of the embankment and towards the Sandwip Channel.

Issue Raised	Comments/Concerns/Expectations
	● Agricultural productivity will also not be impacted.
Resettlement, Compensation, and Livelihood Restoration	● Fishermen will lose their livelihoods. There is an immense need for a livelihood restoration plan for them. ● Livestock (buffalo) dependent communities will be impacted. ● Fisherman livelihoods should be ensured.
Employment	● Skill development training considering the requirements of the industries.
Transportation and Communication	● According to the planning, the existing Dhaka-Chattogram Highway will be a 10-lane highway in the future therefore it needs to be considered. ● Marine drive road can be linked with NSEZ which will reduce a distance of 60-80 km.
Social Infrastructure	● Social infrastructure i.e., roads, schools, hospitals (100 beds), and community clinics need to be established and improved. ● A technical college will be required to develop skilled labour. ● Housing in the Sitakunda area could be proposed. ● A dedicated fire station will be established in the NSEZ. In addition, the capacity of existing fire stations needs to be improved. ● Existing internal roads in Saidpur and Muradpur need to be improved to ensure better movement of workers.
Fish Landing Station/Boat parking	● Accessibility of the fishing area as well as fish landing stations is decreasing due to the NSEZ interventions. ● Fishing equipment such as boats and nets are damaging due to the increasing interventions of vessels in the Sandwip Channel/fishing area.
Wildlife/ Biodiversity/ Ecosystem	● Vegetation cover should be protected. ● Wildlife rehabilitation should be done. Due to fragmentation of habitat and food, wildlife may come to the local community and a conflict between humans and wildlife may occur. ● Impact on biodiversity should be avoided and proper mitigation should be followed.
Environment	● Green industry should be introduced in the NSEZ to reduce environmental pollution.
Natural Disasters	● Sitakunda coast is vulnerable to natural disasters, mainly Cyclones and associated tidal surges. Natural disaster issues should be considered in the NSEZ planning. ● Green belts should be developed to protect the coast from Cyclones and tidal surges.
Drainage	● Proper drainage systems should be developed to avoid flooding in the surrounding areas.
Waste Management	● Regarding waste management, NSEZ can introduce 3R principles (Reduce, Reuse, and Recycle). ● Waste management facilities need to be established considering the workers influx in the region. ● Shipbreaking waste management could be integrated with the NSEZ master plan, it will save agricultural land. A project regarding shipbreaking waste management facilities establishment in Sitakunda Pourashava is in process.
Tourism	● Tourist spots should be avoided for the interventions, and it should be promoted as a potential sector. ● Enhancement of the tourist spots and tourism activities should be done.

Appendix C-4.6: Summary of Workshops – Feni District

The validation workshop was held at the Conference Room of Deputy Commissioner, Feni on the 12th of June 2024. The event commenced at 11:45 AM, with an attendance of a total of 56 participants (47 male and 9 female), including NSEZ authority, elected public representatives, representatives from various government departments, utility providers, business community, non-government organizations, and print and electronic media. Appendix-C (Vol-III) includes a full list of participants for the validation workshop at Feni. Photographs of the participants in the workshop at Feni are given in Figure C-6.

Figure C-6: Photographs of the Participants in the Workshop at Feni

Glimpses of the Workshop at Feni

Glimpses of the Workshop at Feni

Source: EQMS, June 2024

Mr. Abdullah Al Mahmud Faruk, Project Director, inaugurated the session with a welcome statement to all participants and the RESA team. Member of the Parliament (MP) of Sonagazi (Feni-3), and the Deputy Commissioner of Feni District were present as Chair of the workshop.

RESA team made a PowerPoint presentation including EZ background and location, objectives of the study, reference framework, study area, approach and methodology, description of the NSEZ (phasing plan, related facilities, utility requirements, benefits, etc.), environment and social baseline conditions, stakeholder engagement, potential environmental and social risks and impacts on the region and cumulative impact assessment.

Main Issues and Concerns Raised

Table C-6 presents a summary of the main outputs of the validation workshop at Feni.

Table C-6: Summary of the Workshop at Feni

Issue Raised	Comments/Concerns/Expectations
Land Price	• The land acquisition process at the Feni site needs to be prioritized as the DC office has already issued notice but has not confirmed the date/time of land acquisition and land price. Therefore, the people are unable to use their land or sell it to another person. • Local people are digging ponds for aquaculture at the Sonagazi site, it needs to be stopped immediately. • Participants were informed that the land price is different in Mirsharai and Feni. Considering the condition of the land location Mirsharai people are getting more price than the Sonagazi people. Therefore, they requested to consider this issue and ensure adequate payment.
Agriculture	• Crops and different types of vegetation are grown in the Sonagazi area and exported to different areas.

Issue Raised	Comments/Concerns/Expectations
Resettlement, Compensation, and Livelihood Restoration	● There are 5,000 registered fishermen in the Feni district. In addition, 3,000 registered fishermen in Sonagazi Upazila. ● Fisherman and livestock-dependent communities will be impacted. Therefore, the rehabilitation of fishermen and livestock-dependent communities should be ensured on a priority basis.
Employment	● Training in different trades should be given to the local people for their capability improvement and employment in the NSEZ. ● EZ-affected persons should be prioritized for employment. ● BEPZA has announced in the local community for the employment of the local community.
Transportation and Communication	● Fisherman access to the Khals and Sandwip Channel will be restricted. ● The number of traffic in Sonagazi, Feni area has already increased and is damaging the road. ● Considering the increasing number of traffic road improvement/widening is required. ● An underpass/overpass needs to be constructed at Lalpole, Feni area to avoid accidents and traffic congestion. ● A 4-lane road has already been approved by the Executive Committee of the National Economic Council, participants requested to implement the work on a priority basis.
Social Infrastructure	● A 50-bed hospital is in the Sonagazi area which is not equipped to handle the pressure. Therefore, health facilities need to be improved. ● Education facilities are not adequate in the area. ● Skill development training institutes both government and private need to the established and industry/sector-specific training needs to be provided.
Forest	● There is a gazette reserve forest area in Sonagazi Upazila having an area of 3,189 acres under the social forestry program. ● Afforestation on the coastline should be prioritized to protect the coast against tidal surges and cyclones. ● Mangrove species should be prioritized in green belt development.
Wildlife/ Biodiversity/ Ecosystem	● Different wildlife i.e., monkeys, deer, etc. are observed at the Sonagazi end and need to be relocated/rehabilitated. ● Not only the mangrove species but also the fruits bearing trees should be considered in greenbelt development so that the birds and other wildlife can eat.
Environment	● Central Effluent Treatment Plants (CETPs) should be established and ensure the operation and functionality of the CETPs. ● Zero Discharge Plan (ZDP) should be considered to reduce pressure on water resources. ● Rainwater harvesting in each industry should be mandatory. ● Plastic pollution in the marine environment is an issue and it should be ensured that solid waste/plastic waste is not disposed to the aquatic environment. ● Liquid waste can pollute water resources if adequate mitigation measures are not considered. ● Climate change issues need to be considered in the planning and design of NSEZ infrastructure.
Water Resources	● There is an irrigation project, using water from the Feni River. The extraction of 100 MLD water from the Feni River may impact water availability. ● To ensure the sustainable use of water resources a desalination plant and water from Meghna River should be considered.

Issue Raised	Comments/Concerns/Expectations
	● Participants are observing salinity problems in deep tube wells and arsenic in shallow tube wells.
Natural Disasters	● Cyclones and tidal surges are the major natural disasters in the NSEZ region.
Drainage	● Drainage systems should be considered, and improvement will be required.
Tourism	● There are two tourist spots in the Sonagazi area namely Musapur Closure Dam and Muhuri Irrigation Project. These tourist spots need to be developed.
Others	● Facility i.e., security, accommodation, etc. for the investors should be ensured on a priority basis to attract the investors. ● Currently, there is no water supply in the Sonagazi area. Therefore, the water supply should be ensured not only for the NSEZ but also for the local community. ● Electricity supply should be ensured not only for the NSEZ but also for the local community. ● Currently, there is no gas supply in the Sonagazi area. Therefore, the gas supply should be ensured not only for the NSEZ but also for the local community. ● Two to three thanas need to be set up to ensure security in the NSEZ. Traffic police will also be required considering the predicted volume of future road traffic.

Appendix C-4.7: Summary of Workshops – Chattogram Region

The validation workshop was held at the Conference Room of Deputy Commissioner, Chattogram on the 28th of May 2024. The event commenced at 11:30 AM, with an attendance of a total of 49 participants (43 male and 6 female), including NSEZ authority, elected public representatives, representatives from various government departments, utility providers, business community, investors, nongovernment organizations, and print and electronic media. Appendix-C (Vol-III) includes a full list of participants for the regional validation workshop at Chattogram. Photographs of the participants in the regional workshop at Chattogram are given in Figure C-7.

Figure C-7: Photographs of the Participants in the Regional Workshop at Chattogram

Glimpses of the Workshop at Chattogram

Glimpses of the Workshop at Chattogram

Source: EQMS, May 2024

Mr. Shaikh Yusuf Harun, Executive Chairman of BEZA inaugurated the session with a welcome statement to all participants and the RESA team. Member of the Parliament (MP) of Mirsharai (Chattogram-1), Executive Chairman of Bangladesh Economic Zone Authority, and Divisional

Commissioner of Chattogram were present as Special Guests and the Deputy Commissioner of Chattogram District was present as Chair of the workshop.

RESA team made a PowerPoint presentation including EZ background and location, objectives of the study, reference framework, study area, approach and methodology, description of the NSEZ (phasing plan, related facilities, utility requirements, benefits, etc.), environment and social baseline conditions, stakeholder engagement, potential environmental and social risks and impacts on the region and cumulative impact assessment.

Main Issues and Concerns Raised

Table C-7 presents a summary of the main outputs of the validation workshop at Chattogram.

Table C-7: Summary of the Workshop at Chattogram

Issue Raised	Comments/Concerns/Expectations
Water Resources	● Groundwater crisis already exists in the Mirsharai and Sitakunda areas. The extraction of groundwater needs to be stopped immediately. NSEZ should focus on surface water resources to avoid conflicts between different water users. ● Runoff from rainfall is a water source that can be stored in the internal khals by closing the sluice gate and used for construction activities. ● Proposed water sources i.e., groundwater, Feni River, and seawater desalination are not feasible options considering the total water requirements for the NSEZ operation. These could be a temporary option but not a permanent source of water to operate the NSEZ. In addition, the Feni is a transboundary river. ● Seawater desalination plants to meet the water demand of the NSEZ will be a costly option. ● There are two rivers in Chattogram namely Karnaphuli and Halda. Halda is an ecologically sensitive area therefore this option has been excluded. In addition, the salinity level is high in the Karnaphuli River, so this option is also excluded. ● Water crises are observed from October to June in the Chattogram area. ● Surface water collection from the Meghna River could be a feasible option. A 150 km pipeline including pumping stations needs to be established following the alignment of the existing railway line. The approximate cost for a thousand liters will be 100 BDT to 120 BDT, which is lower compared to other countries. ● Only one service provider has been appointed for the PPP Project titled "Water Supply to Mirsharai NSEZ from the Meghna River". However, an open competitive tendering/selection process is required for the selection of the most qualified PPP service provider and to negotiate the price of water. ● The proposed water supply project will also be able to supply water to nearby towns, cities, and pourashavas along the pipeline route, as well as the Chattogram City area if needed. ● Rainwater harvesting, recycling, and reuse of water can be introduced to reduce the pressure on water resources. ● In order to improve the groundwater situation, it is necessary to introduce artificial recharge in the depleted groundwater aquifers.
Agricultural Land and Productivity	● No agricultural land should be acquired in the future considering the national food security issue. ● Due to a lack of water availability, agricultural production was hampered last year in two upazilas namely Mirsharai and Sitakunda.
Livelihood Restoration	● Fishermen and livestock (buffalo) dependent communities will lose their livelihoods. There is an immense need for a livelihood restoration plan for them.

Issue Raised	Comments/Concerns/Expectations
Job opportunities	● Training should be given to the community people residing in the NSEZ and its area of influence in order to increase their readiness to get a job in different industries in NSEZ. ● Requested to provide job opportunities to the community people/affected people. ● Requested to keep quota for the people from the Mirsharai area. ● Currently, there is a gap between demand and supply of workers. Around 2,000 people are already engaged from the Mirsharai area.
Lack of proper infrastructure	● Participants were concerned about the shortage in educational, health, and recreational facilities (schools, community clinics, hospitals, medical colleges, etc.), in addition to the shortage in the infrastructure (mainly roads) in the EZ area. Thus, they requested to pay special attention to the infrastructure and the educational and health facilities. ● A technical college/university will be required to develop skilled manpower. ● Two nos. of bridges have been proposed on the Feni River to make a connection between the Sonagazi and Mirsharai areas. It will be helpful for the workers to move to the industrial zone from their residence proposed in Sonagazi, Feni area. ● One jetty will be constructed in the Sandwip Channel by BIWTA. ● KGDCL is facilitating the gas supply in the NSEZ.
Flora and Fauna/Wildlife / Biodiversity	● Wildlife rehabilitation in surrounding suitable habitat/hilly areas needs to be done. ● A wildlife sanctuary in the hilly area can be declared/established to rehabilitate the existing wildlife available in the proposed NSEZ sites. ● Wildlife Park/ecotourism can be introduced in the NSEZ surrounding area. ● Due to the fragmentation of habitat and food scarcity, wildlife is coming to the locality. ● Vegetation should be restored. Plantation on both sides of the road in the NSEZ would be a good option.
Environmental and Social Impacts and Risks	● The existing scenario (land use and land cover) of the NSEZ and the surrounding area will be completely changed due to the implementation of the NSEZ master plan. ● Existing natural resources i.e., air, water, soil, vegetation, and wildlife in the NSEZ site will be impacted. ● Considering the township development groundwater depletion may occur. In that case, there will be a possibility of salinity intrusion in the groundwater aquifer. ● Ambient air and water pollution from different industries in the NSEZ. ● Traffic will be increased on the existing roads located in NSEZ's surrounding area therefore traffic congestion may occur. ● Green industry should be introduced in the NSEZ to reduce environmental pollution.
Natural Disasters/ Hazards	● To protect the NSEZ from cyclones and tidal surges, a Super Dyke has been constructed at the Mirsharai end, and planned an additional 12.5 km at Sitakunda end. In addition, they have excavated local khals. Participants requested to consider the existing small khals located in the Sitakunda area. ● Green belts should be developed to protect the coast from Cyclones and its associated tidal surges.
Storm Water Drainage	● Existing khals need to be reactivated to ensure a smooth flow of water.

Issue Raised	Comments/Concerns/Expectations
	● Proper drainage systems should be developed to avoid flooding in the surrounding areas.
Waste Management	● A biogas plant can be established considering the types of waste that will be generated in the NSEZ. ● The establishment and function of CETPs in the NSEZ must be ensured to confirm that no hazardous/toxic waste is discharged into the aquatic/marine environment from the NSEZ. ● Regarding waste management and pollution prevention, NSEZ should introduce 3R principles (Reduce, Reuse, and Recycle).
Tourist Spots and Tourism Development	● Tourism development focusing on wildlife could be an option. ● According to the NSEZ master plan, one tourist spot namely Guliakhali Sea Beach falls inside the proposed boundary. This place should be avoided during land acquisition. ● Enhancement of the tourist spots and tourism activities could be done.
Law Enforcement and Security	● An industrial police unit will be established in the NSEZ to provide security in industrial zones. ● A separate police unit (Thana Police) will be required for maintaining peace, and enforcement of law and order in the NSEZ surrounding area. ● Bangladesh Coast Guard is responsible for controlling piracy, illegal trafficking, protecting the fishery, oil, gas, forest resources, and environmental pollution in Bangladesh waters and coastal areas, ensuring overall security and law and order through security assistance to seaports, conducting relief and rescue operation in the coastal areas during natural calamity. They have no adequate number of petrol vessels/boats in the Mirsharai area to respond immediately in case of any need. In this case, capacity strengthening is required.
Establishment of an authority	● Due to the future influx of a large number of laborers in the region, there is a possibility of unplanned development activities in the region. Therefore, it is essential to prepare a land use plan to regulate the unplanned development in the region. ● Participants also propose to establish the “Mirsharai Development Authority” to ensure planned development in the NSEZ region and protect agricultural land encroachment.
Coordination and cooperation among various entities	● All governmental entities will have a proper line of coordination and cooperation that enables them to implement the NSEZ smoothly. ● Coordination and knowledge sharing between NSEZ authority and investors are very important and expected.
Miscellaneous	● Sand from the Sandwip channel is extracted by outsiders. ● Now, land grabbing is an important issue. Land grabbers are excavating ponds for aquaculture activities. Participants requested to stop the activities immediately mentioning the additional soil required during the land development stage. ● Separate facilities for the workers and investors should be ensured. ● Transportation facilities for the worker's movement should be ensured.

Appendix C-4.8: Summary of Workshop - National at Dhaka

The validation workshop was held at Pan Pacific Sonargaon Hotel, Dhaka on the 20th of November 2024. The event commenced at 10:00 AM, with an attendance of a total of 160 participants including project proponents, representatives from various ministries, departments, agencies, utility providers, businessman community, investors, nongovernment organizations, and print and electronic media.

Appendix-C (Vol-III) includes a full list of participants for the national validation workshop at Dhaka. Photographs of the participants in the national workshop at Dhaka are given in Figure C-8.

Figure C-8: Photographs of the Participants in the National Workshop at Dhaka

Panel Discussion Session in the Workshop

Glimpse of Participants in the Workshop

Source: EQMS, November 2024

Mr. Abdullah Al Mahmud Faruk, Project Director, NSEZ Development Project of BEZA inaugurated the session with a welcome speech to all participants. Mr. A S M Humayun Kabir, Additional Secretary, Ministry of Environment, Forest, and Climate Change was present as a Special Guest.

RESA study team made a PowerPoint presentation including objectives of the RESA, NSEZ background and study area, reference framework, approach and methodology, description of the NSEZ (phasing plan, transport network including internal and external roads, railway, water network, power network, gas distribution, water supply, waste management, stormwater drainage system, telecommunication network, plantation plan), ES baseline of the region, stakeholder engagement and information disclosure, potential environmental and social impacts, cumulative impact assessment, institutional framework, and recommendation.

After the presentation on the draft RESA report, a panel discussion was conducted and Mr. Saleh Ahmed, Executive Member of BEZA was the moderator of the panel discussion session. In addition, M. Mahmud Ali, Director of the Urban Development Directorate, Syed Md Nurul Basir, Chairman of the National Housing Authority, Syeda Masuma Khanam, Director (Joint Secretary) of the Department of Environment, Professor Dr. Tanvir Ahmed, Department of Civil Engineering of BUET, and Professor Dr. Mahbuba Nasreen, Institute of Disaster Management and Vulnerability Studies of the University of Dhaka was participated in the discussion session. After the panel discussion, an open discussion and question and answer session was conducted.

Finally, in the closing session Ms. Lamiya Morshed, Principal Coordinator (SDG), SDG Affairs of the Chief Advisor Office delivered her speech as special guest and Chowdhury Ashik Mahmud Bin Harun, Executive Chairman (Senior Secretary) of BEZA delivered his speech as a Chair of the closing session and close the workshop.

Main Issues and Concerns Raised

Table C-8 presents a summary of the main outputs of the national validation workshop at Dhaka.

Table C-8: Summary of the National Workshop at Dhaka

Issue Raised	Comments/Concerns/Expectations
Social Dynamics and Discrimination	• Social and cultural dynamics will be changed in the EZ area and surrounding area due to the population influx for jobs, education, etc. purposes.

Issue Raised	Comments/Concerns/Expectations
	• Women, children, and youth groups will be impacted, and recommendations need to be incorporated in the recommendation section.
Employment and Livelihoods	• The inclusion of women, youth, and children should be ensured. • Employment for differently challenged people should be ensured. • The local community should be given priority in the employment opportunity. • Char Khandakar under Sonagazi Upazila and Kumira in Sitakunda Upazila area are two major fishermen living areas. Mainly they depend on the fish captured from the seashore area. Access rights for the artisanal fisherman should be ensured as mentioned in SDG target 14B. • Fish processing industries should be promoted in the NSEZ. • Necessary skill set under the skill development program for the NSEZ workforce as per the demand and availability of the trading opportunities in and around the NSEZ should be revisited in consultation with the UCEP Bangladesh.
Utility Requirement	• After the full completion of the EZ, the power demand will be 3,248 MW per day. • The gas demand will be 700 MMCFD (million cubic feet per day). • Approximately 1,033 MLD (millions of liters per day) of water will be required. Currently, a water treatment plant and water supply pipeline with a capacity of 100 MLD are under construction. BEZA is collaborating with CWASA through a public-private partnership (PPP) to meet the water demand.
Labor Accommodation/ Housing, Transportation, etc.	• Currently, on average 40% of people globally live in urban areas and it is expected that it will reach 70% by the year 2050. • National Housing Authority (NHA) is implementing housing projects in two modules including low-income community housing and daily rent base (affordable housing). • As a national authority, NHA is implementing projects in Upazila and rural areas. NHA is willing to support BEZA if they are invited to work jointly to solve the housing for the workers and build a planned city in the EZ area. • If any government authority does not come forward for the development of a planned city, then the haphazard development will take place around the EZ. Slumification will take place, which will impact local environmental and social conditions. • There is an acute scarcity of labor in the National Special Economic Zone compared to other economic zones such as Srihatta and Jamalpur EZ. • Low-cost transportation is required for the worker's movement. BRTC and other bus services from different points can be introduced as low-cost transportation. • Designated access route at the entry point of the three major approach road of the NSEZ should be considered to avoid the growing traffic congestion prior to the full-fledged operation of the EZ.
Land Resources	• One of the positive sides of this EZ is the availability of vast government barren land and people displacement is less. • To save the agricultural land UDD prepares master plans. Single-cropped land is discouraged for other uses (industrial and residential). In addition, double and triple-cropped land avoidance is preferred.

Issue Raised	Comments/Concerns/Expectations
Water Resources	• Urban Development Directorate (UDD) has developed a master plan considering the entire Mirsharai Upazila. • As per the report, water scarcity will imanate from the rapid urbanization of Mirsharai triggered by the development of NSEZ. Annual water demand in the next 20 years will be 233 million cubic meters (MCM). Currently, the volume of available water is 105 MCM and the shortage amount will be 128 MCM. • During the operation of the EZ, the groundwater level will be depleted in the area. • Water management prescription of the UDD report should be incorporated in the RESA report.
Environmental Quality Monitoring (air, water, noise)	• Impacts of noise pollution to be considered. • All the industries will be categorized into four types i.e., red, orange, yellow, and green for environmental approval. • DOE is responsible for ambient air quality monitoring and Continuous Air Monitoring Stations (CAMS) can be established under the PRIDE project. • Except for noise from vehicle operations, industrial noise inside the NSEZ should follow the WHO standards as well as occupational safety and hazard issues should be considered. • Storm water retention pond, rainwater gardening, permeable footpath and many other nature-based solutions for efficient water resource management in NSEZ should be addressed by the RESA report. • A regional water quality monitoring process must be developed and implemented to control water pollution.
Mangrove Forest, Habitat loss, Biodiversity Management	• Biodiversity conservation - nature-based solutions and ecosystem-based approaches should be introduced. • Biodiversity conservation as well as climate change adaptation should be considered not only in the project site but also in the township development area. • Approximately 16,000,000 trees have been cut or removed from the EZ site. • Habitat of sea birds, shore birds, migratory birds, etc. already been lost due to the implementation of the EZ. • 22% of the area of the NSEZ will be a green zone, with trees and lakes. • EZ area is a suitable breeding and feeding ground for marine and coastal fisheries including Kain Magur *(Plotosus canius),* Nona Tengra *(Mystus gulio),* Pangas *(Pangasius),* Bhekti *(Lates calcarifer),* etc.
Waste Management	• Central Sewage Treatment Plants (CSTPs), Central effluent treatment plants (CETPs), and waste management are the responsibility of the entrepreneurs, producers, and investors. • CETPs will be set up in the NSEZ. Without a CETP, it is not possible to create a green economic zone. • If effluent treatment plants are properly constructed, pollution can be reduced. If BEZA and DOE work in coordination, this economic zone will become the country's first compliance zone.
Resources Efficiency	• Phasing plan should be incorporated in the NSEZ development practices and unused/undevelped land will be allocated for renewable energy generation.

Issue Raised	Comments/Concerns/Expectations
	• Energy efficiency technology should be used in industrial development as well as township development. • Fossil fuel can be used only for the first phase of development and renewable energy (specifically rooftop/floating solar panel) should be prioritized for the second and third phases of development.
Disasters	• Chattogram region is situated in a high-risk zone for earthquake disasters. • Super dyke should be monitored strongly to protect the site during cyclone and storm surges. • Flash flood issues need to be considered in the study.
Coordination among different stakeholders	• A multi-stakeholder steering committee under the leadership of BEZA should be established to oversee the activities of RESA. • Better coordination among the government ministries/departments/ agencies and monitoring of implementation activities of the NSEZ as well as other projects/activities in the region. • BEZA shall inform DOE during TOR preparation of plot allotment regarding the monitoring activities. • The roles and responsibilities of the Ministry of Fisheries and Livestock and the Department of Fisheries should be incorporated into the study report.
Documentation update and implementation	• RESA recommendations should be concrete and specific for inside activities in NSEZ, site-specific EIAs for different infrastructure/zones, external stressors, and other development partners. • To monitor long-term environmental and social impacts in the region, a comprehensive monitoring framework should be prepared under the leadership of BEZA. • RESA is not a static document it should be considered as a live document and should be updated from time to time by adopting the changes that will be made in the master plan of the EZ. • Proper implementation of the safeguard documents/management plans should be ensured.
Development Authority	• Currently, there is no development authority in the EZ area and the location falls outside of the jurisdiction of the Chattogram Development Authority (CDA). • Chattogram regional office of the Urban Development Directorate (UDD) has recently got approval, and this office will look after the issues in the EZ area. • The recommendation of the UDD Development Plan on Mirsharai Upazila should be addressed by the RESA report.
Miscellaneous	• NSEZ will be developed phase by phase. From now the first phase is starting and it will continue for the next five years. • UDD has prepared a Development Project Proposal (DPP) for the preparation of the master plan for the Sitakunda and Sonagazi Upazilas and submitted it to the planning commission for approval. UDD is also expecting assistance from the BEZA regarding the issues.

APPENDIX D

Appendix D: Lab Test Report

Appendix D-1: Ambient Air Quality Monitoring Report

Ref: EQMS/Ambient Air Quality/20240110071

EQMS ENVIRONMENTAL LABORATORY

Analysis Results of Ambient Air Quality

Project Name : Regional Environmental & Social Consultancy Services (RESA) for National Special Economic Zone (NSEZ)

Description of Activity : Ambient Air Quality

Monitored By : EQMS Environmental Monitoring Team

Monitoring Location :
AQ-1: Near BADC switch gate, Char Chandia, Sonagazi, Feni, 22°47'36.148"N, 91°23'34.199"E
AQ-2: Near 7 no. Sonagazi Union Parishad, Sonagazi, Feni. 22°51'2.332"N, 91°24'14.888"E
AQ-3: East side of the road, Bishumiyarhat, Zorarjong, Mirsharai; 22°51'35.38"N, 91°30'31.534"E
AQ-4: Near BEZA Administrative building, NSEZ; 22°45'37.566"N, 91°28'5.761"E
AQ-5: South Mogadia, Mirsharai.; 22°42'49.566"N, 91°31'34.458"E

Monitoring Date : 07.12.2023 to 17.12.2023

Date of Analysis : 14.01.2024

Description of Analysis:

Sl.	Sampling location	Sampling date	Air Pollutants Concentration							CO mg/m3
			SPM µg/m³	PM10 µg/m³	PM2.5 µg/m³	SO_2 µg/m³	NO_2 µg/m³	O3 µg/m³	NH3 µg/m³	
1.	AQ1	12/12/2023	165.64	79.51	46.38	11.63	21.18	27.04	0.00	0.08
2.	AQ2	11/12/2023	126.73	55.75	33.41	25.45	29.24	31.77	0.00	0.07
3.	AQ3	07/12/2023	72.13	33.90	20.15	24.38	31.06	36.19	0.00	0.12
4.	AQ4	14/12/2023	129.30	59.48	35.80	21.55	27.14	29.01	0.00	0.11
5.	AQ5	10/12/2023	124.28	54.32	33.19	15.40	17.91	25.89	0.00	0.06
Duration (hours)			**8**	**24**	**24**	**24**	**24**	**8**	**24**	**8**
Air Pollution (Control) Rules, 2022*			-	150	65	80	80	100	400	5
Method of Analysis Instrument Use: AQM-09			Light Scattering Nephelometer			High Sensitivity Electrochemical				

Note: * Air Pollution (Control) Rules, 2022. Legend: Legend: SPM - Suspended Particulate Matter, PM10 -Particulate Matter of a diameter of 10 micron or less, PM2.5 -Particulate Matter of a diameter of 2.5 micron or less, SO2 -Sulphur Di-Oxide, NOx -Oxides of Nitrogen, CO - Carbon Monoxide, O3 – Ozone, NH3 – Ammonia,

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Ref: EQMS/Ambient Air Quality/ 20240110071

EQMS ENVIRONMENTAL LABORATORY

Analysis Results of Ambient Air Quality

Project Name : Regional Environmental & Social Consultancy Services (RESA) for National Special Economic Zone(NSEZ)

Description of Activity : Ambient Air Quality

Monitored By : EQMS Environmental Monitoring Team

Monitoring Location :
AQ-6: Beribadh Road, Infront of Unigas Plant, Barabkunda, Sitakunda; 22°33'57.532"N, 91°39'12.96"E
AQ-7: Goll chattor of komor ali Bazar, Mirsharai.; 22°41'11.543"N, 91°38'8.382"E
AQ-8: Middle Abu turab Bazar, Mirsharai, Chattogram. 22°44'52.103"N, 91°33'26.088"E
AQ-9: Infront of Government technical school & college, Sitakunda; 22°37'39.974"N, 91°38'46.504"E
AQ-10: Infront of kazi company market, CNG station, Baman sundor, Darogarhat, Mirsharai, Chattogram; 22°47'51.09"N, 91°30'47.515"E

Monitoring Date : 07.12.2023 to 17.12.2023

Date of Analysis : 14.01.2024

Description of Analysis:

Sl.	Sampling location	Sampling date	Air Pollutants Concentration							CO mg/m3
			SPM µg/m3	PM10 µg/m³	PM2.5 µg/m³	SO_2 µg/m³	NO_2 µg/m³	O3 µg/m3	NH3 µg/m3	
1.	AQ6	08/12/2023	40.61	19.49	10.84	26.44	19.47	24.83	0.00	0.10
2.	AQ7	09/12/2023	60.31	31.67	17.29	31.52	15.98	21.59	0.00	0.14
3.	AQ8	15/12/2023	124.58	58.16	34.89	22.21	18.59	23.13	0.00	0.17
4.	AQ9	16/12/2023	53.49	25.65	15.97	39.90	33.06	35.42	0.00	0.22
5.	AQ10	13/12/2023	152.53	71.22	40.05	18.62	15.17	20.02	0.00	0.11
Duration (hours)			**8**	**24**	**24**	**24**	**24**	**8**	**24**	**8**
Air Pollution (Control) Rules, 2022*			-	**150**	**65**	**80**	**80**	**100**	**400**	**5**
Method of Analysis Instrument Use: AQM-09			Light Scattering Nephelometer			High Sensitivity Electrochemical				

Note: * Air Pollution (Control) Rules, 2022. Legend: Legend: SPM - Suspended Particulate Matter, PM10 -Particulate Matter of a diameter of 10 micron or less, PM2.5 -Particulate Matter of a diameter of 2.5 micron or less, SO2 -Sulphur Di-Oxide, NOx -Oxides of Nitrogen, CO - Carbon Monoxide, O3 – Ozone, NH3 – Ammonia, LSN - Light Scattering Nephelometer

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Appendix D-2: Ambient Noise Level Monitoring Report

Ref: EQMS/Noise Level/20240110072

EQMS ENVIRONMENTAL LABORATORY
Analysis Results of Noise Level

Project Name : Regional Environmental & Social Consultancy Services (RESA) for National Special Economic Zone (NSEZ)
Description of Activity : Noise Level Monitoring
Monitored By : EQMS Environmental Monitoring Team
Monitoring Location:
NL1 - Infront of BEZA administrative building, NSEZ, 22°45'38.607"N, 91°28'5.447"E
NL2 - Beribadh road, near CP Mor, NSEZ, 22°43'52.935"N, 91°30'18.62"E
NL3 - Infront of Olikhan govt, Primary school,Ichakhali, Mirsharai, 22°51'38.371"N, 91°30'31.029"E
NL4 - Zero point, Sonagazi municipality, Sonagazi, Feni, 22°50'57.149"N, 91°23'30.014"E
NL5 - Junction of 4 road at Vorer Bazar, shaherkhali, Mirsharai, 22°42'39.605"N, 91°33'56.55"E
NL6 - East muradpur deli bazar, Muradpur swandip ghatghor road, Mirsharai, 22°36'1.149"N, 91°38'59.053"E
NL7 - 3 rastar mor, brickfiled bazar, sitakunda, Chattogram, 22°38'6.503"N, 91°37'3.158"E
NL8 - Gol circle of komor ali bazar, Mirsharai, 22°41'11.472"N, 91°35'8.581"E
NL9 - Beside Uni gas central jame mosque, Barabkunda, Sitakunda, 22°33'54.628"N, 91°39'15.329"E
NL10 - Junction of 3 road at banatoli vor bazar, Mirsharai, 22°46'1.597"N, 91°31'17.428"E
Monitoring Date : 7th – 16th December, 2023
Date of Analysis : 14th January, 2024

Description of Analysis:

Sampling Locations	Location Setting	Time	Noise Level in dB(A)			Bangladesh Standard*	IFC Guideline
			Leq	L_{max}	L_{min}		
ANL-1	Industrial Zone	Day	48.0	66.4	35.1	75	70
		Night	44.0	57.4	31.6	70	70
ANL-2	Mixed Zone	Day	62.2	83.4	40.4	60	55
		Night	53.5	76.6	40.7	50	45
ANL-3	Silent Zone	Day	60.6	88.1	34	50	55
		Night	48.4	67.5	40.1	40	45
ANL-4	Commercial Zone	Day	69.6	92.1	50.9	70	70
		Night	58.4	77.6	43.2	60	70
ANL-5	Commercial Zone	Day	60.2	84.7	31.3	70	70
		Night	39.4	60.8	30.8	60	70
ANL-6	Commercial Zone	Day	65.0	86.7	42	70	70
		Night	51.6	71.9	40	60	70
ANL-7	Commercial Zone	Day	61.0	85.7	30.8	70	70
		Night	51.9	78.5	30.8	60	70
ANL-8	Commercial Zone	Day	61.1	85.3	32.1	70	70
		Night	57.9	83.5	32.7	60	70
ANL-9	Industrial Zone	Day	60.7	88.6	35.5	75	70
		Night	46.4	68.1	31.6	70	70
ANL-10	Commercial Zone	Day	56.5	76.1	31.6	70	70
		Night	47.0	67.8	33.1	60	70

**Noise Pollution (Control) Rules, 2006*

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Appendix D-3: Surface Water Quality Report

Ref: EQMS/Surface Water Quality/ 202312271591

EQMS WET LABORATORY

Test Results of Surface Water Quality

Project Name : Regional Environmental & Social Consultancy Services (RESA) for National Special Economic Zone (NSEZ)
Description of Sample : Surface Water Quality
Sampling Personnel : EQMS Monitoring Team (Mr. Mahbub Alam and Toffazal Hossain)
Sampling Location :

S.No.	Location	Date	Station No.	Latitude	Longitude
1.	Ichakhali Khal	16.12.2023	SWQ-1/1 (U/S)	22°45'50.064"N	91°28'41.982"E
2.		16.12.2023	SWQ-1/2 (D/S)	22°44'52.65"N	91°26'27.95"E
3.	Daborkhali Khal	16.12.2023	SWQ-1/3 (D/S)	22°43'27.576"N	91°27'28.481"E
4.	Bamansundar Khal	16.12.2023	SWQ-2/1 (U/S)	22°43'27.576"N	91°27'28.481"E
5.		16.12.2023	SWQ-2/2 (D/S)	22°42'54.626"N	91°28'36.85"E
6.	Hoania Khal	16.12.2023	SWQ-3/1 (U/S)	22°43'10.113"N	91°31'11.309"E
7.		16.12.2023	SWQ-3/2 (D/S)	22°42'21.837"N	91°29'48.274"E
8.	Saherkhali Khal	16.12.2023	SWQ-4/1 (U/S)	22°42'19.117"N	91°32'28.728"E
9.		16.12.2023	SWQ-4/2 (D/S)	22°41'23.281"N	91°31'32.998"E
10.	Domkhali Khal	16.12.2023	SWQ-5/1 (U/S)	22°40'56.512"N	91°33'46.037"E
11.		16.12.2023	SWQ-5/2 (D/S)	22°40'26.007"N	91°32'59.339"E
12.	Feni River (Muhuri Reservoir)	16.12.2023	SWQ-6/1 (U/S)	22°50'29.859"N	91°27'19.327"E
13.	Feni River (Muhuri Reservoir)	30.11.2023	SWQ-6/2 (D/S)	22°45'25.711"N	91°25'14.407"E
14.	Swandip Channel	30.11.2023	SWQ-7/1 (U/S)	22°43'3.094"N	91°26'17.988"E
15.		30.11.2023	SWQ-7/2 (D/S)	22°38'34.304"N	91°33'11.849"E

Analysis Date (Initiate) : 01.12.2023 & 18.12.2023
Report Submit and Issue Date : 26.12.2023

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Ref: EQMS/Surface Water Quality/ 202312271591

SL.	Testing Specification	Method	Unit	Test Result					Bangladesh Standard[1]
				SWQ-1/1 (U/S)	SWQ-1/2 (D/S)	SWQ-1/3 (D/S)	SWQ-2/1 (U/S)	SWQ-2/2 (D/S)	
1	pH	Ion electrode	-	7.11	7.18	7.91	7.60	7.46	6-9
2	Salinity	Ion electrode	ppt	2.58	2.90	2.86	2.60	2.42	-
3	DO	Ion electrode	mg/L	5.7	6.2	6.3	6.1	6.8	≥5
4	COD	APHA 3112.B	mg/L	18	135	78	50	48	50
5	BOD_5 (at 20°C)	Ion electrode	mg/L	3.6	5.8	4.5	3.2	4.0	≤6
6	TSS	EPA Method 160.2	mg/L	129	125	144	130	175	-
7	Ammonia	Amino acid	mg/L	0.44	0.65	0.30	2.99	1.86	0.3
8	Phosphate	EPA method 200.7	mg/L	1.3	0.4	1.0	2.7	2.6	0.5
9	Nitrate (NO_3^--N)	Ion electrode	mg/L	2.3	0.2	4.3	1.2	0.3	7.0
10	Lead	Ion electrode	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	0.1
11	Mercury	USEPA 410.4	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.004
12	Total Coliform	AFNOR approved	n/100 ml	15	20	35	20	25	≤5000
13	Fecal Coliform	AFNOR approved	n/100 ml	7	11	14	12	11	-
14	Total Chromium	Cadmium Reduction	mg/L	0.004	0.001	0.008	0.001	0.001	0.05
15	Cadmium	AAS	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	-
16	Nickel	Colorimetric method	mg/L	0.001	0.009	0.008	0.008	0.007	-
17	Iron	EPA Phenanthroline	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	-
18	Manganese	Periodate method	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	-
19	Zinc	Zincon Method	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	-
20	Oil and Grease	USEPA1 Hexane Extractable Gravimetric Method	mg/L	0.57	0.85	1.14	1.14	1.20	-

Note: AAS: Atomic Absorption Spectroscopy

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[1] According to the Schedule-2 (Ka), Rule 31 (4) [Water usable by fisheries] of Environmental Conservation Rules, amendment 2023.

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Ref: EQMS/Surface Water Quality/ 202312271591

SL.	Testing Specification	Method	Unit	Test Result					Bangladesh Standard [2]
				SWQ-3/1 (U/S)	SWQ-3/2 (D/S)	SWQ-4/1 (U/S)	SWQ-4/2 (D/S)	SWQ-5/1 (U/S)	
1	pH	Ion electrode	-	7.92	7.64	7.62	7.65	7.65	6-9
2	Salinity	Ion electrode	ppt	1.96	2.61	3.23	4.21	2.46	-
3	DO	Ion electrode	mg/L	7.2	7.0	6.8	7.4	7.2	≥5
4	COD	USEPA 410.4	mg/L	28	31	38	42	31	50
5	BOD_5	Ion electrode	mg/L	2.5	3.0	2.8	2.1	2.4	≤6
6	TSS	EPA Method 160.2	mg/L	130	163	152	202	119	-
7	Ammonia	Nessler method	mg/L	0.35	<0.01	0.27	0.02	1.61	0.3
8	Phosphate	Amino acid	mg/L	2.5	3.5	2.3	2.1	3.9	0.5
9	Nitrate	Cadmium Reduction	mg/L	<0.01	0.3	0.9	0.2	3.0	7.0
10	Lead	APHA 3111.B	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	0.1
11	Mercury	APHA 3112.B	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.004
12	Total Coliform	AFNOR approved	n/100 ml	35	40	25	15	15	≤5000
13	Fecal Coliform	AFNOR approved	n/100 ml	13	27	14	7	9	-
14	Total Chromium	EPA method 200.7	mg/L	0.008	0.009	0.004	0.007	0.001	0.05
15	Cadmium	AAS	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	-
16	Nickel	Colorimetric method	mg/L	0.001	0.008	0.007	0.008	0.001	-
17	Iron	EPA Phenanthroline	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	-
18	Manganese	Periodate method	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	-
19	Zinc	Zincon Method	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	-
20	Oil and Grease	USEPA1 Hexane Extractable Gravimetric Method	mg/L	1.42	1.48	1.28	1.48	1.71	-

Note: AAS: Atomic Absorption Spectroscopy

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[2] According to the Schedule-2 (Ka), Rule 31 (4) [Water usable by fisheries] of Environmental Conservation Rules, amendment 2023.

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Ref: EQMS/Surface Water Quality/ 202312271591

SL.	Testing Specification	Method	Unit	Test Result					Bangladesh Standard [3]
				SWQ-5/2 (D/S)	SWQ-6/1 (U/S)	SWQ-6/2 (D/S)	SWQ-7/1(U/S)	SWQ-7/2(D/S)	
1	pH	Ion electrode	-	7.61	7.64	7.12	6.87	7.05	6-9
2	Salinity	Ion electrode	ppt	1.51	0.22	15.7	16.8	16.3	-
3	DO	Ion electrode	mg/L	7.7	7.6	6.6	6.0	6.3	≥5
4	COD	USEPA 410.4	mg/L	42	28	31	37	44	50
5	BOD_5	Ion electrode	mg/L	2.7	3.1	2.5	2.3	2.4	≤6
6	TSS	EPA Method 160.2	mg/L	167	199	208	130	132	-
7	Ammonia	Nessler method	mg/L	1.11	0.92	<0.01	0.11	0.21	0.3
8	Phosphate	Amino acid	mg/L	1.2	0.9	0.8	2.3	2.0	0.5
9	Nitrate	Cadmium Reduction	mg/L	1.0	2.0	2.0	0.6	0.6	7.0
10	Lead	APHA 3111.B	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	0.1
11	Mercury	APHA 3112.B	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.004
12	Total Coliform	AFNOR approved	n/100 ml	10	18	21	24	28	≤5000
13	Fecal Coliform	AFNOR approved	n/100 ml	4	8	10	9	4	-
14	Total Chromium	EPA method 200.7	mg/L	0.007	0.003	0.001	0.001	0.002	0.05
15	Cadmium	AAS	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	-
16	Nickel	Colorimetric method	mg/L	0.001	0.001	0.008	0.008	0.004	-
17	Iron	EPA Phenanthroline	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	-
18	Manganese	Periodate method	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	-
19	Zinc	Zincon Method	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	-
20	Oil and Grease	USEPA1 Hexane Extractable Gravimetric Method	mg/L	2.0	1.22	1.28	2.28	3.14	-

Note: AAS: Atomic Absorption Spectroscopy

-End-

Received By:

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[3] According to the Schedule-2 (Ka), Rule 31 (4) [Water usable by fisheries] of Environmental Conservation Rules, amendment 2023.

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Appendix D-4: Groundwater Quality Report

Ref: EQMS/Ground Water Quality/ 202312271592

EQMS WET LABORATORY

Test Results of Ground Water Quality

Project Name : Regional Environmental & Social Consultancy Services (RESA) for National Special Economic Zone (NSEZ)
Description of Sample : Ground Water Quality
Sampling Personnel : EQMS Monitoring Team (Mr. Mahbub Alam and Toffazal Hossain)
Sampling Location :

S.No.	Location	Date	Station No.	Latitude	Longitude
1.	NSEZ site (DPHE office)	15.12.2023	GWQ-1	22°45'48.18" N	91°28'33.23" E
2.	Taker Hat Cyclone Shelter, Ichhakhali	15.12.2023	GWQ-2	22°48'31.14" N	91°28'5.42" E
3.	Moghadia, Mirsharai	15.12.2023	GWQ-3	22°44'43.46" N	91°32'38.92" E
4.	Saidpur, Sitakunda	15.12.2023	GWQ-4	22°38'6.76" N	91°37'2.92" E
5.	East Saherkhali Govt. Primary School	15.12.2023	GWQ-5	22°42'39.16" N	91°33'55.40" E

Analysis Date : 17.12.2023 – 26.12.2023
Reporting Date : 29.01.2024

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Ref: EQMS/Ground Water Quality/ 202312271592

SL.	Testing Specification	Method	Unit	Test Result					Bangladesh Standard[i]
				GWQ-1	GWQ-2	GWQ-3	GWQ-4	GWQ-5	
1	Salinity	Ion electrode method	ppt	0.27	0.83	1.53	0.56	0.39	-
2	Turbidity	Turbidimetric Photoelectric Method	NTU	1.8	4.4	0.6	0.4	0.1	5
3	pH	Ion electrode method	-	8.41	8.40	8.50	8.48	8.46	6.5 – 8.5
4	TDS	Ion electrode method	ppm	290	850	1590	600	410	1000
5	Iron	EPA Phenanthroline method 315 B	mg/L	0.70	2.31	0.27	0.14	0.11	0.3 – 1.0
6	Manganese	Periodate method	mg/L	0.2	0.4	0.2	0.1	0.1	0.4
7	Arsenic	Modified Gutzeit	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	0.05
8	Potassium	Turbidimetric Method	mg/L	10.1	9.5	8.6	7.7	6.8	12
9	Zinc	Zincon Method	mg/L	0.2	0.4	0.3	0.2	0.5	5
10	Total Chromium	EPA method 200.7	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	0.05
11	Calcium	Colorimetric Method	mg/L	51	57	47	45	48	75
12	Chloride	Mercury (II) thiocyanate	mg/L	9	60	150	24	6	250
13	Fluoride	Photometric ion selective method	ppm	0.02	0.06	0.04	0.04	0.06	1.0
14	Nitrate (NO_3^-)	Cadmium Reduction	mg/L	0.8	35	9.5	1.0	38	45
15	Nitrite (NO_2^-)	Ferrous Sulphate method	mg/L	<0.01	0.09	0.05	<0.01	0.08	1.0
16	Magnesium	Calmagite method	mg/L	32	35	37	26	21	30.0–35.0
17	Copper	Adaptation of EPA 200.8 method	mg/L	0.02	0.09	0.09	0.16	0.05	1.5
18	Hardness	EDTA Titrimetric method	mg/L	148	176	169	90	64	500
19	Ammonia	Nessler method	mg/L	0.03	0.21	0.08	0.13	0.14	1.5
20	Aluminum	Adaptation of the aluminon method	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	0.2
21	Boron	UVS/APHA 4500.B	mg/L	<0.2	0.67	1.035	<0.2	<0.2	1.0
22	Cadmium	Graphite Furnace AAS/APHA 3111.B	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.003
23	Lead	Graphite Furnace AAS/APHA 3111.B	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
24	Mercury	APHA 3112.B	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
25	Sodium	APHA 3500-Na B	mg/L	74.2	240	171	248	176	200
26	Nickel	Photometric Method	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	0.1
27	Total Coliform	AFNOR approved	n/100 ml	0	0	0	0	0	0
28	Fecal Coliform	AFNOR approved	n/100 ml	0	0	0	0	0	0

--End--

[i] *According to the Schedule-2, Rule 31 (Kha) of Environmental Conservation Rules, Amendment 2023, Government of Bangladesh.*

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Appendix D-5: Soil Quality Report

Ref: EQMS/Soil Quality/ 202312101616

EQMS WET LABORATORY

Test Results of Soil Quality

Project Name : Regional Environmental & Social Consultancy Services (RESA) for National Special Economic Zone (NSEZ)
Description of Sample : Soil
Collected By : EQMS Monitoring Team
Sampling Location : SQ1 - 22°47'24.855"N, 91°24'38.209"E (At Char chadia, Feni,Chattogram)
SQ2 - 22°39'28.004"N, 91°34'39.565"E (Near Baribadh Road, Mahanagar sea beach,sitakundu, Chattogram)
Sampling Date : 17.12.2023 – 28.12.2023
Reporting Date : 04.02.2024

Description of Analysis:

Parameter	Unit	Concentration Present		Analysis Method
		SQ-1	SQ-2	
pH	-	7.31	7.28	US EPA 9045D
Electrical Conductivity (EC_{25})	(dS/m)	0.75	0.85	Australian Method 1:5 Water Suspension Method
Salinity	ppt	0.48	0.544	1:5 Soil/Water Extract electrical conductivity
Total Nitrogen	ppm	2.0	2.4	Ion selective method by nitrogen sensor
Phosphorous	ppm	1.2	1.4	Ion selective method by phosphorous sensor
Potassium	ppm	2.1	3.0	Ion selective method by potassium sensor
Organic Matter	%	0.647	0.651	Wet Oxidation Method
Chloride (Cl-)	mg/L	1083	1855	APHA 4110.B
Calcium (Ca)	meq/100 g soil	4.83	4.47	Ammonium Acetate extraction method
Magnesium (Mg)	meq/100 g soil	5.61	6.16	Ammonium Acetate extraction method
Copper (Cu)	ppm	4.22	6.74	DTPA extraction method
Zinc (Zn)	ppm	0.68	0.92	DTPA extraction method
Lead (Pb)	ppm	21.00	26.61	Nitric-perchloric acid digestion method
Cadmium (Cd)	ppm	0.20	0.26	Nitric-perchloric acid digestion method
Nickel (Ni)	ppm	44.39	53.00	Nitric-perchloric acid digestion method
Chromium	ppm	30.82	43.46	Nitric-perchloric acid digestion method
Sulfate (SO_4^{2-}) as Sulfur	ppm	137.48	90.95	Turbidimetric Method
Texture	--	Silty Clay Loam	Silty Clay	Marchel triangle using sand, silt and clay %.
Particle Size Distribution				
Sand	%	1.1	1.02	Hydrometer Method
Silt	%	65.01	52.10	Hydrometer Method
Clay	%	33.89	46.88	Hydrometer Method

Prepared By
Ahmed Jubaer
Technical Manager

Test Performed By
Al Hasan Kabir
Chemist

Approved By
Md. Saifur Rahman
Quality Manager

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1

Appendix D-6: Sediment Quality Report

Ref: EQMS/Sed Quality/ 202312101616

EQMS WET LABORATORY

Test Results of Sediment Quality

Project Name : Regional Environmental & Social Consultancy Services (RESA) for National Special Economic Zone (NSEZ)
Description of Sample : Sediment Sample
Collected By : EQMS Monitoring Team
Sampling Location : SeQ1 - 22°43'24.344"N, 91°26'12.443"E (Confluence of Ichakhali Khal)
SeQ2 - 22°40'57.553"N, 91°27'23.013"E (Proposed Jetty area)
SeQ3 -22°38'5.206"N, 91°30'36.946"E (Confluence of Domkhali Khal)
SeQ4 -22°37'19.419"N, 91°33'21.117"E (Downstream of Fakirhat ghat,Saidpur)
SeQ5 -22°43'52.743"N, 91°24'36.693"E (Char in the Sandwip Channel, near Urirchar)
SeQ6 -22°44'53.326"N, 91°24'13.206"E (Confluence of Feni and Little Feni River)
SeQ7 -22°45'56.389"N, 91°22'53.92"E (Near to Musapur Closure-Feni EZ)
SeQ8 -22°48'1.864"N, 91°25'52.325"E (Feni River)
Sampling Date : 17.12.2023 – 28.12.2023
Reporting Date : 04.02.2024

Description of Analysis:

Parameter	Unit	Concentration Present				Analysis Method
		Sed1	Sed2	Sed3	Sed4	
pH	-	7.17	7.21	7.60	7.42	US EPA 9045D
Electrical Conductivity	dS/m	1.40	2.28	2.18	1.38	Australian Method 1:5 Water Suspension m.
Total Nitrogen	ppm	1.2	1.8	1.1	2.1	Ion selective method by nitrogen sensor
Phosphorous	ppm	0.8	1.0	1.2	1.4	Ion selective method by phosphorous sensor
Potassium	ppm	2.1	2.4	2.3	2.4	Ion selective method by potassium sensor
Organic Matter Content	%	2.18	2.32	2.064	2.32	Wet Oxidation Method
Chloride (Cl-)	mg/L	6008	7034	6040	7271	APHA 4110.B
Calcium (Ca)	meq/100g	5.67	4.97	6.39	6.39	Ammonium Acetate extraction method
Magnesium (Mg)	meq/100g	7.46	6.94	8.67	8.34	Ammonium Acetate extraction method
Copper (Cu)	ppm	5.91	5.28	5.75	5.92	DTPA extraction method
Zinc (Zn)	ppm	0.58	0.68	0.55	0.71	DTPA extraction method
Lead (Pb)	ppm	22.51	22.94	23.59	23.80	Nitric-perchloric acid digestion method
Cadmium (Cd)	ppm	0.20	0.27	0.27	0.25	Nitric-perchloric acid digestion method
Nickel (Ni)	ppm	46.42	44.88	43.10	38.47	Nitric-perchloric acid digestion method
Chromium	ppm	37.23	34.80	32.45	30.54	Nitric-perchloric acid digestion method
Sulfate (SO_4^{2-}) as Sulfur	ppm	95.76	101.20	84.08	94.30	Turbidimetric Method
Texture	--	Silty Clay Loam	Silty Clay	Silty Clay	Silty Clay	Marchel triangle using sand, silt and clay %.

Prepared By
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Technical Manager

Test Performed By
Al Hasan Kabir
Chemist

Approved By
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Ref: EQMS/Sed Quality/ 202312101616

Description of Analysis:

Parameter	Unit	Concentration Present				Analysis Method
		Sed5	Sed6	Sed7	Sed8	
pH	-	7.47	7.38	7.21	7.31	US EPA 9045D
Electrical Conductivity	dS/m	2.35	2.25	2.40	1.44	Australian Method 1:5 Water Suspension m.
Total Nitrogen	ppm	2.3	2.2	2.4	1.3	Ion selective method by nitrogen sensor
Phosphorous	ppm	0.9	1.2	1.1	1.2	Ion selective method by phosphorous sensor
Potassium	ppm	2.1	2.2	2.0	2.4	Ion selective method by potassium sensor
Organic Matter Content	%	2.32	2.18	2.44	2.064	Wet Oxidation Method
Chloride (Cl-)	mg/L	6824	6368	5973	6105	APHA 4110.B
Calcium (Ca)	meq/100g	6.54	6.73	6.65	5.01	Ammonium Acetate extraction method
Magnesium (Mg)	meq/100g	7.92	8.01	7.94	9.47	Ammonium Acetate extraction method
Copper (Cu)	ppm	5.76	5.59	6.06	6.15	DTPA extraction method
Zinc (Zn)	ppm	0.58	0.45	0.43	0.52	DTPA extraction method
Lead (Pb)	ppm	23.81	23.82	23.15	28.33	Nitric-perchloric acid digestion method
Cadmium (Cd)	ppm	0.29	0.20	0.27	0.28	Nitric-perchloric acid digestion method
Nickel (Ni	ppm	41.70	42.80	47.31	46.22	Nitric-perchloric acid digestion method
Chromium	ppm	30.54	32.73	34.17	35.37	Nitric-perchloric acid digestion method
Sulfate (SO_4^{2-}) as Sulfur	ppm	100.16	127.20	90.15	105.86	Turbidimetric Method
Texture	--	Silty Clay	Silty Clay	Silty Clay	Clay	Marchel triangle using sand, silt, and clay %.

--End--

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APPENDIX E

Appendix E: Critical Habitat Screening

1.1 Definitions and Concepts of Critical Habitat

Environmental and Social Standard 6 (ESS6): Biodiversity Conservation and Sustainable Management of Living Natural Resources of the World Bank Environmental and Social Framework (ESF) requires a differentiated risk management approach to habitats based on their sensitivity and values. ESS6 addresses all habitats, categorized as 'modified habitat', 'natural habitat', and 'critical habitat'. As per article 23 of ESS6 Critical habitat is defined as areas with high biodiversity importance or value, including:

a) Habitat of significant importance to Critically Endangered or Endangered species, as listed in the IUCN Red List of threatened species or equivalent national approaches.
b) Habitat of significant importance to endemic or restricted-range species.
c) Habitat supports globally or nationally significant concentrations of migratory or congregatory species.
d) Highly threatened or unique ecosystems.
e) Ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described above in (a) to (d).

In areas of critical habitat, the Borrower will not implement any project activities that have potential adverse impacts unless all of the following conditions are met:

- No other viable alternatives within the region exist for the development of the project in habitats of lesser biodiversity value.
- All due process required under international obligations or national law that is a prerequisite to a country granting approval for project activities in or adjacent to a critical habitat has been complied with.
- The potential adverse impacts, or likelihood of such, on the habitat, will not lead to a measurable net reduction or negative change in those biodiversity values for which the critical habitat was designated.
- The project is not anticipated to lead to a net reduction in the population of any Critically Endangered, Endangered, or restricted-range species, over a reasonable time period.
- The project will not involve significant conversion or significant degradation of critical habitats.
- The project's mitigation strategy will be designed to achieve net gains of those biodiversity values for which the critical habitat was designated.
- A robust and appropriately designed, long-term biodiversity monitoring and evaluation program aimed at assessing the status of the critical habitat is integrated into the Borrower's management program.

Screening and assessing critical habitats for a project are essential steps to ensure environmental sustainability, legal compliance, risk management, and stakeholder engagement throughout the project lifecycle. The first stage of the Critical Habitat Assessment (CHA) involves conducting a screening exercise to rapidly assess species of conservation concern or those with restricted ranges recorded within the study region of the EZ, or those considered potentially present. This screening assesses these species against thresholds for determining Conservation High (CH) status.

CHA screening has been conducted for all species considered present or potentially present within the study region of the EZ that are globally of conservation concern, including those classified as Critically Endangered, Endangered, and Vulnerable, or those with restricted ranges, as indicated in the IBAT search or from field surveys. Species with a global conservation status of Near Threatened (NT) or lower have been excluded from the CHA screening unless they possess significant national or regional conservation status.

1.2 Critical Habitat-qualifying Species as per ESS 6 Criteria 23 (a), (b) and (c)

The seventy-nine (79) threatened species are potentially found within a 50 km radius using the Integrated Biodiversity Assessment Tool (IBAT). Besides these species, a total of 19 'restricted range' species were also found through IBAT screening. The identification of Critical Habitat-qualifying Species through IBAT is enhanced by a subsequent screening process. The list of species was further updated with data from the IUCN Red List of Threatened Species of Bangladesh (IUCN Bangladesh 2015). When determining the conservation status, priority was given to the national Red List ratings and the global IUCN Red List status. Thereafter, the relevance of critical habitat was assessed for each species based on expert judgment. In this regard, Key Informant Interviews (KIIs) with relevant experts, Focus Group Discussions (FGDs) with locals, and conducted a secondary literature search. Additionally, the IUCN Red List of Threatened Species of Bangladesh was used to examine the distribution of these CH-qualifying species. Through this comprehensive approach, only the following species, out of the initially identified 98, were assessed to confirm their occurrence in the study region of the NSEZ.

1. Chinese Pangolin (*Manis pentadactyla*)		
Status	**Global IUCN: Critically Endangered (CR)**	**IUCN Bangladesh: Critically Endangered (CR)**
Notes	The Chinese Pangolin is found in the Himalayan foothills of Nepal, southern Bhutan, northern and northeastern India, northeast and southeast Bangladesh, northern and western Myanmar, extending to Lao PDR and northern Vietnam, northwest Thailand, and southern China, including Hainan, Taiwan, and Hong Kong. In Bangladesh, this species is rare and reported only in the hills of the northeast and southeast regions of the country. Although there are reports of this species in the northeast and southeast regions, secondary literature suggests that the Chinese Pangolin has never been reported from the study region of NSEZ. There is very little information available on population levels at any level (local, national, or global) with few exceptions, and there is a paucity of research on abundance. No live specimens were recorded during the baseline survey of NSEZ, and it is considered absent in the study region.	
Criteria (a)	The current range according to the IUCN indicates that its Area of Occurrence (AOO) overlaps with the study region of the EZ; however, the habitat requirements of this species suggest that the chance of their occurrence in the study region of the EZ is very low. Unlikely that terrestrial habitat within the study region would support ≥ 0.5% of the global population and as such the thresholds for determination of Critical Habitat under Criteria (a) are not met.	
Criteria (b)	Chinese Pangolin is not endemic, or a range-restricted species and this Criteria is not relevant to this species.	
Criteria (c)	This criterion is not relevant to a resident Chinese Pangolin species	
2. Irrawaddy Dolphin (*Orcaella brevirostris*)		
Status	**Global IUCN: Endangered (EN)**	**IUCN Bangladesh: Near Threatened (NT)**
Notes	Globally, the Irrawaddy Dolphin is distributed across warm coastal waters and rivers from the Bay of Bengal to western Sulawesi, Indonesia. It is found in Bangladesh, Brunei Darussalam, Cambodia, India, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam. In Bangladesh, the species is mostly found in waterways within the Sundarbans mangrove forest and freshwater-affected coastal waters in the Bay of Bengal. Bangladesh's coastal water ecosystems support an estimated number of 5,800	

	individuals of Irrawaddy Dolphin. Focus Group Discussions (FGDs) with local people, Key Informant Interviews (KIIs), and relevant secondary literature suggest their presence in the Sandwip Channel adjacent to the coastline of the NSEZ.
Criteria (a)	The current range, as per the IUCN, suggests that its Area of Occurrence (AOO) intersects with the study region of the EZ Area. However, baseline biodiversity surveys could not confirm their presence in the aquatic ecosystems of the Sandwip channel along the NSEZ. It is unlikely that the aquatic habitat within the study region would support ≥ 0.5% of the national population, and thus, the thresholds for determining Critical Habitat under Criteria (a) are not met.
Criteria (b)	This species is not an endemic or range-restricted and as such Criteria (b) is not relevant to this species.
Criteria (c)	Irrawaddy dolphins are facultative migrants. This means they aren't strictly migratory but may move between freshwater and saltwater habitats depending on various factors. So, thresholds for Criteria (c) are not met, and no further assessment is required.

3. Bengal Slow Loris (*Nycticebus bengalensis*)		
Status	**Global IUCN: Endangered (EN)**	**IUCN Bangladesh: Near Threatened (NT)**
Notes	Bengal Slow Loris is native to Bangladesh, Cambodia, China, India, Lao PDR, Myanmar, Thailand, and Vietnam. In Bangladesh, this species is rare and currently distributed in mixed evergreen forests of northeast and southeast only. It should be noted that the results of recent studies, field trips at NSEZ study regions, Focus Group Discussions (FGDs) with locals, and relevant Key Informant Interviews (KIIs) suggested their absence in the study region of NSEZ.	
Criteria (a)	Though the EZ study region overlaps with AOO for this species as per the IUCN Red List of Threatened Species of Bangladesh, the study region does not support habitats suitable for this species. Therefore, Criteria (a) is not relevant to this species.	
Criteria (b)	Since it's not a restricted-range or endemic species and suitable habitats are not present within the study region, Criteria (b) is not triggered, and no further assessment is required.	
Criteria (c)	This is not a congregatory or migratory species and as such this criteria is not relevant.	

4. Phayre's Leaf Monkey (*Trachypithecus phayrei*)		
Status	**Global IUCN: Endangered (EN)**	**IUCN Bangladesh: Critically Endangered (CR)**
Notes	This species occurs in Bangladesh, China, India, Myanmar, Lao PDR, Thailand and Viet Nam. In Bangladesh, Phayre's Langur is mainly found in the mixed evergreen forests, and adjacent plantations, especially bamboo clumps of Sylhet, Chattogram Districts, and the Chittagong Hill Tracts region. It should be noted that the results of recent studies, field trips at NSEZ study regions, Focus Group Discussions (FGDs) with locals, and relevant Key Informant Interviews (KIIs) suggested their absence in the study region of NSEZ.	
Criteria (a)	The range of this species overlaps with the study region of NSEZ. IUCN enlisted globally Endangered and locally Critically Endangered species only and certain to not occur in the EZ study region due to lack of suitable habitat. Therefore, it is certain that the EZ site and study region will not support this globally threatened species.	

Criteria (b)	Since it's not a restricted-range or endemic species and suitable habitats are not present within the study region, Criteria (b) is not triggered, and no further assessment is required.	
Criteria (c)	This is not a congregatory or migratory species and as such this criteria is not relevant.	
5. Ganges River Dolphin (*Platanista gangetica*)		
Status	**Global IUCN: Endangered (EN)**	**IUCN Bangladesh: Vulnerable (VU)**
Notes	Ganges River Dolphin occurs in Bangladesh, India, Nepal, and Pakistan. Its subspecies *(P. g. gangetica*) occurs in the Ganges Brahmaputra-Meghna, and Karnaphuli-Sangu River systems of the South Asian subcontinent, from the deltas upstream to where they are blocked by rocky barriers, shallow water, fast currents, dams, or barrages. All major rivers of Bangladesh support this species. It should also be noted that the results of recent studies, field trips at NSEZ study regions, Focus Group Discussions (FGDs) with locals, and relevant Key Informant Interviews (KIIs) suggested their absence in the study region of NSEZ.	
Criteria (a)	Though the EZ study region overlaps with AOO for this species as per the IUCN Red List of Threatened Species of Bangladesh, the study region does not support habitats suitable for this species. Therefore, Criteria (a) is not relevant to this species.	
Criteria (b)	Since it's not a restricted-range or endemic species and suitable habitats are not present within the study region, Criteria (b) is not triggered, and no further assessment is required.	
Criteria (c)	This is not a congregatory or migratory species and as such this criteria is not relevant.	
6. Spoon-billed Sandpiper (*Calidris pygmaea*)		
Status	**Global IUCN: Critically Endangered (CR)**	**IUCN Bangladesh: Critically Endangered (CR)**
Notes	Spoon-billed Sandpiper is listed as Critically Endangered because it has an extremely small population, with a lower bound that is thought to now fall below 250 mature individuals in a single population, that is undergoing a rapid continuing decline in excess of 25% in one generation (with a current estimated 8% annual reduction) and has suffered an extremely rapid population reduction in the previous three generations. This is a very rare winter migrant to a few coastal mudflats in Bangladesh. More than 90% of its population lives in a few unprotected small mudflats. In Bangladesh, the species occurs in the coastal mudflats in the southeast region of the country. It should also be noted that the results of recent studies, field trips at NSEZ study regions, Focus Group Discussions (FGDs) with locals, and relevant Key Informant Interviews (KIIs) suggested their absence in the study region of NSEZ.	
Criteria (a)	The area of occurrence (AOO) mentioned in the IUCN Red List of Bangladesh for this species does not overlap with the study region of the NSEZ. Therefore, Criteria (a) is not relevant to this species.	
Criteria (b)	Since it's not a restricted-range or endemic species, Criterion (b) is not triggered, and no further assessment is required.	

Criteria (c)	This species is migratory and gregarious; however, their EAAA, as per the IUCN, does not overlap with the study region, and as such, this species cannot be assessed under this criterion.	
7. Great Knot (*Calidris tenuirostris*)		
Status	**Global IUCN: Endangered (EN)**	**IUCN Bangladesh: Endangered (EN)**
Notes	This species summers in the northeast of Siberia, Russia, and winters in Australia, throughout the coastline of India, Bangladesh, Pakistan, and the eastern coast of the Arabian Peninsula. In Bangladesh, the species occurs on the coasts of the southeast and southwest regions of the country. It should also be noted that the results of recent studies, field trips at NSEZ study regions, Focus Group Discussions (FGDs) with locals, and relevant Key Informant Interviews (KIIs) suggested their absence in the study region of NSEZ.	
Criteria (a)	A non-breeding species and only occurs in low numbers on migration. The global population has been estimated at 292,000-295,000 individuals and it is therefore very unlikely that the EZ study region will support important concentrations of this species; the loss of which would result in a change in their global conservation status.	
Criteria (b)	This species is not endemic or range-restricted and as such Criteria (b) is not relevant to this species.	
Criteria (c)	Great Knots are a migratory and congregatory species. However, secondary literature suggests that this species has not been recently recorded within the EZ study region, and the baseline study of NSEZ also did not confirm their occurrence in the study region. Therefore, the project region is not important for this species, and the thresholds for determining Critical Habitat under Criterion (c) are not met.	
8. Indian Skimmer (*Rynchops albicollis*)		
Status	**Global IUCN: Endangered (EN)**	**IUCN Bangladesh: Critically Endangered (CR)**
Notes	Indian Skimmer global range extends through southern Asia, including Pakistan, India, Nepal, Myanmar, and Cambodia. It occurs mainly along the coasts of southwest and southeast regions of Bangladesh in winter and this species is a regular winter migrant and has a very small range with the Extent of Occurrence estimated to be less than 100 km2. It is found in only one coastal lagoon (one location) which is far away from the study region of NSEZ.	
Criteria (a)	The area of occurrence (AOO) mentioned in the IUCN Red List of Threatened Species of Bangladesh for this species does not overlap with the study region of the NSEZ. Therefore, Criteria (a) is not relevant to this species.	
Criteria (b)	This species is not endemic or range-restricted and as such Criteria (b) is not relevant to this species.	
Criteria (c)	Indian Skimmers are a migratory and congregatory species. However, secondary literature suggests that this species has not been recently recorded within the EZ study region, and the baseline study of NSEZ also did not confirm their occurrence in the study region. Therefore, the project region is not important for this species, and the thresholds for determining Critical Habitat under Criterion (c) are not met.	
9. Pallas's Fish Eagle (*Haliaeetus leucoryphus*)		
Status	**Global IUCN: Endangered (EN)**	**IUCN Bangladesh: Endangered (EN)**

Notes	Its global range extends through Central, South, and Southeast Asia. It occurs mainly in the haors and open water central, southwest, and northeast regions of Bangladesh as well as in other larger wetlands and the Sundarbans Mangrove Forest. This species is an uncommon breeding migrant to Bangladesh and its population is estimated very low (< 250).
Criteria (a)	Though the EZ study region overlaps with AOO for this species as per the IUCN Red List of Threatened Species of Bangladesh, the study region does not support habitats suitable for this species. Therefore, Criteria (a) is not relevant to this species.
Criteria (b)	This species is not endemic or range-restricted and as such Criteria (b) is not relevant to this species.
Criteria (c)	Pallas's Fish Eagles are breeding migrants; however, they are not known to migrate through the EZ study region. This species has not been recently recorded within the Project study region and the NSEZ baseline study also did not confirm their occurrence in the study region. Therefore, the EZ study region is not important for this species, and the thresholds for determining Critical Habitat under Criteria (c) are not met.

10. Steppe Eagle (*Aquila nipalensis*)		
Status	**Global IUCN: Endangered (EN)**	**IUCN Bangladesh: Least Concern (LC)**
Notes	The Steppe Eagle lives in Africa, Arabia, the Middle East, South and East Asia including Bangladesh, Bhutan, China, India, Mongolia, Myanmar, Nepal, Pakistan, and Russia (Siberia). This uncommon winter migrant is widely distributed in Bangladesh. It is not a habitat specialist and occurs in a wide variety of habitats. The total global population is 50,000 to 75,000 individuals.	
Criteria (a)	The study region of NSEZ does not hold any Steppe Eagle as per the baseline biodiversity survey for the project. The threshold for triggering Criteria (a) would be between 250 and 375 birds within the AOO for the populations to be in excess of 0.5% of the global population. Therefore, Criteria (a) is not relevant to this species.	
Criteria (b)	This species is not an endemic or range-restricted and as such Criteria (b) is not relevant to this species.	
Criteria (c)	The Steppe Eagle is a migratory bird in Bangladesh; however, no birds were recorded at the NSEZ study region during the baseline survey. Therefore, this bird species is not utilizing any habitat of the study region. As such, it is not possible to determine an Ecologically Appropriate Area of Assessment (EAAA), and Critical Habitat determination cannot be made.	

11. Black Softshell Turtle (*Nilssonia nigricans*)		
Status	**Global IUCN: Critically Endangered (CR)**	**IUCN Bangladesh: Critically Endangered (CR)**
Notes	Black Softshell Turtle is reported only from Bangladesh and India. It inhabits freshwater river systems, hill streams, wetlands, shrine ponds, dams, and some other water bodies. Before it was discovered in India in the 1990s it was considered to be the only 'endemic' vertebrate in Bangladesh. Its total population is roughly estimated to be less than 2,500.	
Criteria (a)	Though the EZ study region overlaps with AOO for this species as per the IUCN Red List of Threatened Species of Bangladesh, the study region does not support habitats suitable for this species. Therefore, Criteria (a) is not relevant to this species.	

Criteria (b)	This species is not an endemic or range-restricted and as such Criteria (b) is not relevant to this species.	
Criteria (c)	Criteria are not relevant to a resident species.	
12. Northern River Terrapin (*Batagur baska*)		
Status	**Global IUCN: Critically Endangered (CR)**	**IUCN Bangladesh: Critically Endangered (CR)**
Notes	Northern River Terrapin is native to Bangladesh, Cambodia, India, Indonesia, and Malaysia. In Bangladesh, this species is used to be found in the large rivers and estuaries of the coastal region of Greater Noakhali, Barisal, and Khulna Districts, including the Sundarbans Mangrove Forest. It is considered uncommon and Critically Endangered and there are no records of the adult population.	
Criteria (a)	This species nests on sandbars and riverbanks, and the IUCN Bangladesh delineated AOO does not overlap with the study region of NSEZ. Therefore, Criterion (a) is not relevant to this species.	
Criteria (b)	This species is not an endemic or range-restricted and as such Criteria (a) is not relevant to this species.	
Criteria (c)	Criteria (c) is not relevant to a resident species.	
13. Yellow Monitor (*Varanus flavescens*)		
Status	**Global IUCN: Endangered (EN)**	**IUCN Bangladesh: Near Threatened (NT)**
Notes	The species is known to occur in Bangladesh, Bhutan, India, Nepal and Pakistan. In Bangladesh, the yellow Monitor occurs almost in every part of the country barring the deep forests, although not uncommon in the periphery. There are no current data on population size and certain threats are affecting the species and this has led to eradication in some parts of its range in the country.	
Criteria (a)	Though the EZ study region overlaps with AOO for this species as per the IUCN Red List of Threatened Species of Bangladesh, the study region does not support this species as per our primary baseline study. Therefore, Criteria (a) is not relevant to this species.	
Criteria (b)	This species is not an endemic or range-restricted and as such Criteria (b) is not relevant to this species.	
Criteria (c)	Criteria (c) is not relevant to a resident species.	
14. Indian Softshell Turtle (*Nilssonia gangetica*)		
Status	**Global IUCN: Endangered (EN)**	**IUCN Bangladesh: Endangered (EN)**
Notes	Indian Softshell Turtle is found in Bangladesh, India, Nepal, and Pakistan (Ganges, Indus, and Mahanadi river systems). In Bangladesh, this species lives in the major river systems (Ganga-Padma, Jamuna-Brahmaputra, Surma-Kushiara-Megna, and so on) and floodplains.	
Criteria (a)	Though the EZ study region overlaps with AOO for this species as per the IUCN Red List of Threatened Species of Bangladesh, the study region does not support habitats suitable for this species. Therefore, Criteria (a) is not relevant to this species.	
Criteria (b)	This species is not an endemic or range-restricted and as such Criteria (b) is not relevant to this species.	

Criteria (c)	This criteria is not relevant to a resident species.	
15. Indian Peacock Softshell Turtle (*Nilssonia hurum*)		
Status	**Global IUCN: Endangered (EN)**	**IUCN Bangladesh: Least Concern (LC)**
Notes	The species is native to Bangladesh, India, Nepal and Pakistan. In Bangladesh, the species is widely distributed in the rivers, khals, lakes, ponds, other freshwater bodies, and major wetland habitats, minus the hilly regions of the north-east of the country. It should also be noted that the results of recent studies, field trips at NSEZ study regions, Focus Group Discussions (FGDs) with locals, and relevant Key Informant Interviews (KIIs) suggested their absence in the study region of NSEZ.	
Criteria (a)	Though the EZ study region overlaps with AOO for this species as per the IUCN Red List of Threatened Species of Bangladesh, the study region does not support freshwater habitats suitable for this species. Therefore, Criteria (a) is not relevant to this species.	
Criteria (b)	This species is not an endemic or range-restricted and as such Criteria (b) is not relevant to this species.	
Criteria (c)	Criteria (c) is not relevant to a resident species.	
16. Sundori (*Heritiera fomes*)		
Status	**Global IUCN: Endangered (CR)**	**IUCN Bangladesh: N/A**
Notes	*Heritiera fomes* is a species of mangrove tree in the family Malvaceae. Its common names include sunder, sundri, jekanazo and pinlekanazo. It is the dominant mangrove tree species of the Sundarbans of Bangladesh and India and comprises about 70% of the trees in the area. Compared to other species of mangrove, it grows in less saline environments and on drier ground that gets inundated by the tide only infrequently.	
Criteria (a)	Secondary Literature and primary baseline survey for NSEZ suggest that the habitat along the coastline of Sandwip channel does not hold any species of Sundori. Therefore, Criteria (a) is not relevant to this species.	
Criteria (b)	This species is not an endemic or range-restricted and as such Criteria (a) is not relevant to this species.	
Criteria (c)	This criteria is not relevant to a resident species.	

1.3 Criterion (d): Highly Threatened or Unique Ecosystems

Guidance Note of ESS6 defines highly threatened or unique ecosystems as:

- At risk of significantly decreasing in area or quality
- With a small spatial extent and/or
- Containing unique assemblages of species including assemblages or concentrations of biome-restricted species.

This evaluation of the primary habitats within the NSEZ site and study region suggests that there are none that meet the Criterion and has also been reviewed against definitions for ESS6 Criterion (d) (Table E-1).

Table E-1: Summary of assessment of habitats in the EZ study region against criterion (d)

Definition	Assessment
Risk of significantly decreasing in area or quality	The proposed NSEZ and its associated access roads and other infrastructure might decrease both the extent and quality of the habitat. However, given the wide distribution of this vegetation type, it is not currently considered to pose a significant risk.
Small spatial extent	The habitat is widespread.
Containing unique assemblages of species including assemblages or concentrations of biome-restricted species	The vegetation type does not support unique assemblages or a concentration of biome-restricted species.

Based on the above, it can be concluded that the NSEZ area thus does not trigger CH under ESS6 Criterion (d).

1.4 Criterion (e): Ecological Functions or Characteristics that are Needed to Maintain the Viability of the Biodiversity Values Described in ESS6 Critical Habitat Criteria (a) to (d)

ESS6 Criterion (e) focuses on identifying the ecological functions and characteristics essential for the long-term viability of the biodiversity values described in earlier criteria (a) to (d). These values include:

- Habitat of significant importance to Critically Endangered or Endangered species as listed in the IUCN Red List of Threatened Species or equivalent national approaches.
- Habitat of significant importance to endemic or restricted-range species.
- Habitat supports globally or nationally significant concentrations of migratory or congregatory species.
- Highly threatened or unique ecosystems.

In essence, Criterion (e) aims to pinpoint the specific ecological attributes that maintain the viability and integrity of these crucial habitats and the species they support. Quantitative significance thresholds are not established for this criterion. Therefore, expert judgment and qualitative assessment are paramount. The EZ study region was screened using expert advice. Given the sparse vegetation, consisting primarily of widespread homestead plant species, and the absence of Critically Endangered or Endangered species, endemic or restricted-range species, migratory or congregatory species in large numbers, and highly threatened or unique ecosystems, the EZ area does not qualify for Criterion (e).

1.5 Conclusions and Recommendations

For determining whether the EZ site and the study region comprise a critical habitat, the following guidelines must be applied as per the applicable reference frameworks:

To determine the critical habitat of an area, only the Criterion and thresholds provided for defining a CH are indicative for decision-making as there is no universally accepted or automatic formula.

- To identify critical habitat in the study area or EZ area, the project type, scale, anticipated impacts or mitigation strategy is irrelevant. Critical habitat identification is based only on the presence of high biodiversity values in the study area or EZ area.
- The assessment of critical habitat must not focus solely on the EZ site but on the whole landscape.
- The CHA must consider the distribution and connectivity of features important to the CH trigger species concerned, as well as the ecological processes that support these features.

Although fifteen (15) species were reported from the study region as potential trigger species for Critical Habitat (CH), comprising four (04) Critically Endangered (CR) and eleven (11) Endangered (EN) species according to the global IUCN status, only nine (09) trigger the CH criterion based on their

national IUCN status. The remaining six (06) species do not meet the CH criterion as their national IUCN status is Vulnerable, Near Threatened, or Least Concern. According to the assessment conducted following the ESS6 of the World Bank Environmental and Social Framework (ESF) and its Guidance Note (2018), none of the species in the study area meet the threshold limit for Criterion (a). Moreover, the study area does not qualify for CH Criteria (b) to (e) and does not overlap fully or partially with any internationally and/or nationally designated area.

Thus, it has been concluded that the proposed NSEZ site and study region is not a Critical Habitat for any of the identified species, because the study area does not meet any of the ESS 6 of ESF, 2017 and its Guidance Note (2018) criteria during the critical habitat screening study. Hence, the EZ area and study region do not qualify for critical habitat areas.

Appendix E-1: IUCN Red List of Threatened Species – CR & EN Screened through IBAT

IBAT

Priority Species

Habitat of significant importance to priority species will trigger Critical Habitat status (See PS6: para 16). IBAT provides a preliminary list of priority species that could occur within the 50km buffer. This list is drawn from the IUCN Red List of Threatened Species (IUCN RL). This list should be used to guide any further assessment, with the aim of confirming known or likely occurrence of these species within the project area. It is also possible that further assessment may confirm occurrence of additional priority species not listed here. It is strongly encouraged that any new species information collected by the project be shared with species experts and/or IUCN wherever possible in order to improveIUCN datasets.

IUCN Red List of Threatened Species - CR & EN

The following species are potentially found within 50km of the area of interest.
For the full IUCN Red List please refer to the associated csv in the report folder.

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Nilssonia nigricans	Black Softshell Turtle	REPTILIA	CR	Decreasing	Terrestrial, Freshwater
Eretmochelys imbricata	HawksbillTurtle	REPTILIA	CR	Decreasing	Terrestrial, Marine
Batagur dhongoka	Three-striped Roofed Turtle	REPTILIA	CR	Decreasing	Terrestrial, Freshwater
Manis pentadactyla	Chinese Pangolin	MAMMALIA	CR	Decreasing	Terrestrial
Carcharhinus longimanus	Oceanic Whitetip Shark	CHONDRICHTHYES	CR	Decreasing	Marine
Sphyrna lewini	Scalloped Hammerhead	CHONDRICHTHYES	CR	Decreasing	Marine
Sphyrna mokarran	Great Hammerhead	CHONDRICHTHYES	CR	Decreasing	Marine
Anoxypristis cuspidata	Narrow Sawfish	CHONDRICHTHYES	CR	Decreasing	Marine

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Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Pristis zijsron	Green Sawfish	CHONDRICHTHYES	CR	Decreasing	Marine
Rhina ancylostoma	Bowmouth Guitarfish	CHONDRICHTHYES	CR	Decreasing	Marine
Rhynchobatus australiae	Bottlenose Wedgefish	CHONDRICHTHYES	CR	Decreasing	Marine
Rhynchobatus laevis	Smoothnose Wedgefish	CHONDRICHTHYES	CR	Decreasing	Marine
Glaucostegus granulatus	Sharpnose Guitarfish	CHONDRICHTHYES	CR	Decreasing	Marine
Glaucostegus obtusus	Widenose Guitarfish	CHONDRICHTHYES	CR	Decreasing	Marine
Glaucostegus thouin	Clubnose Guitarfish	CHONDRICHTHYES	CR	Decreasing	Marine
Rhinobatos annandalei	Bengal Guitarfish	CHONDRICHTHYES	CR	Decreasing	Marine
Rhinobatos lionotus	Smoothback Guitarfish	CHONDRICHTHYES	CR	Decreasing	Marine
Sonneratia griffithii		MAGNOLIOPSIDA	CR	Decreasing	Terrestrial, Marine
Pristis pristis	Largetooth Sawfish	CHONDRICHTHYES	CR	Decreasing	Marine, Freshwater
Houbaropsis bengalensis	Bengal Florican	AVES	CR	Decreasing	Terrestrial
Calidris pygmaea	Spoon-billed Sandpiper	AVES	CR	Decreasing	Terrestrial, Marine, Freshwater

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Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Batagur baska	Northern River Terrapin	REPTILIA	CR	Decreasing	Terrestrial, Marine, Freshwater
Glaucostegus typus	Giant Guitarfish	CHONDRICHTHYES	CR	Decreasing	Marine
Maculabatis bineeshi	Shorttail Whipray	CHONDRICHTHYES	CR	Decreasing	Marine
Pelochelys cantorii	Asian Giant Softshell Turtle	REPTILIA	CR	Decreasing	Terrestrial, Marine, Freshwater
Glyphis gangeticus	Ganges Shark	CHONDRICHTHYES	CR	Decreasing	Marine, Freshwater
Balaenoptera musculus	Blue Whale	MAMMALIA	EN	Increasing	Marine
Chelonia mydas	Green Turtle	REPTILIA	EN	Decreasing	Terrestrial, Marine
Cuon alpinus	Dhole	MAMMALIA	EN	Decreasing	Terrestrial
Elephas maximus	Asian Elephant	MAMMALIA	EN	Decreasing	Terrestrial
Geoclemys hamiltonii	Spotted Pond Turtle	REPTILIA	EN	Decreasing	Terrestrial, Freshwater
Hardella thurjii	Crowned RiverTurtle	REPTILIA	EN	Decreasing	Terrestrial, Freshwater
Orcaella brevirostris	Irrawaddy Dolphin	MAMMALIA	EN	Decreasing	Marine, Freshwater
Panthera tigris	Tiger	MAMMALIA	EN	Decreasing	Terrestrial

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Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Rhincodon typus	Whale Shark	CHONDRICHTHYES	EN	Decreasing	Marine
Varanus flavescens	Yellow Monitor	REPTILIA	EN	Decreasing	Terrestrial
Isurus oxyrinchus	Shortfin Mako	CHONDRICHTHYES	EN	Decreasing	Marine
Carcharhinus amblyrhynchos	Grey Reef Shark	CHONDRICHTHYES	EN	Decreasing	Marine
Nilssonia gangetica	Indian Softshell Turtle	REPTILIA	EN	Decreasing	Terrestrial, Freshwater
Nilssonia hurum	Indian Peacock Softshell Turtle	REPTILIA	EN	Decreasing	Terrestrial, Freshwater
Nycticebus bengalensis	Bengal Slow Loris	MAMMALIA	EN	Decreasing	Terrestrial
Hoolock hoolock	Western Hoolock Gibbon	MAMMALIA	EN	Decreasing	Terrestrial
Platanista gangetica	Ganges RiverDolphin	MAMMALIA	EN	Decreasing	Freshwater
Eusphyra blochii	Winghead Shark	CHONDRICHTHYES	EN	Decreasing	Marine
Mobula eregoodoo	Longhorned Pygmy Devil Ray	CHONDRICHTHYES	EN	Decreasing	Marine
Negaprion acutidens	Sharptooth Lemon Shark	CHONDRICHTHYES	EN	Decreasing	Marine
Stegostoma tigrinum	Indo-Pacific Leopard Shark	CHONDRICHTHYES	EN	Decreasing	Marine

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Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Aetomylaeus maculatus	Mottled Eagle Ray	CHONDRICHTHYES	EN	Decreasing	Marine
Rhinoptera javanica	Javanese Cownose Ray	CHONDRICHTHYES	EN	Decreasing	Marine
Mobula tarapacana	Sicklefin Devil Ray	CHONDRICHTHYES	EN	Decreasing	Marine
Mobula thurstoni	Bentfin Devil Ray	CHONDRICHTHYES	EN	Decreasing	Marine
Isurus paucus	Longfin Mako	CHONDRICHTHYES	EN	Decreasing	Marine
Acropora rudis		ANTHOZOA	EN	Decreasing	Marine
Trachypithecus phayrei ssp. phayrei		MAMMALIA	EN	Decreasing	Terrestrial
Pateobatis uarnacoides	Whitenose Whipray	CHONDRICHTHYES	EN	Decreasing	Marine
Maculabatis gerrardi	Whitespotted Whipray	CHONDRICHTHYES	EN	Decreasing	Marine
Alopias pelagicus	Pelagic Thresher	CHONDRICHTHYES	EN	Decreasing	Marine
Himantura undulata	Honeycomb Whipray	CHONDRICHTHYES	EN	Decreasing	Marine
Heritiera fomes		MAGNOLIOPSIDA	EN	Decreasing	Terrestrial, Marine, Freshwater
Holothuria scabra		HOLOTHUROIDEA	EN	Decreasing	Marine

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Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Holothuria lessoni		HOLOTHUROIDEA	EN	Decreasing	Marine
Thelenota ananas	Pineapple Sea Cucumber	HOLOTHUROIDEA	EN	Decreasing	Marine
Urogymnus polylepis	Giant Freshwater Whipray	CHONDRICHTHYES	EN	Decreasing	Marine, Freshwater
Rhinoptera jayakari	Oman Cownose Ray	CHONDRICHTHYES	EN	Decreasing	Marine
Mobula birostris	Oceanic Manta Ray	CHONDRICHTHYES	EN	Decreasing	Marine
Asarcornis scutulata	White-winged Duck	AVES	EN	Decreasing	Terrestrial, Freshwater
Calidris tenuirostris	Great Knot	AVES	EN	Decreasing	Terrestrial, Marine
Rynchops albicollis	Indian Skimmer	AVES	EN	Decreasing	Terrestrial, Freshwater
Haliaeetus leucoryphus	Pallas's Fish-eagle	AVES	EN	Decreasing	Terrestrial, Freshwater
Aquila nipalensis	Steppe Eagle	AVES	EN	Decreasing	Terrestrial
Telatrygon crozieri	Indian Sharpnose Ray	CHONDRICHTHYES	EN	Decreasing	Marine
Pateobatis bleekeri	Bleeker's Whipray	CHONDRICHTHYES	EN	Decreasing	Marine
Pastinachus gracilicaudus	Narrow Cowtail Ray	CHONDRICHTHYES	EN	Decreasing	Marine

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Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Mobula mobular	Spinetail Devil Ray	CHONDRICHTHYES	EN	Decreasing	Marine
Aetobatus flagellum	Longhead Eagle Ray	CHONDRICHTHYES	EN	Decreasing	Marine
Lamiopsis temminckii	Broadfin Shark	CHONDRICHTHYES	EN	Decreasing	Marine
Trachypithecus phayrei	Phayre's Leaf-monkey	MAMMALIA	EN	Decreasing	Terrestrial
Trachypithecus pileatus ssp. pileatus	Blond-bellied Langur	MAMMALIA	EN	Decreasing	Terrestrial
Himantura uarnak	Coach Whipray	CHONDRICHTHYES	EN	Decreasing	Marine

Restricted Range Species

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Rhinobatos lionotus	Smoothback Guitarfish	CHONDRICHTHYES	CR	Decreasing	Marine
Odorrana livida	Green Cascad eFrog	AMPHIBIA	LC	Decreasing	Terrestrial, Freshwater
Chirixalus simus	Assam Asian Treefrog	AMPHIBIA	LC	Stable	Terrestrial, Freshwater
Megophrys serchhipii	Serchhip's Horned Toad	AMPHIBIA	LC	Decreasing	Terrestrial, Freshwater

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Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Ophisternon bengalense	Bengal Mud Eel	ACTINOPTERYGII	LC	Stable	Marine, Freshwater
Bengala elanga	Bengala Barb	ACTINOPTERYGII	LC	Unknown	Freshwater
Xenentodon cancila		ACTINOPTERYGII	LC	Unknown	Freshwater
Oreichthys cosuatis		ACTINOPTERYGII	LC	Unknown	Freshwater
Oryzias dancena	Indian Ricefish	ACTINOPTERYGII	LC	Stable	Marine, Freshwater
Pseudosphromenus cupanus	Spiketail Paradise Fish	ACTINOPTERYGII	LC	Stable	Freshwater
Oryzias carnaticus	Spotted Ricefish	ACTINOPTERYGII	LC	Unknown	Marine, Freshwater
Macrobrachium scabriculum		MALACOSTRACA	LC	Unknown	Freshwater
Macrobrachium rude		MALACOSTRACA	LC	Unknown	Freshwater
Macrobrachium rosenbergii	Giant River Prawn	MALACOSTRACA	LC	Unknown	Freshwater
Fregetta tropica	Black-bellied Storm-petrel	AVES	LC	Decreasing	Terrestrial, Marine
Badis chittagongis		ACTINOPTERYGII	DD	Unknown	Freshwater
Pseudolaguvia inornata		ACTINOPTERYGII	DD	Unknown	Freshwater
Psilorhynchus rahmani		ACTINOPTERYGII	DD	Unknown	Freshwater

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APPENDIX F

Appendix F: Water Quality Modelling Report

1. Introduction

Bangladesh has an impressive track record of growth and development. It has been among the fastest-growing economies in the world over the past decade, supported by a demographic dividend, strong ready-made garment exports, remittances, and stable macroeconomic conditions. Bangladesh sets a target to reach a middle-income country by 2031. To achieve its vision of attaining upper middle-income status by 2031, Bangladesh needs to create jobs and employment opportunities through a competitive business environment, increased human capital and skilled labor force, efficient infrastructure, and a policy environment that attracts private investments. In this regard, the Government of Bangladesh (GOB) has launched an initiative to provide industrial land and infrastructure to increase private investments with the support of the Bangladesh Economic Zones Authority (BEZA).

National Special Economic Zone (NSEZ) at Chattogram, Bangladesh, is a successful initiative of BEZA to fulfill the dream of regeneration of that congregational tradition in modern Bangladesh. NSEZ, with its multi-dimensional features, is a great junction of domestic and foreign investment, industrialization, and the economy at the entrance of the southeastern part of the country. One of the largest economic and industrial zones in South Asia, NSEZ, will be a state-of-the-art industrial city. It is one of the government's priority projects for industrialization and job creation. Among the initiatives taken by the GOB to establish 100 economic zones in the country, NSEZ has the highest priority.

1.1 Background

Water quality modeling is vital for predicting and understanding the impact of human activities on aquatic ecosystems and supporting effective environmental protection measures. It plays a key role in regulatory compliance by assessing water quality against established standards. Additionally, this model aids in optimizing resource management, infrastructure design, and emergency response planning, contributing to sustainable water use and ecosystem health. For the Regional Environmental and Social Assessment (RESA) study, water quality modelling along with the necessary hydrological modelling study has been initiated and is present in the subsequent chapters. Water quality in the khals of the NSEZ area and the peripheral water resources systems of NSEZ, like rivers, estuaries, and Sandwip Channel, have been considered here for this water quality and pollution dispersion modelling study.

Water quality modeling plays a crucial role in regional environmental and social impact assessment studies due to its ability to predict and assess the potential impacts of various activities or events on water bodies. With the help of a water quality model, the behavior of pollutants in water bodies under different scenarios, like high or low tide in khals in the NSEZ or the Sandwip channel, can be understood, allowing analysts to predict the potential impacts of proposed EZ or activities on water quality. This helps in identifying potential risks and designing appropriate mitigation measures. The NSEZ is comprised of different types of industrial zones, residential areas, and other necessary infrastructure like roads, khals, super dyke, bridges, gas, power, and water supply network systems. From different sources, pollutants can meet in the khals water, or the surface water of the Sandwip Channel located on the west side of the NSEZ. Industrial effluent and other surface runoff will produce contaminated water, and after passing through the Central Effluent Treatment Plant (CETP), it will end up in the khals and channels. Considering any worst-case scenario like CETP failure and heavy rainfall runoff, khals, and Sandwip Channel's water pollution disperse conditions can be simulated through this water quality modelling study, thus helping in mitigation measures for ecological sustainability.

The scope of work for this water quality modelling study mainly comprises the study of present and previous water quality conditions and other hydro-meteorological parameters like rainfall, water level, circulation, runoff, and hydrological characteristics of the study area. Using suitable software like the

MIKE FM 21 module, this water quality modelling study has been conducted and presented in the RESA report.

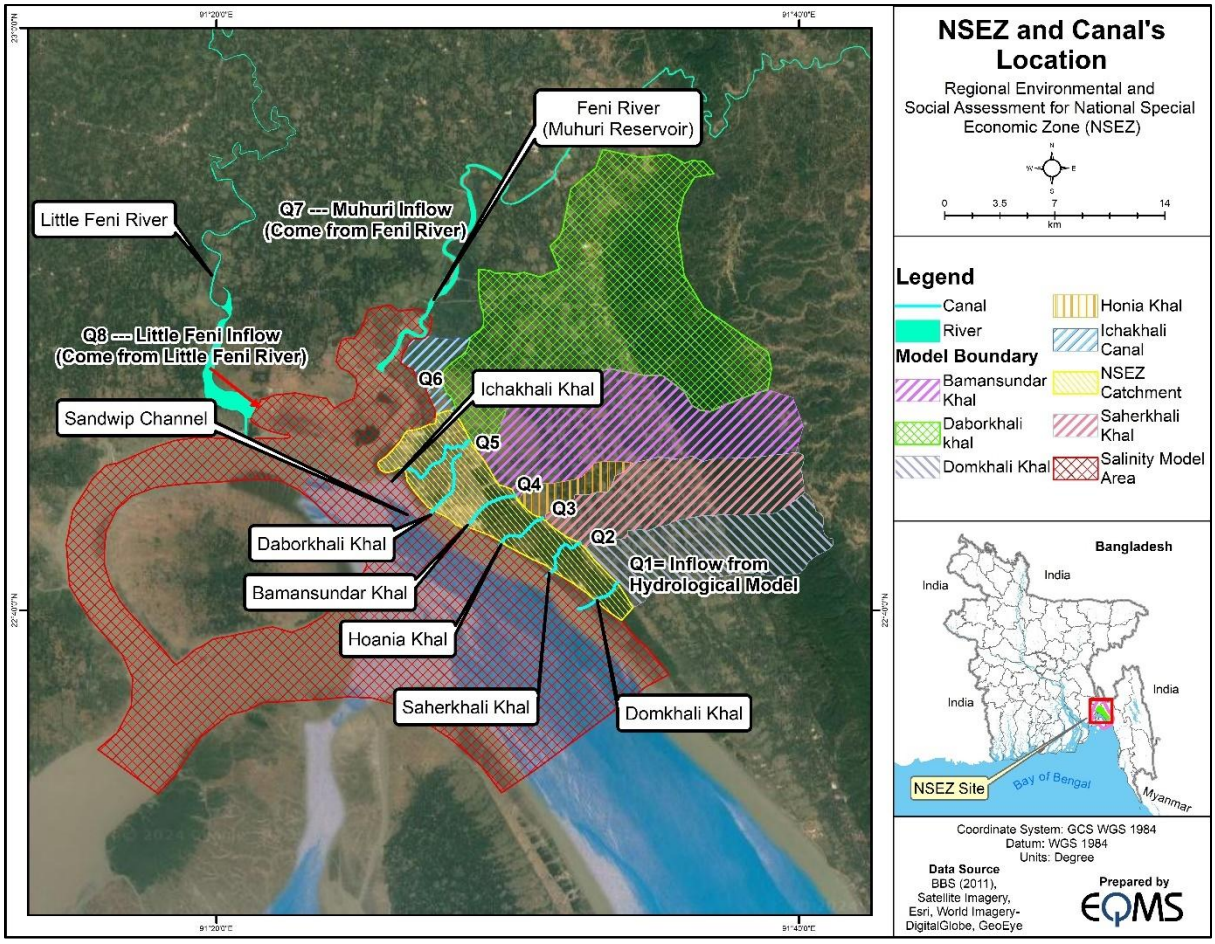
The specific outcomes of this study are to present the spatial distribution of present water quality conditions in the khals in the NSEZ site and the Sandwip Channel, the spatial distribution of contaminated water after the CETP, surface runoff, and pollution from inside the NSEZ.

1.2 Study Area

The study area for the water quality modelling has been considered primarily for the NSEZ located in Sonagazi Upazila of Feni district and Mirsharai and Sitakunda Upazila of Chattogram district. Different rivers and inside khals carry runoff from the catchment and finally discharge to the Sandwip Channel and has impacts on the discharge water quality.

Figure-1 shows the outlets of the main rivers and inside khals of NSEZ, which was used as the water quality modelling catchment boundary and the RESA study buffer zone. The discharge outlet of Little Feni River, Feni River (Muhuri Reservoir), and the inside khals namely Ichakhali, Daborkhali, Bamansundar, Hoania, Saherkhali, and Domkhali khal's catchment discharges have fallen in the Sandwip Channel are considered in the model domain. Upper catchment and lower catchment boundary conditions for hydrologic and hydrodynamic model inputs like discharge, water level, slope and energy gradients, and bathymetric conditions of rivers and khals have been used and the output of this model have been used in the water quality model domains. A buffer zone of the RESA study region (in pink color), channel, rivers, and inside khals of NSEZ are shown in Figure-1.

Figure-1: NSEZ Location and Water Quality Modelling Area



Source: BEZA, 2023

A water availability study was conducted by the Institute of Water Modelling (IWM), the rivers and khal's locations have been identified here along with the cross-checking of field visits and satellite data.

Sandwip channel and the discharge outlets have been considered at the estuary of the Bay of Bengal and a water pollution study has been forecasted within the model catchment boundary for a 1 in 10-year, 20-year, 50-year, and 100-year flood return periods and drainage discharges from the outlets.

1.3 Objective of the Study

The objective of this study is to develop a water quality model for the peripheral area of NSEZ within the model domain and inside khals of the NSEZ located in Sonagazi Upazila of Feni District, Mirsharai and Sitakunda Upazila of Chattogram District. For this water quality modelling, MIKE-21 FM and ECO Lab FM Modules have been used. These models help to understand the present water quality status and assess the impact of various pollutants coming from industry via the Central Effluent Treatment Plants (CETPs) and Sewage Treatment Plants (STPs) and the failure of the CETPs and STPs on the aquatic ecosystem (both river and marine) with different return periods like 10-year, 20-year, 50-year, and 100-year. The study aims to provide valuable insights into sustainable water resource management and pollution control policy guidelines for the NSEZ.

2. Approach and Methodology

2.1 Data Collection

Different types of hydrological, hydrodynamic, meteorological, and morphological data have been collected. Description of the model data and data acquisition plan have been described below. Different types of gauge station data for the rivers mentioned earlier and runoff data from the catchment models have been presented here in the subsequent chapters. Effective locations of the gauge stations have been used to make more stable models as the input parameter of the water quality model.

Different hydrological, hydro-dynamic, and water quality parameters from the NSEZ catchment area and surrounding areas have been collected from primary and secondary sources and considered as one of the important model inputs for this water quality modelling study.

2.1.1 Hydro-Morphological Data

River morphological data have been collected, sorted, and pre-processed for the initial input of the model, such as cross-sectional data, riverbed elevations, and hydraulic depths of the rivers/ khals of Muhuri regulators, Musapur Dam, and khals inside the NSEZ area. Data collection has been done from the Bangladesh Water Development Board (BWDB) and other local government and authorities or some secondary sources data from relevant previous studies have also been used here where necessary and applicable. In case of no such primary data, we have used secondary data from satellite-based remote sensing data like global bathymetric data, land use data, topographic data, etc. Estuary and Sandwip channel bathymetric profiles have been collected from authentic sources like previous studies of BEZA (specifically by IWM) and have merged the primary and secondary data to formulate complete data.

These data were essential to set up the water quality hydro-dynamic model setup and different parameters for pollution dispersion projection within the model domain.

2.1.2 Hydrological data

Hydrological data related to river flow, discharge, and seasonal tidal water level variations have also been collected for the hydrological data input of the water quality modelling. This data is crucial for calibrating the hydrodynamic model and further use in the WQ model. Tidal water levels at the nearest gauge stations have been collected (as much as available) for model calibration and validation. Flow data like discharge at the downstream of Muhuri reservoir, Little Feni River (Musapur Dam), and at the inlet point of inside khals have been collected for the boundary conditions of the model. For the data collection process, different sources have been used like BEZA, BWDB, SOB, IWM survey/studies, and the secondary sources of the relevant previous studies by BEZA or IWM. Consultation at the local level and discussion with the regional executive engineers of BWDB have also been conducted and relevant information has been incorporated in the model and report as well.

Rainfall-runoff modelling has been considered for this water quality modeling study and these data have been collected from the previous studies of BEZA, IWM, etc. Corresponding major hydrological input parameters like rainfall, evaporation, transpiration, and runoff coefficient parameters have also been incorporated from the previous studies. Frequency analysis of hydrological events has also been used for this modelling study. Tidal data from the nearest gauge station have been considered for the WQ modeling and the impact on the pollution dispersion study.

Major data that has been used for this study is listed below:

1. Rainfall, water level, cross sections of the model rivers/ khals from secondary sources.
2. Discharge data of Feni River upstream and downstream of Muhuri regulatory.
3. Tidal water level data of Feni River, Choto Feni River, and khals including Domkhali, Saherkhali, Bamansundar, Ichakhali khals inside the NSEZ.
4. Discharge, tidal water level, and bathymetric profile of the Sandwip Channel near the NSEZ.
5. Water level, discharge, and cross-section at the mouth point of Musapur closure dam.
6. Water level, discharge, and cross sections of Feni closure and regulator dam.
7. Topographic elevations of NSEZ and Digital Elevation Model (DEM) data or spot elevation data from secondary sources.
8. Satellite images of land topography, water surfaces, and land use, land covers.

2.1.3 ETP, CETP, and Effluent Discharge Data

Different locations of ETPs and CETPs have been demarcated from the previous studies like the master plan and water availability study by the BEZA and IWM and subsequently have been used in the water quality modeling study.

2.1.4 Urbanization and Population Data

Urbanization with extended roads and land impervious surfaces has an impact on the water discharge to the khals inside the NSEZ area. To consider this phenomenon, available master plan data for the future urbanized area and the population projection have been used in the data analysis and water quality modeling.

2.1.5 Water Quality Data

Collection of water quality parameters such as pH, Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Nutrients (Nitrate, Phosphate), Heavy metals, and total coliforms from relevant secondary sources along with the field sampling and laboratory testing from the mentioned locations in December 2023. This data has been used for model calibration and validation. CETP and STP discharges and different industrial zoning and phases have been considered for the development of the model setup, and the water pollution load has been incorporated here.

For the water quality analysis for the RESA study and the water pollution modelling study under the RESA study of the NSEZ development area, water samples have been collected from different locations. Recent sampling water quality data and previous sampling water quality data have been used in this model. Recent samples have been collected from 16 December 2023 to 30 December 2023.

Water quality sampling locations have been shown in Table-1.

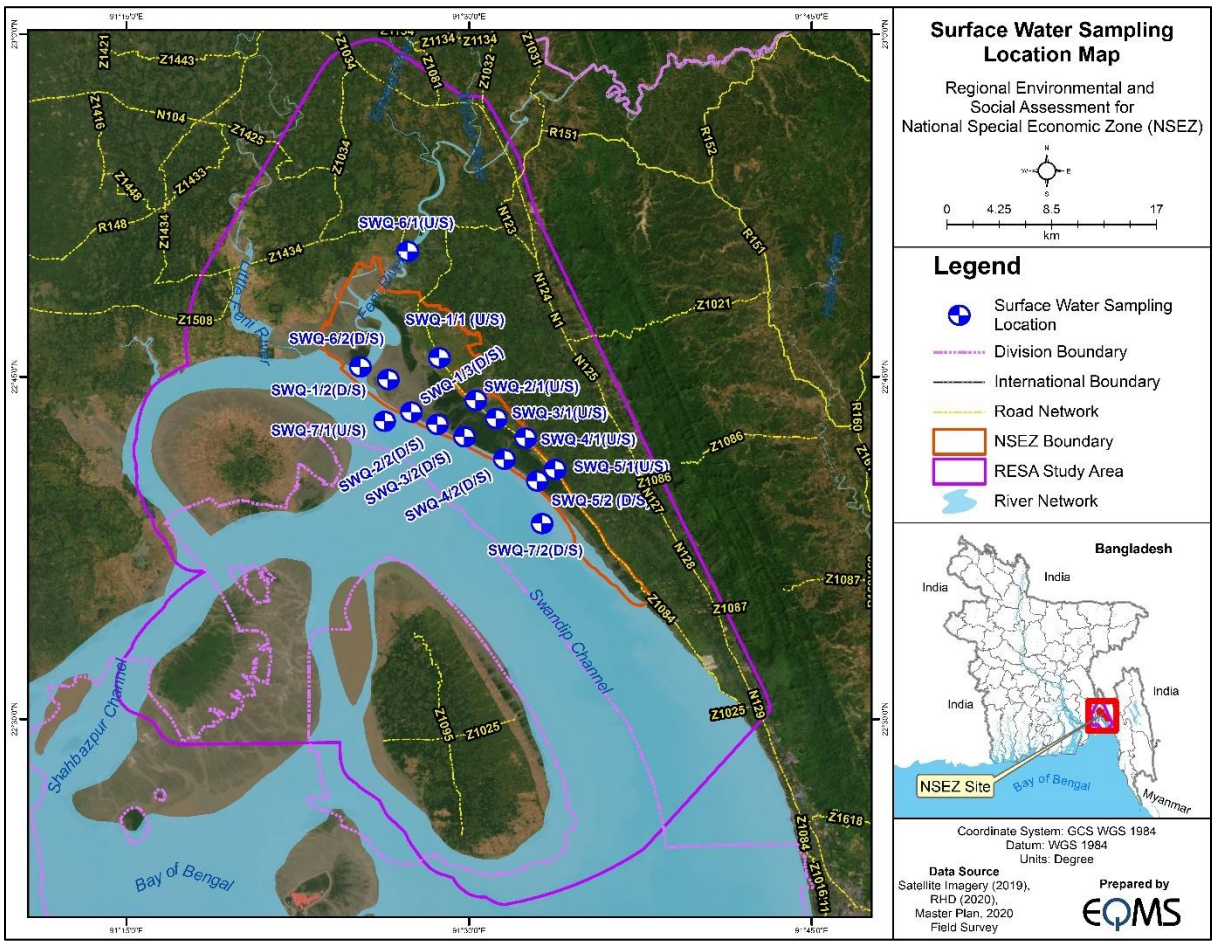
Table-1: Water Quality Sampling Locations from NSEZ Area

SL#	Khal Name	Sample ID	Location	
			Latitude	Longitude
1.	Ichakhali Khal	SW-1/1 (U/S)	22°45'50.064"N	91°28'41.982"E
		SW-1/2 (D/S)	22°44'52.65"N	91°26'27.95"E
2.	Daborkhali Khal	SW-1/3 (D/S)	22°43'27.576"N	91°27'28.481"E
3.	Bamansundar Khal	SW-2/1 (U/S)	22°43'27.576"N	91°27'28.481"E

SL#	Khal Name	Sample ID	Location	
			Latitude	Longitude
		SW-2/2 (D/S)	22°42'54.626"N	91°28'36.85"E
4.	Hoania Khal	SW-3/1 (U/S)	22°43'10.113"N	91°31'11.309"E
		SW-3/2 (D/S)	22°42'21.837"N	91°29'48.274"E
5.	Saherkhali Khal	SW-4/1 (U/S)	22°42'19.117"N	91°32'28.728"E
		SW-4/2 (D/S)	22°41'23.281"N	91°31'32.998"E
6.	Domkhali Khal	SW-5/1 (U/S)	22°40'56.512"N	91°33'46.037"E
		SW-5/2 (D/S)	22°40'26.007"N	91°32'59.339"E
7.	Feni River (Muhuri Reservoir)	SW-6/1 (U/S)	22°50'29.859"N	91°27'19.327"E
		SW-6/2 (D/S)	22°45'25.711"N	91°25'14.407"E
8.	Sandwip Channel	SW-7/1 (U/S)	22°43'3.094"N	91°26'17.988"E
		SW-7/2 (D/S)	22°38'34.304"N	91°33'11.849"E

Source: EQMS, December 2023

Figure-2: Surface Water Quality Sampling Locations



Source: EQMS, 2024

2.1.6 Meteorological Data

Acquisition of meteorological data like rainfall and others (temperature, wind speed, and direction) have been collected from the Bangladesh Meteorological Department (BMD) and published reports by BEZA,

IWM, etc. Extreme rainfall events and surface runoff scenarios have also been estimated through runoff modelling and incorporated into the hydrodynamic model and the water quality models as well.

Global Circulation Data

From the previous study and available global model data like East Indian Coastal Current (EICC) data or Global Circulation Model (GCM) information generated data relevant to circular impact on the tidal level have been incorporated in the hydrodynamic model and checked for the sensitivity of the model domain.

Climate Change Data

Basic model output from the climate change scenario like RCP 4.5 and RCP 8.5 models (from AR6, IPCC) and Bangladesh Delta Plan-2100 have been used to address climate change issues like sea level rise and subsequent flood level increases. An increase in rainfall intensity and flood level scenarios have been considered for this study.

2.2 Hydrologic Model Setup

Topographical and land elevation data like zone-wise land elevation profiles have been collected from secondary sources and the Digital Elevation model (DEM) has been generated here to use in the model input.

2.2.1 Topographical Data

Topographical and land elevation data has been collected and based on the collected data Digital Elevation Model (DEM) has been prepared and used in the model.

2.2.2 Rainfall-Runoff Model Setup

Watersheds and sub-watersheds have been delineated to identify the catchment runoff inside the EZ area and runoff coming from the upper watersheds of the NSEZ area through khals have been analyzed through hydrologic modeling. These runoffs have been used as the input boundary conditions of the hydrodynamic model as shown later.

For catchment and sub-catchment area delineation available topographic data from the previous studies BEZA, IWM, etc. have been collected and used. MIKE 21 FM model software has been used to delineate the catchment and based on the khal's locations, sub-catchments have been generated and shown in the corresponding subchapter of this report. Upstream discharge and various wastewater discharge sources have been considered for the model input as well.

2.2.3 2D Hydrodynamic MIKE 21 FM Model Setup

The hydrodynamic model (HD) in the MIKE 21 FM module simulates the changes in water level and water flow with time due to various forces. This module is based on Navies-Stokes equations with three-dimensional incompressibility and uniform distributions of Reynolds numbers. It is subject to the Boussinesq assumption and the hydrostatic pressure assumption for this model setup as well.

Building up of hydrodynamic model (MIKE 21 FM) to simulate water flow, water levels, and velocities in the rivers, dams, estuary, and inside khals in the NSEZ area different data inputs are checked before used in the model to avoid the uncertainties in the analysis. Calibration of the model has been done using the observed hydrological data to ensure an accurate representation of the model output.

2.2.4 Water Quality Modelling MIKE ECO Lab Setup

The water quality modelling approach comprises an integrated Advection-Dispersion (AD) and water quality modules in the 2D hydrodynamic model. The two modules simultaneously describe the discharge, transport, and effects of pollutants in the river system. The AD module works based on the hydrodynamic description of water levels and flows calculated by the Hydrodynamic (HD) modules and the existing flow condition. The conceptual flow diagram has been shown below describing the integration of the water quality modules and the input parameters needed for water quality modelling.

Incorporating the water quality module (ECO-Lab) into the MIKE-21 model to simulate the fate and transport of pollutants in rivers and sea-front estuaries like the Sandwip Channel was the main objective of using this model. Defining the relevant water quality parameters, such as BOD, COD, nutrients, and other pollutants, and specifying their sources and boundary conditions were also other objectives for this study. We have used the spatial domain for the water quality model, which includes rivers, khals, estuaries, and coastal areas of the study area. Defining the computational grid within the domain, ensuring an appropriate balance between resolution and computational efficiency for this model.

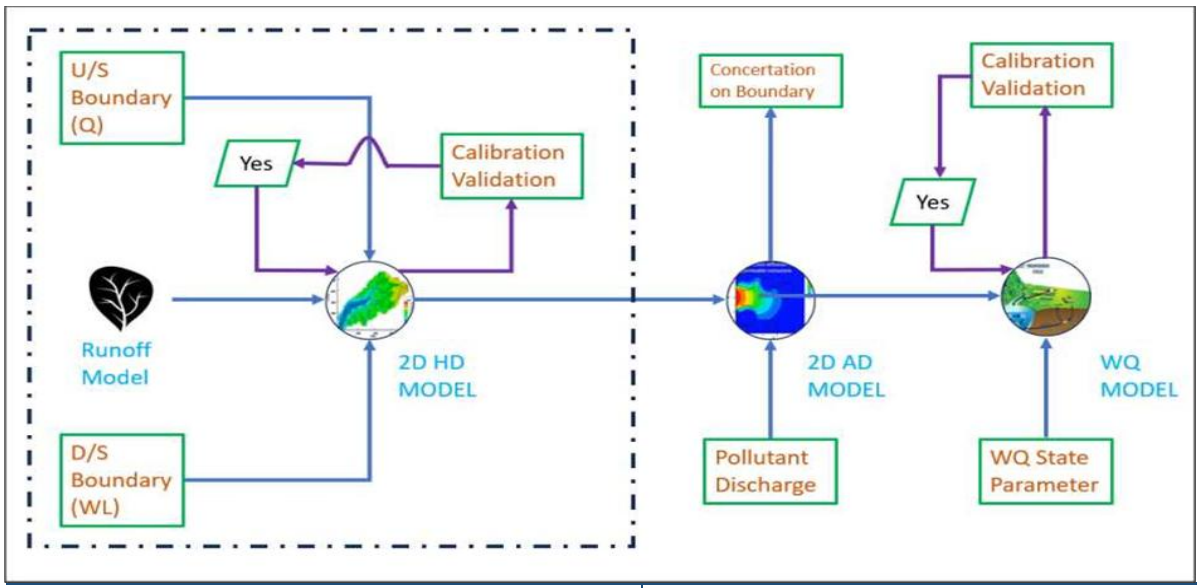
In this study, dry and heavy monsoon seasons water quality of the river and khals have been considered as a baseline condition of the model, and an initial model run was also done based on it. The water quality model domain comprises Little Feni River, Feni River, and the khals inside the NSEZ area have been simulated for extreme conditions like heavy monsoon pollution dispersion and dry season/low flow pollution scenarios. Finally, this model describes the changes in the water quality parameters like BOD, COD, TSS, DO, Ammonia, Nitrate, Phosphate, Lead, Mercury, and Total Coliform concentrations in 2D water quality modelling systems.

Physical and chemical parameters of water quality have been considered here for this study:

1. pH
2. Nitrate (NO_3^-)
3. Dissolved Oxygen (DO)
4. Chemical Oxygen Demand (COD)
5. Ammonia (NH_3)
6. Phosphate (PO_4^3)
7. Total Suspended Solids (TSS)
8. Total Chromium
9. Total Coliform (TC)
10. Biochemical Oxygen Demand (BOD)
11. Mercury (Hg)
12. Lead (Pb)

The flow chart for the water quality modelling has been depicted in Figure-3.

Figure-3: Flow Chart for Hydrologic-Hydrodynamic and Water Quality Modelling



Hydrodynamic (HD) Model Set-up [Initial Segment]	**2-D WQ Model Set-up & Final Output** [Final Segment]

Source: EQMS, 2023

2.3 Model Calibration and Validation

To calibrate the water quality model using the collected water quality data and observed water level and discharge data have been used. Adjusting the model parameters to match observed water quality values and improve the model's accuracy. Validating the model using another set of independent water quality data to verify its reliability and predictive capabilities. For model calibration and validation different sets of data have been used like observed data, existing water level data, state governing coefficients, etc.

The parameter calibration of the water quality numerical model mainly consisted of adjusting the diffusion coefficient, attenuation coefficient, and the related biochemical reaction rates of the pollution parameters based on the simulation results. After the initial setting of the parameters, the water quality simulation for the NSEZ catchment area within the study period (model running time for stabling) has been conducted to obtain good simulation results for the water pollution indices along with the hydrodynamic flow fields.

2.4 Scenario Analysis and Final Output

Developing various scenarios to simulate the impact of different pollution sources and pollution control measures on water quality has been done for this study. These scenarios included changes in industrial discharges and other sources of pollutants. Analyzing the effectiveness of potential interventions and identifying the most suitable measures to improve water quality in the project area were also considered here. Different return periods model scenarios have also been generated like 1 in 10-years, 20-years, 50-years, and 100-years return periods for dry and monsoon seasons pollution dispersion.

For example, 10-year return periods have been analyzed through hydrologic modelling, and based on that data pollution dispersion mechanisms have been varied from the average year and future projection years. Based on this temporal variability, WQ model outputs have been generated.

Different scenarios like Business-As-Usual (BAU) indicating the functional treatment systems and pessimistic scenarios like the functionality of the CETPs e.g., 50% not functional, 100% not functional scenarios have been considered for this WQ modeling report.

For example, a 10-year return period has been analyzed through hydrologic modelling, and based on that data pollution dispersion mechanisms varied from the average year and future projection. Based on this temporal variability, the WQ model output has been generated and explained in this report.

Different scenarios like Business-As-Usual (BAU) indicating the functional treatment systems and pessimistic scenarios like the functionality of the CETPs e.g., 50% not functional, 100% not functional scenarios have been considered for this WQ modeling report.

3. WATER QUALITY MODEL DEVELOPMENT

The model has been set up with different stages like hydrological models, hydrodynamic models, and finally the water quality models. Different types of hydrological, morphological, and water quality parameters have been considered to be set as the input components in the water quality model.

The hydrological model (NAM Hydrological model) has been developed to estimate inflow in each khal and khal inside the EZ area. The rainfall runoff model comprises 7 nos. of sub-catchments, having a total area of 438.05 sq. km in which 51.80 sq. km contributes runoff to all the khals inside the NSEZ. The runoff-inflow data have been used in the 2D hydrodynamic model input and water quality modelling as well. Feni River inflow (runoff-discharge) data at the Muhuri Regulator downstream have been used from the 2D morphological model.

3.1 Data Used for the Hydrological Modelling

The following hydrological parameters and historical data have been used for this hydrological modelling prior to the water quality simulation and dispersion model. All of these data have been collected from the Bangladesh Water Development Board (BWDB).

- **Rainfall stations**: Sikderhat, Rajbaritila, Mirsharai measuring gauge stations (Source: BWDB, 2024)
- **Evaporation stations**: Cumilla meteorological station (Source: BWDB, 2024)

The hydrodynamic 2D model (MIKE 21FM model developed by DHI) has been developed using several inflow boundaries. This 2D hydrodynamic model has been used combined with MIKE & ECO Lab (Water Quality Module) for a 2D water quality modelling to see the future water quality dispersion of the study area. The total area covered for the hydrodynamic model has been found to be 438.05 sq. km as per the model setup.

3.2 Data Used in the Water Quality Model

The following data at the model boundary conditions have been used for the water quality modelling.

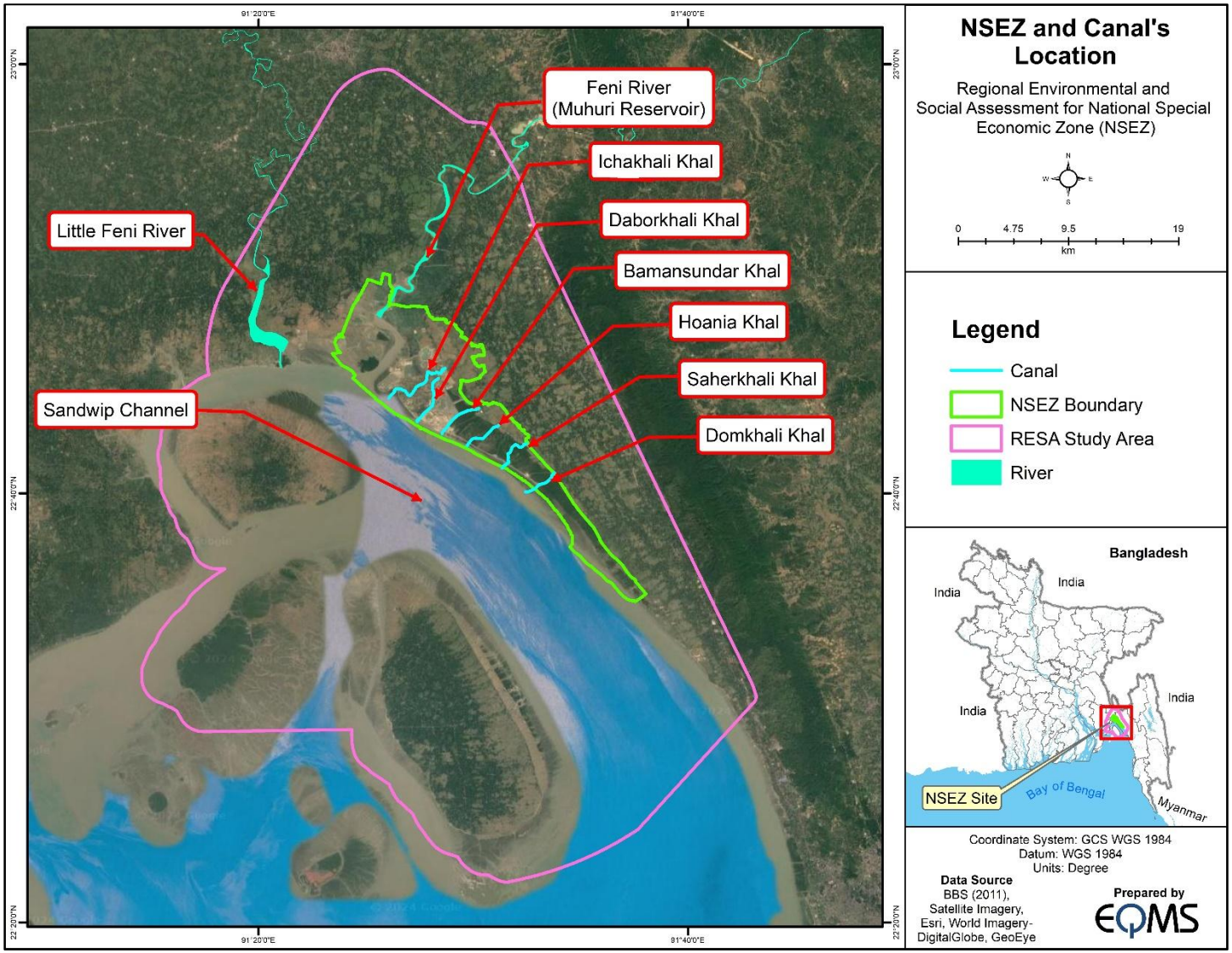
- **Upstream (U/S) Boundary condition**: Inflow Boundaries taken from the Hydrological model and BWDB data.
- **Downstream (D/S) Boundary condition**: Sandwip East and West water level Boundary is calculated from tidal constituent.
- **Observed Water Level data** at Sandwip and Feni mouth points for Calibration collected from secondary sources.
- **Bathymetry data** of each channel and Feni River were collected from secondary sources.
- The bathymetry data of Sandwip Channel has been collected from secondary Global bathymetric radar data sources.

Figure-4 shows the hydrological model boundary comprising rivers, khals, and sea-front areas like the Sandwip Channel. A total of seven rivers and khals input data have been considered here for hydrological and hydrodynamic model components and after these models run completed, outcomes have been used in the water quality model called ECO Lab FM Module as mentioned in the approved methodology.

Sub-catchments area has been shown in Figure-5 covering Mirsharai, Feni, Fatikchari (downstream landscape), and some parts of Sitakundo Upazila. The Unions (lower administrative boundary of Upazila) covered are Saherkhali, Ichakhali, Muradpur, Saidpur, Sonagazi, and Char Chandina. Rainfall runoff from this area has been considered for this model boundary.

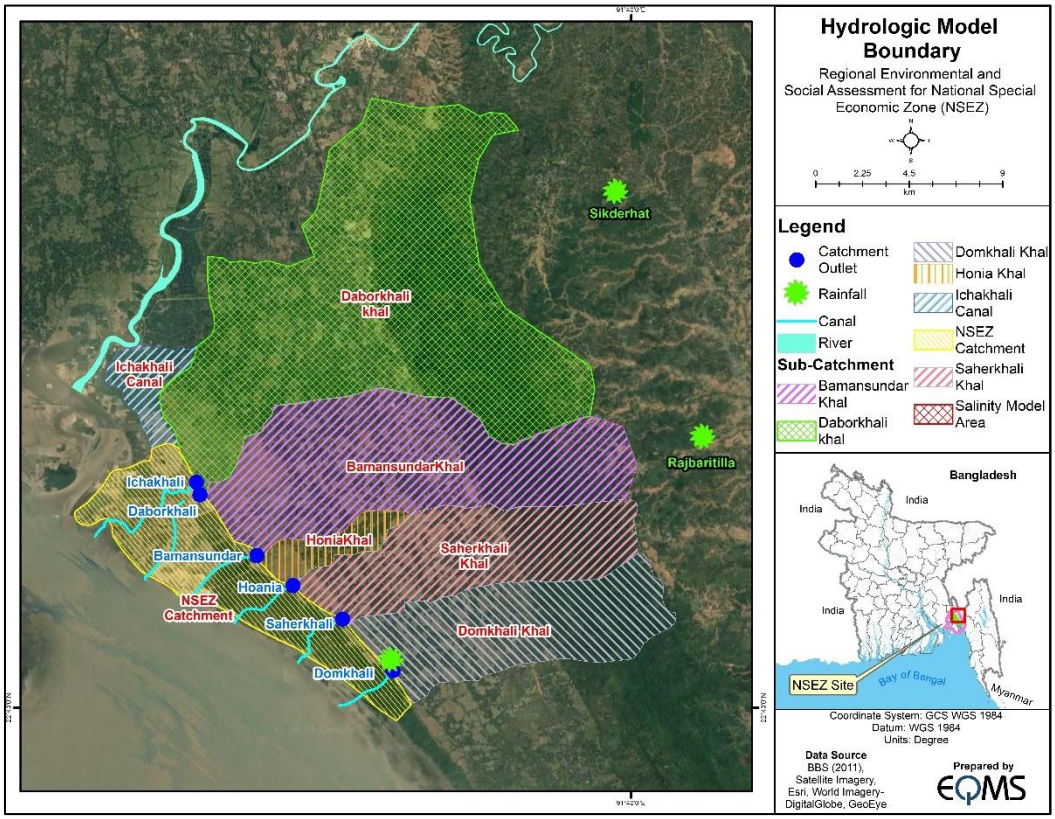
Figure-6 shows the hydro-dynamic model like khal water level, cross-sections, invert level, etc. have been incorporated into the model. The model water level data input boundary, water level gauge station data use locations, and khal's inflow discharge and water level data have also been used for the completion of model setup and the MIKE 21 FM model has been run for stabling and after stabling, the model has been run to acquire the final results. The final output has then been used for the water quality model domain and finally, the water quality model shows the water dispersion scenarios.

Figure-4: Model catchment area and the model components in the NSEZ area and within the buffer region in Mirsharai and Feni in Chattogram



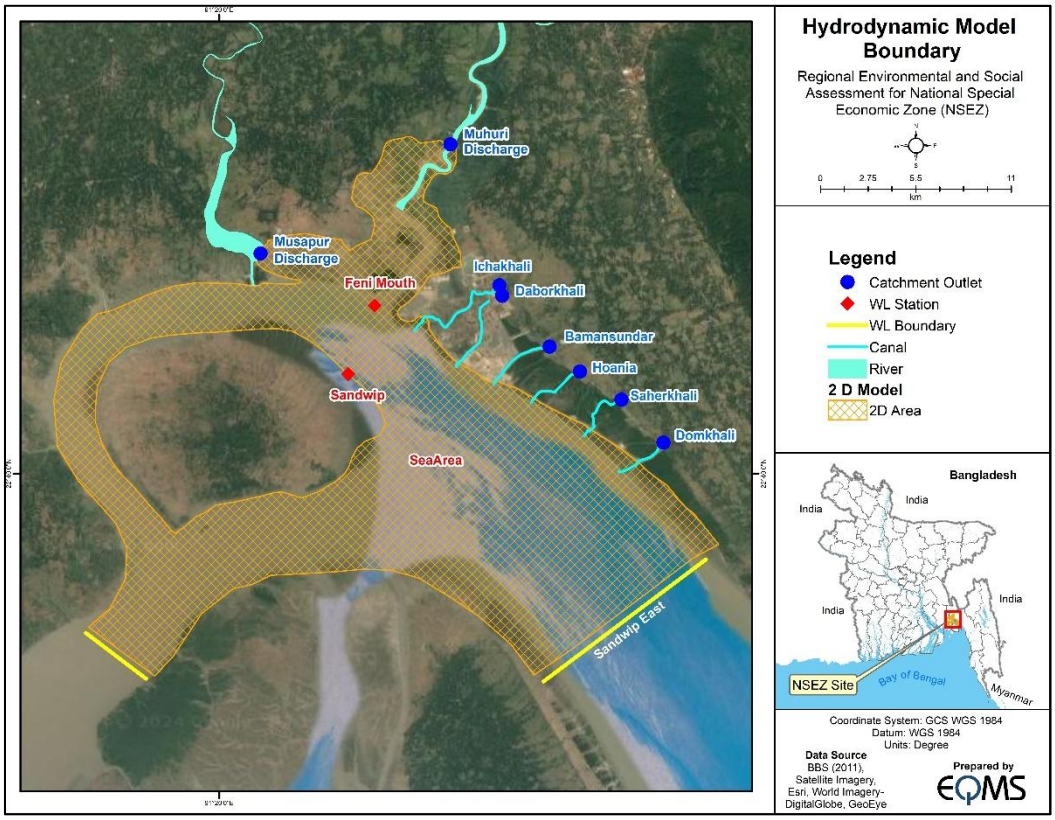
Source: EQMS, 2024

Figure-5: Hydrological model for the land use catchment and the sub-catchments in the model domain



Source: EQMS, 2024

Figure-6: Hydro-dynamic Model for the Rivers, Khals, and the Sandwip Channel in Mirsharai



Source: EQMS, 2024

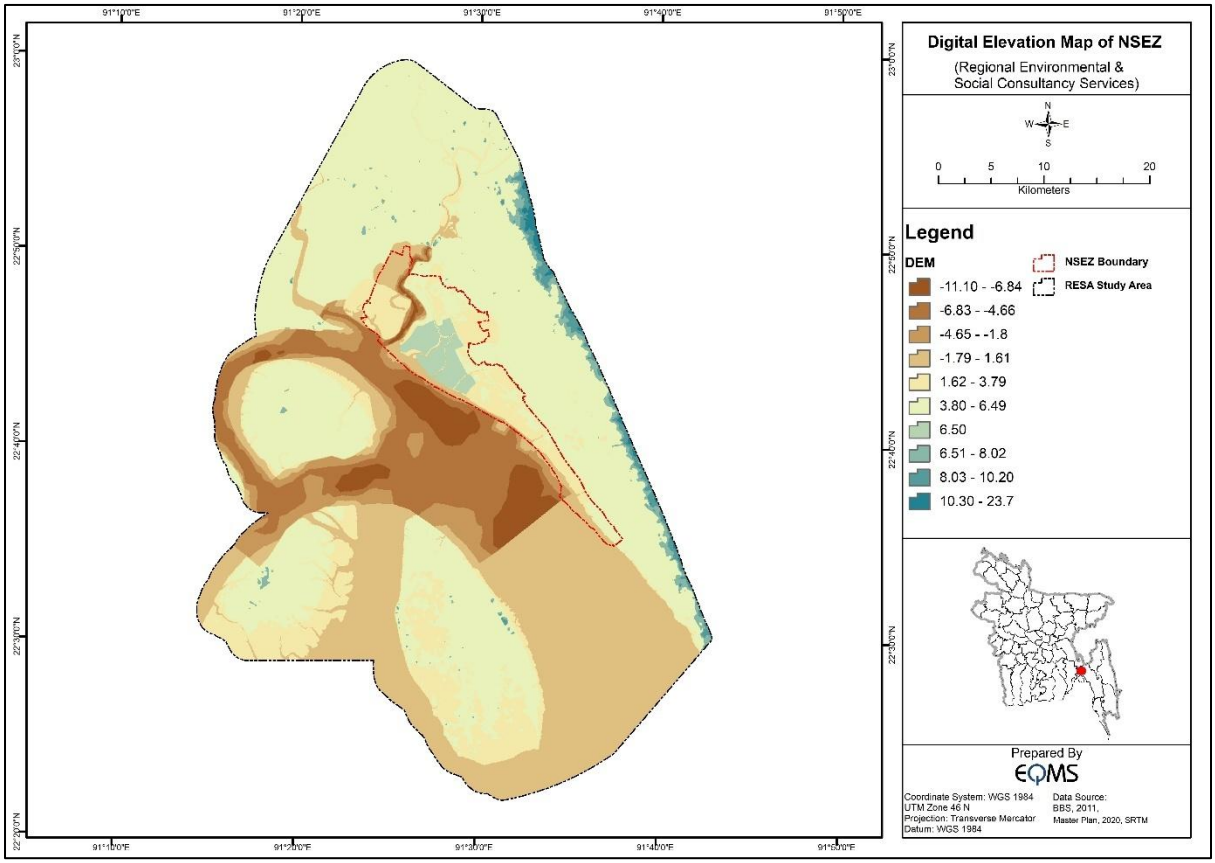
3.2.1 Topographic Condition

The study area is generally flat and low-lying towards the Bay of Bengal and Sandwip Channel. The site belongs to the sea-land interactive sedimentary plain, and the terrain appears to be relatively flat. No hilly area has been found inside the NSEZ site and its immediate surroundings.

For the preparation of the Digital Elevation Model (DEM) of the study region within the area of interest and the NSEZ development area, different types of elevation data have been used like Copernicus-based FABDEM which is a satellite-based elevation data comprising the land topography excluding the tree and building heights. In addition, some land surveyed data (by IWM) and ocean bathymetric data have been used and finally, two DEM maps have been produced with spatial analysis. The data provided was recently collected recently over the past few years. The resolution of this data is 30 meters at the equator. Table-2 shows the elevation ranges and the covered area for the NSEZ development area.

The bathymetry of all khals is taken from secondary sources of previous studies by the IWM. Sandwip channel and Urirchar channel's bathymetric data have been taken from secondary sources like global bathymetric radar data. Copernicus DEM data has been used to delineate the hydrological watershed area for the hydrological model. Figure-7 shows the bathymetric and topographic elevation map for this water quality modelling study.

Figure-7: Bathymetry Data Collection from Different Sources



Source: BEZA and EQMS, 2024

Topographic elevation ranges between -11.07m (MSL) to 23.7m (MSL). The elevation ranges have been presented in Table-2.

Table-2: Topographic Elevation Profiles within the NSEZ Area

SL#	Elevation Range (mMSL)	Covered Area (Sq. Km)	Area (Acre)	Area (%)
1	-11.10 - -6.84	59.97	14817.21	2.94

SL#	Elevation Range (mMSL)	Covered Area (Sq. Km)	Area (Acre)	Area (%)
2	-6.83 - -4.66	181.54	44857.99	8.89
3	-4.65 - -1.8	89.14	22024.97	4.37
4	-1.79 - 1.61	536.64	132601.36	26.28
5	1.62 - 3.79	219.68	54281.40	10.76
6	3.80 - 6.49	880.20	217495.17	43.11
7	6.50	24.67	6095.05	1.21
8	6.51 - 8.02	25.61	6328.36	1.25
9	8.03 - 10.20	18.32	4527.70	0.90
10	10.30 - 23.7	6.07	1500.67	0.30

Source: EQMS, 2024

The elevation range of different model catchments like Ichakhali, Daborkhali, Bamansundar, Hoania, Saherkahli, and Domkhali khals inside of the NSEZ has been shown in Table-3.

Table-3: Model Catchment-wise Topographic Elevation (unit in mMSL)

SL#	Model Catchments	Max Elevation (mMSL)	Min Elevation (mMSL)	Avg. Elevation (mMSL)	Area Coverage (Sq. km)
1.	Ichakhali khal	7.9	0.8	4.1	10.2
2.	Daborkhali khal	236.3	0.5	34.3	171.6
3.	Bamansundar khal	267.8	-0.5	31.7	90.0
4.	Hoania khal	7.7	2.0	4.3	9.5
5.	Saherkahli khal	227.6	1.5	43.1	52.3
6.	Domkhali khal	212.4	1.0	41.6	52.7
7.	NSEZ boundary	6.5	-7.90	3.5	51.8

Source: EQMS, 2024

The NSEZ boundary represents only the NSEZ site. The inside elevation ranges and coverage area of the NSEZ site have been presented in Table-4.

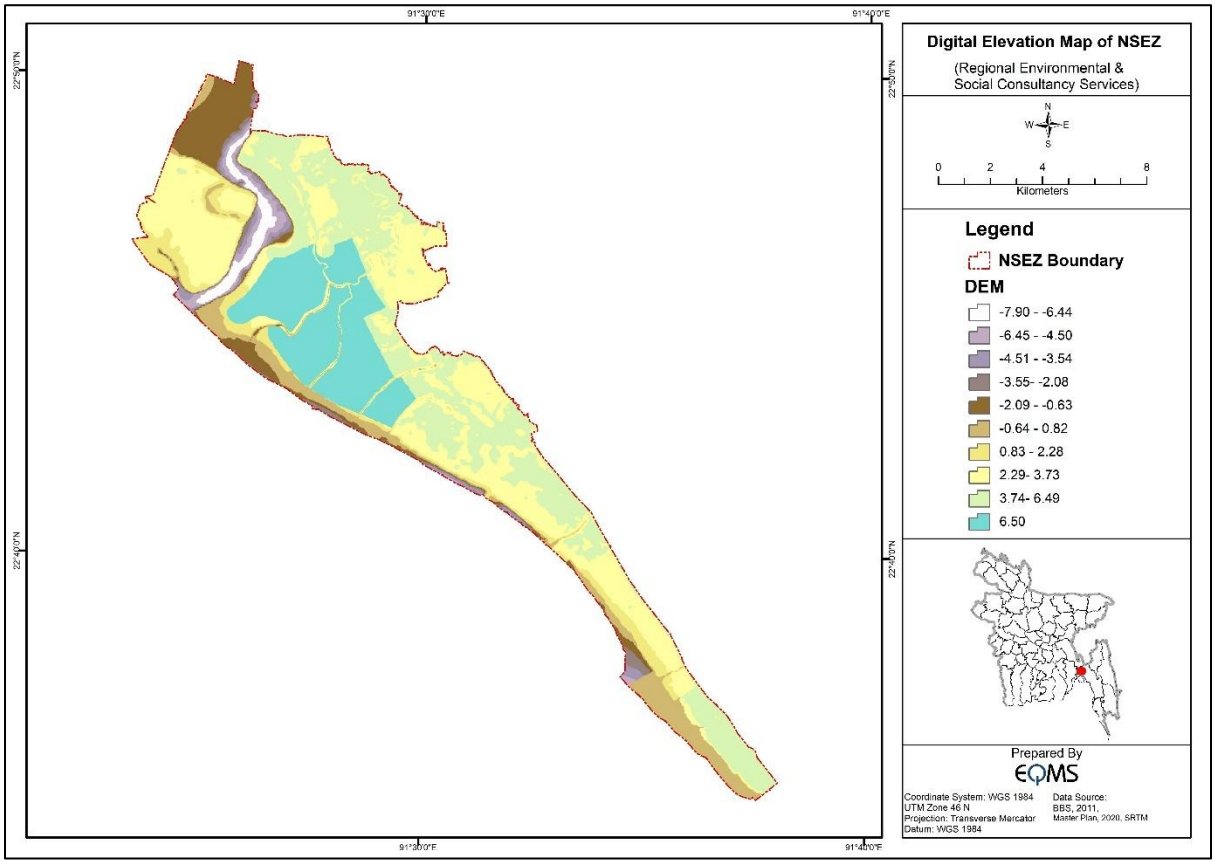
Table-4: Topographic Elevation Profiles inside the NSEZ Site

SL#	Elevation Range (mMSL)	Covered Area (Sq. Km)	Area (Acre)	Area Cover (%)
1.	-7.90 - -6.44	2.66	656.06	1.83
2.	-6.45 - -4.50	2.47	610.64	1.70
3.	-4.51 - -3.54	2.34	578.29	1.61
4.	-3.55- -2.08	2.27	561.45	1.56
5.	-2.09 - -0.63	9.74	2,406.65	6.71
6.	-0.64 - 0.82	11.34	2,801.48	7.81
7.	0.83 - 2.28	9.70	2,397.78	6.68
8.	2.29- 3.73	42.76	10,565.36	29.44
9.	3.74- 6.49	37.54	9,275.63	25.85

SL#	Elevation Range (mMSL)	Covered Area (Sq. Km)	Area (Acre)	Area Cover (%)
10.	6.50	24.40	6,029.03	16.80

Source: EQMS Consulting Limited, March 2024

Figure-8: Digital Elevation Model of the NSEZ Site



Source: EQMS and BEZA, 2024

NSEZ development area topographic elevation ranges between -7.90m (MSL) to 6.50m (MSL). In the downstream of Feni River and the low-lying area like in Sandwip Channel and its downstream topographic elevation ranges between -7.90m (MSL) to -0.64m (MSL). Over the NSEZ development area, topographic elevation ranges between 2.28m (MSL) to 6.50m (MSL). The NSEZ development area DEM is shown in Figure-8.

3.2.2 Discharge and Water Level

Water level and discharge data have been collected from BWDB as shown in Table-5.

Table-5: List of Hydrological Data Measurement and Data Acquisition Stations by BWDB

Measuring Station	Location	Type	Source
Feni Mouth	Feni River	Water Level	***
Sandwip	Sandwip Channel	Water Level	***
Feni Regulator	Feni River	Discharge	Model Simulated
Musapur Regulator	Feni River	Discharge	Model Simulated

Source: Bangladesh Water Development Board, 2023

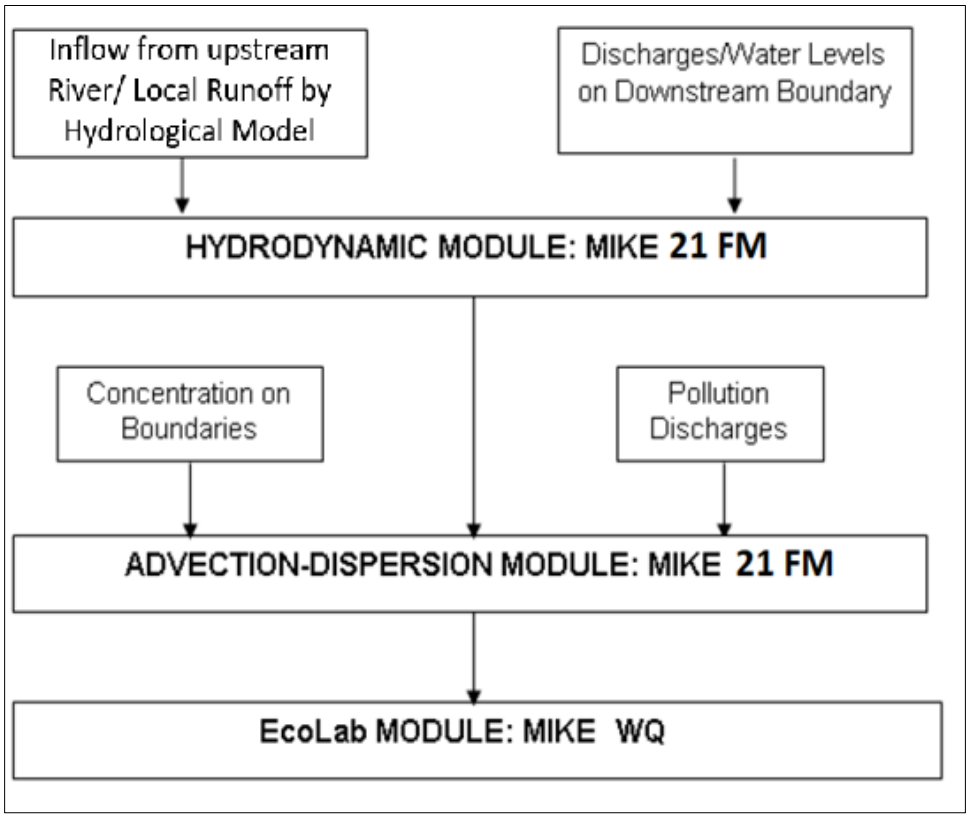
3.2.3 Water Quality at Present

Inside all the Khals in the EZ area carry upstream runoff/discharges. All khals are controlled by the regulator at the downstream part where it meets with the Sandwip Channel. Water samples have been collected from all these khals and after getting the lab test result, it has been incorporated into the model for water quality dispersion scenario simulation.

3.3 Water Quality Model Build-up

The water quality modelling approach comprises of an integrated Advection-Dispersion (AD) and ECO Lab modules in the MIKE 21FM. The two modules simultaneously describe the discharge, transport, and effects of pollutants in the river system and the Sandwip channel. The AD module works based on the hydrodynamic description of water levels and flows calculated by the Hydrodynamic (HD) module in MIKE 21FM. The conceptual flow diagram shown below describes the integration of the MIKE 21FM modules and the input parameters needed for water quality modelling in Figure-9.

Figure-9: Conceptual Flow Diagram of MIKE 2D water quality model



Source: EQMS, 2023

The water quality model comprises only significant perineal waterbodies (Six khals inside the EZ area, Feni River, Little Feni River, and the interaction of these rivers with Sandwip Channel) has been simulated for dry months. Minor khals and floodplain channels which dry out in the dry months are absent in the hydrodynamic model.

3.3.1 Rainfall-Runoff Model

The rainfall-runoff model comprises Seven Nos. of sub-catchments, having a total area of 438.05 sq. km in which 51.80 sq. km contributes runoff to all khals inside the NSEZ area is shown (shown in pink color) in Error! Reference source not found. and the rest of the area's (386.3 sq. km) runoff passes the a ssociated khals inside the NSEZ area. There are three rainfall stations inside or periphery of the catchment area, which have been used in the model, and the weightage of every rainfall station is calculated by the Thiessen polygon method to input in the model. Monthly evaporation at Cumilla weather station has been used here. The sub-catchment area and rainfall weightage of the hydrological Model are shown in Figure-10 and Table-6.

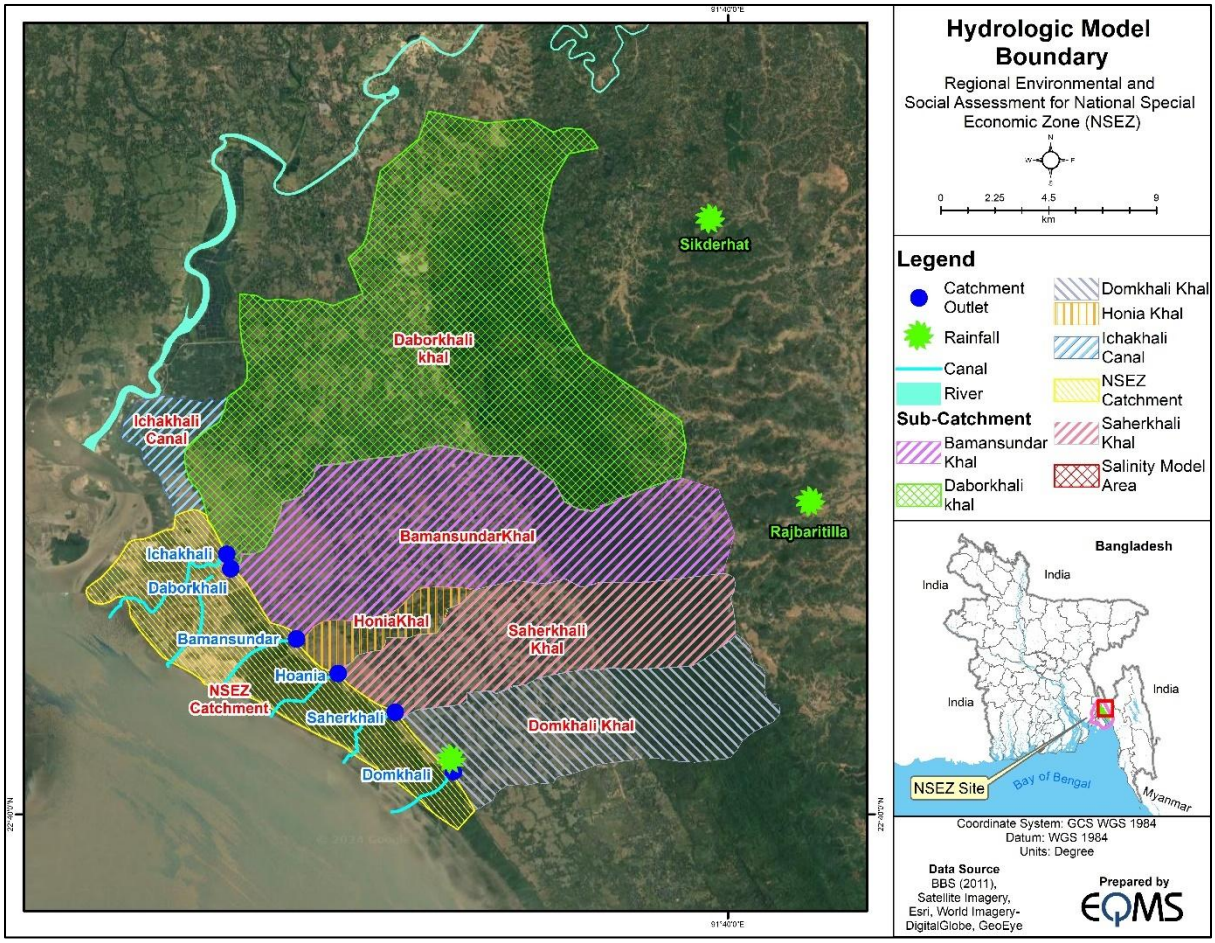
Table-6: Catchment Area and Rainfall Weightage in Different Catchment

SL#	Catchment Name	Area (sq. km)	Rainfall Weightage (%)		
			Mirsharai St.	Rajbaritilla St.	Sikderhat St.
1.	Ichakhali khal	10.2	1.00	0	0
2.	Daborkhali khal	171.6	0.25	0.35	0.4
3.	Bamansundar khal	90.0	0.65	0.35	0.0
4.	Hoania khal	9.5	1.0	0.0	0.0
5.	Saherkhali khal	52.3	0.6	0.4	0.0
6.	Domkhali khal	52.7	0.9	0.1	0.0
7.	NSEZ Catchment	51.8	1.0	0.0	0.0

Source: Bangladesh Water Development Board, 2023

The rainfall-runoff model is simulated from the year 1980 to 2020 to estimate the upstream inflow for six khals that have been used in the water quality model. The simulated runoff hydrograph and flow station in six khals are shown in Figure-11 to Figure-17 and Table-7 respectively.

Figure-10: Rainfall-runoff Model Set up to Determine the Inflow of Water Quality Model



Source: EQMS, 2024

Figure-11: Runoff at Inflow Location of Ichakhali Khal from Rainfall-Runoff Model

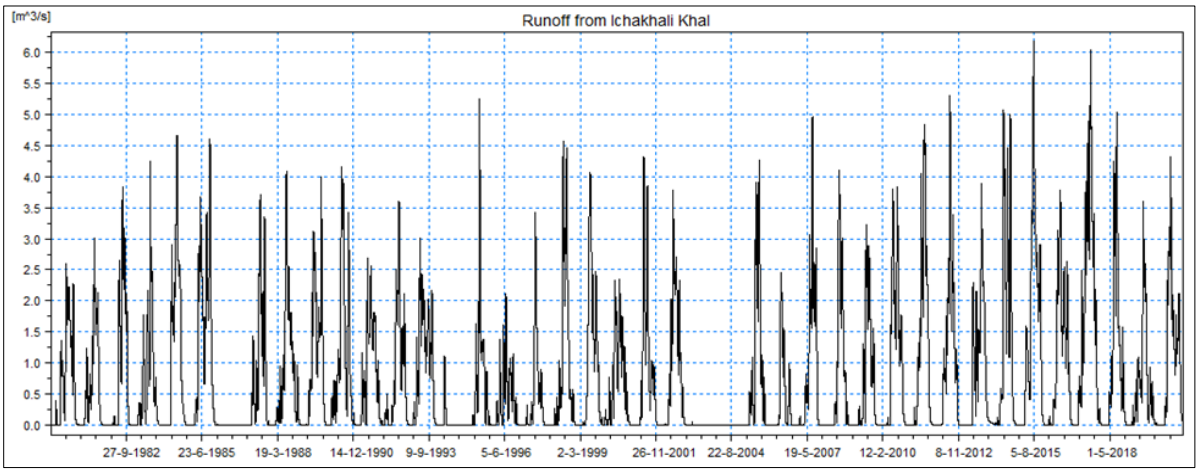


Figure-12: Runoff at Inflow Location of Daborkhali Khal from Rainfall Runoff Model

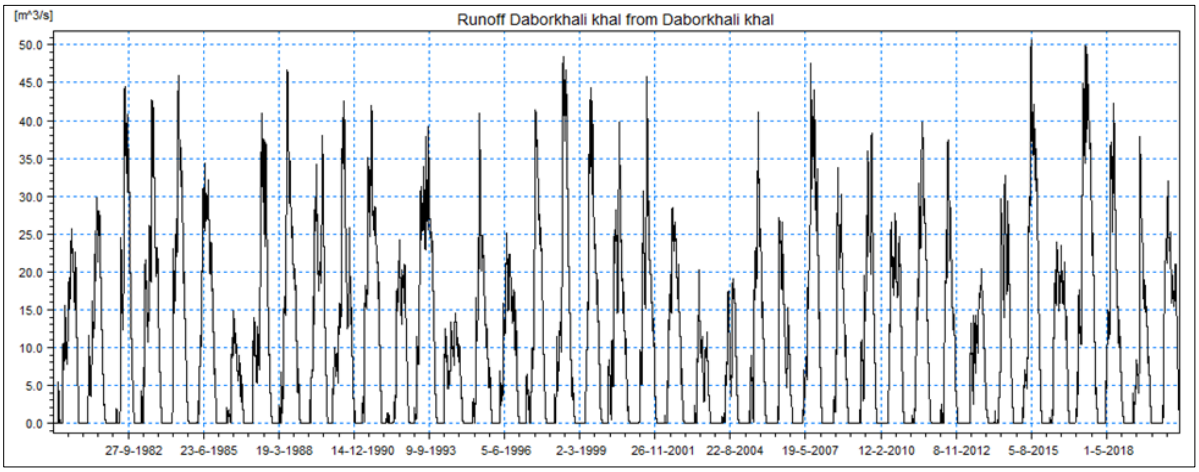


Figure-13: Runoff at Inflow Location of Bamansundar Khal from Rainfall-Runoff Model

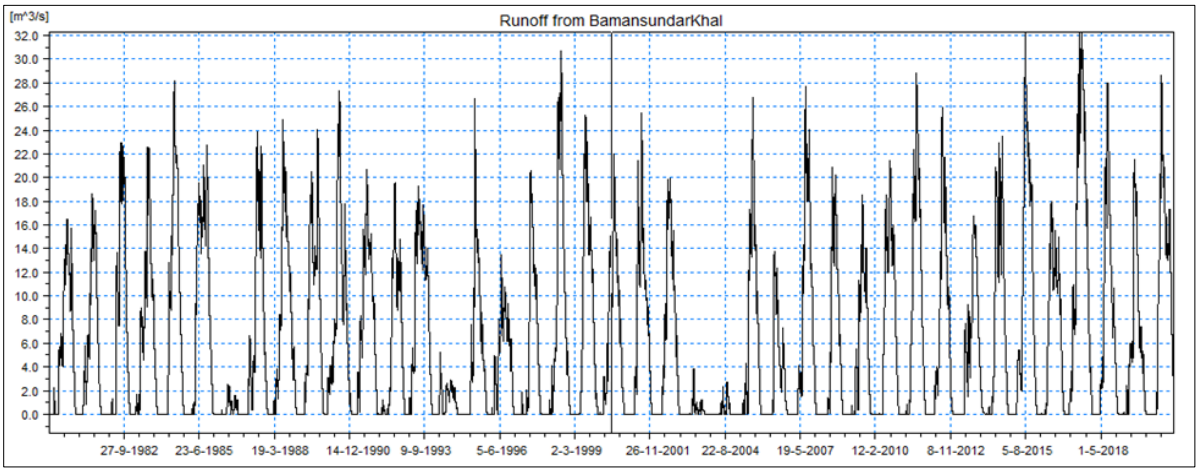


Figure-14: Runoff at Inflow Location of Hoania Khal from Rainfall Runoff Model

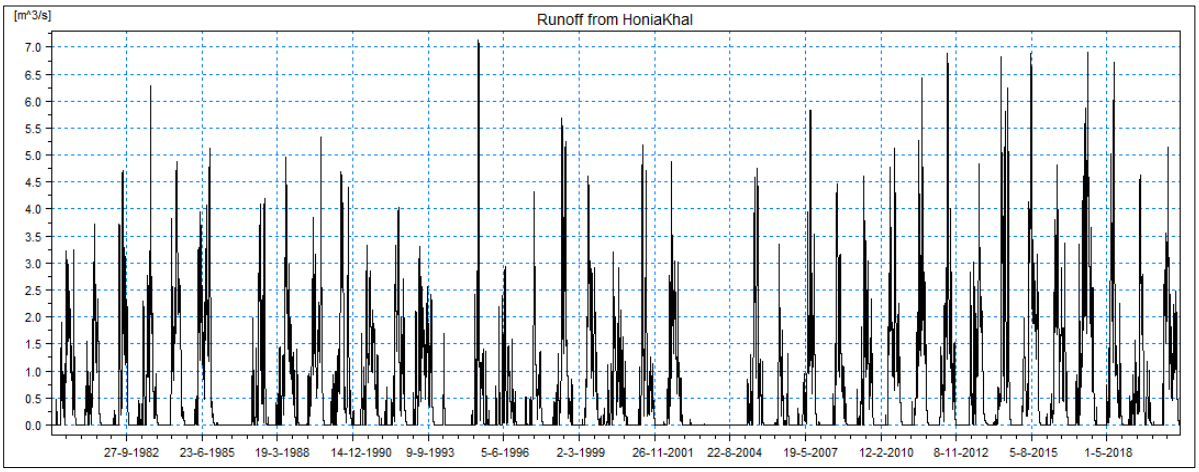


Figure-15: Runoff at Inflow Location of Saherkhali Khal from Rainfall-Runoff Model

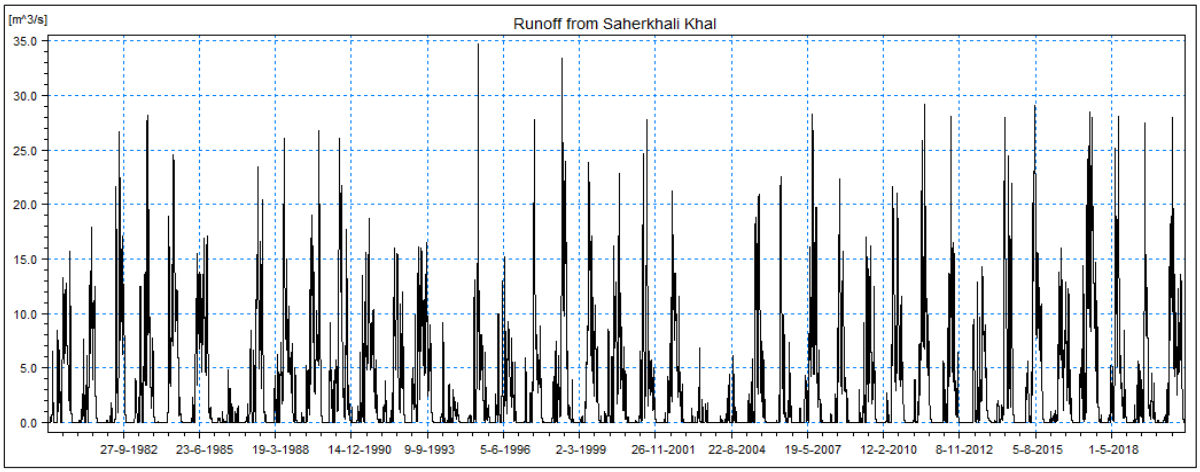


Figure-16: Runoff at Inflow Location of Domkhali Khal from Rainfall Runoff Model

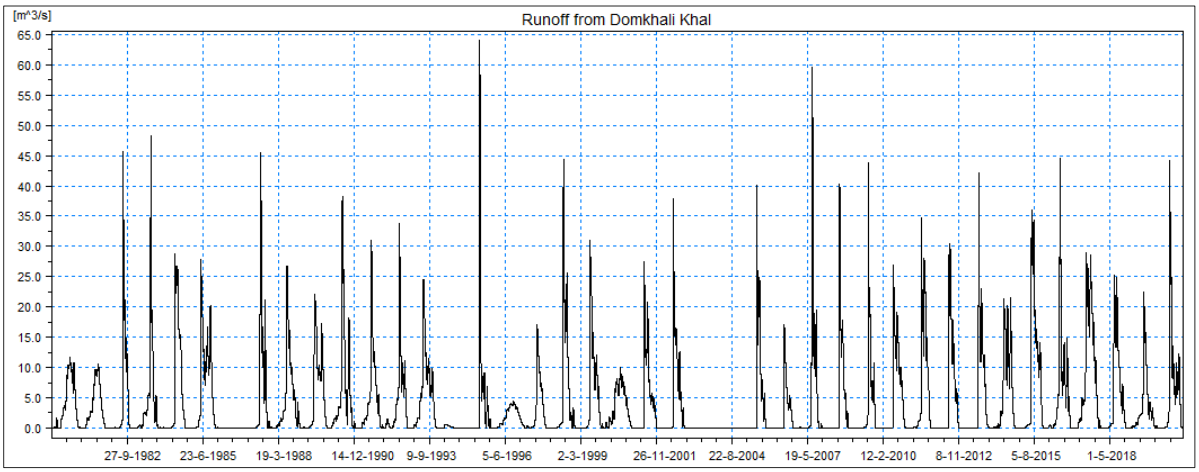
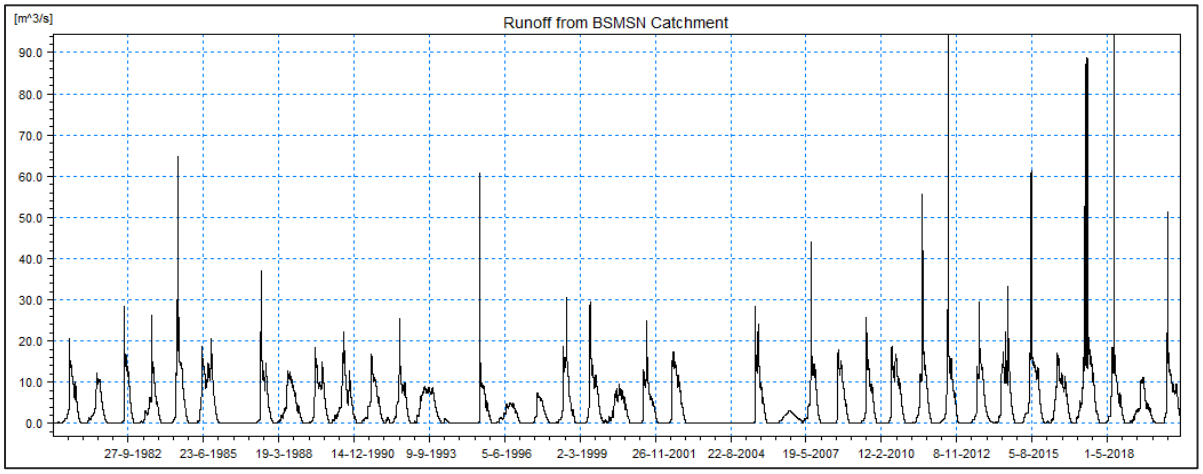


Figure-17: Local Runoff Inside the NSEZ from Rainfall Runoff Model



Maximum, minimum, and average runoff (discharge) from the hydrological model is shown in Table-7. All the above output results are from the modelling results of the MIKE 21 FM module.

Table-7: Inflow Statistics at Boundary Locations from Rainfall-runoff Model

SL#	Khals Name	Maximum Runoff (m^3/s)	Minimum Runoff (m^3/s)	Average Runoff (m^3/s)
1.	Ichakhali Khal	6.18	0.00	0.76
2.	Daborkhali Khal	50.63	0.00	10.44
3.	Bamansundar Khal	62.22	0.00	6.13
4.	Hoania Khal	7.13	0.00	0.72
5.	Saherkhali Khal	34.71	0.00	3.49
6.	Domkhali Khal	64.04	0.00	4.01
7.	NSEZ Catchment	119.72	0.00	3.89

Table-7 shows the maximum runoff from different catchments of Ichakhali, Daborkhali, Bamansundar, Hoania, Saherkhali, Domkhali and NSEZ area is 6.18, 50.63, 62.22, 7.13, 34.71, 64.04 and 119.72 m^3/s respectively. The above graphs show the runoff amount from the model-generated rainfall runoff.

3.3.2 Hydrodynamic Model Set Up with MIKE 21 FM

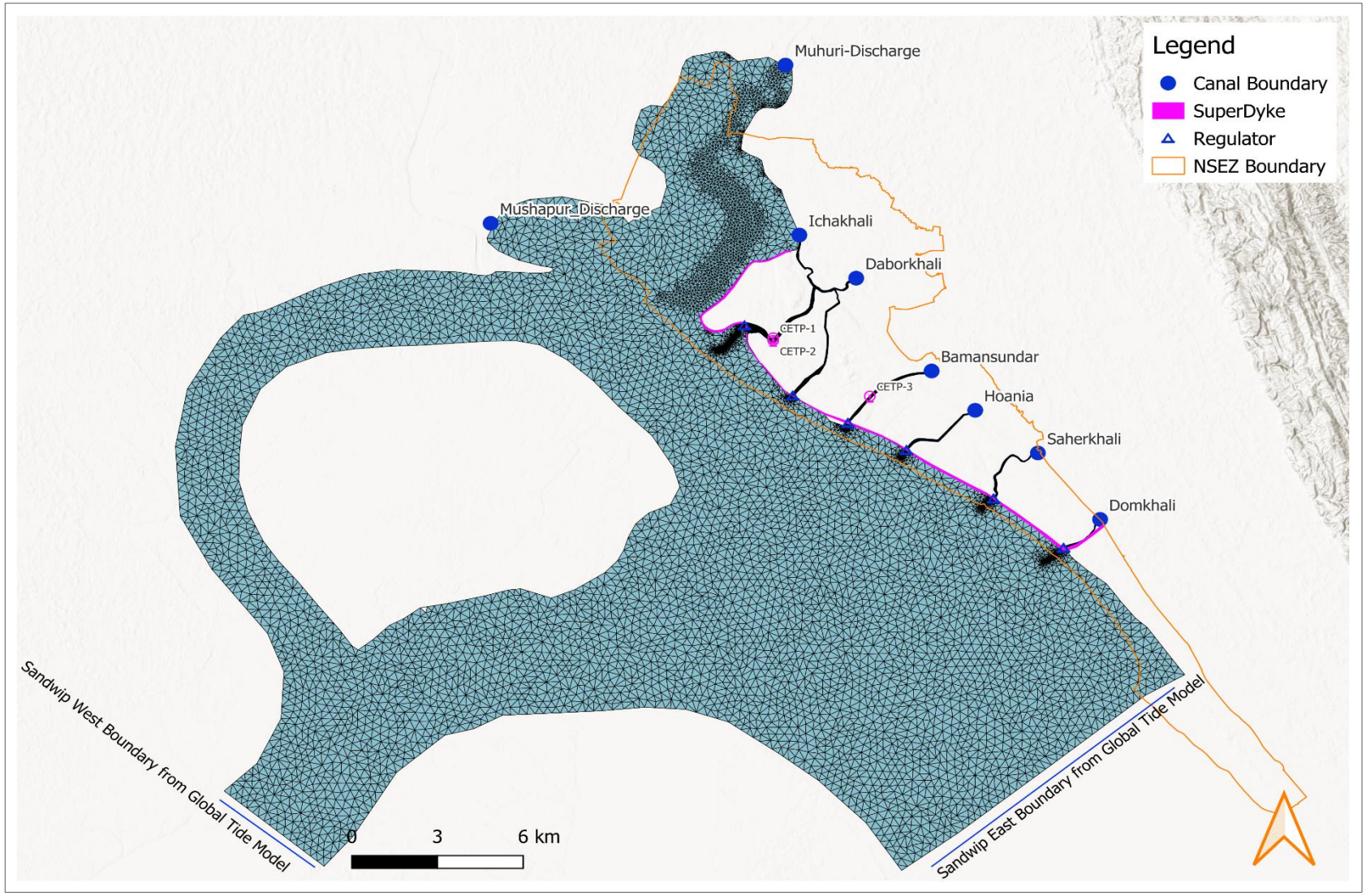
MIKE 21 FM is a comprehensive modelling system for 2D water modelling based on a flexible mesh-finite volume method. The modelling system has been developed for application within oceanographic, coastal, and estuarine environments (DHI, 2012). The model development refers to how the MIKE 21 FM model has been configured in the actual program interface. The full configurations are presented below. MIKE 21 FM is a system used for 2D modelling of free surface flows and transport phenomena. It is applicable wherever stratification has been ignored in order to simulate the hydraulic conditions in the model area. The module simulates the variations of the water level and the flow in reaction to a variety of forcing functions, including bed resistance, Coriolis force, flood and drying condition, depth correction, precipitation and evaporation, Eddy viscosity initial condition, etc. The boundary condition is defined by certain codes. Initially, the model scans the mesh and provides default codes. There are eight boundary types like: 1) Land (zero normal velocity), 2) Land (zero velocity), 3) Specified velocities, 4) specified fluxes, 5) specified level, 6) specified discharge, 7) Free outflow, 8) Flather condition. Depending on the aim of the simulation, not all of these factors have been accounted for in this study. If need any detailed study, this experiment can go further for better results.

3.3.2.1 2D Mesh Generation

The mesh generator tool is an inbuilt tool of MIKE 21 FM. The mesh generator has been constructed of meshes that consist of both triangular and quadrangular elements. The approach is that the area of interest is divided into different regions (like road, flat land, low land, high land, river, etc.) described through polygons. Each polygon has distinct properties like the maximum area of the mesh, shape (triangular or quadrangular), interpolation technique, etc. In this study, water dynamics with heat exchange between the Sandwip Channel and the river have been simulated. Triangular mesh performs well on the Sandwip channel where flow direction is not defined. Thus, triangular mesh is used everywhere in this model domain.

One of the advantages of the flexible mesh is creating different sizes of elements for different parts of the area. Small sizes of the element (mesh) give more detailed information in the important areas. In the plain area where water level, flow velocity, and other variables do not vary rapidly, larger size mesh is used than in other areas. These element size differences also give advantages to the model calculation time. Model calculation time is directly related to the number of calculation nodes in the model. Each element represents one calculation node. Since the total calculation nodes are reduced with a bigger size of elements at some parts, calculation time is reduced too.

Figure-18: Polygon for Bathymetric Mesh Generation for the RESA WQ Model Domain Area



Source: BWDB, IWM 2023

The mesh generation tools allow the user to create polygons that define the model extent and regions with local properties. The steps to generate such a mesh are the following:

- Defining polygons to be used for triangular mesh by boundary file (mainly (.xyz) file, it is generated from shape file of the different area with model domain).
- Setting properties for each (default values used if local properties are not supplied).
- Setting the excluded properties where high land where inundation never happens, or area is less important for the model.
- Generating the mesh within each polygon.
- Analyses the mesh based on one time step, area, and angle of the mesh.

The mesh of the model for the study area is shown in Figure-18. The primary input for the simulation is the bathymetry file, which is in general terms the topographic file for this software. Once the mesh elements are created, the topographic data has been used to interpolate a topographic surface over the generated mesh. Surveyed cross sections have been used after correction to prepare the topographic surface (see topography section for details). The mesh topography is shown in Figure-18 and Figure-19. Land parts are kept undefined in the model domain.

Figure-19: Mesh Representing Model Bathymetric Variation within the Model Domain

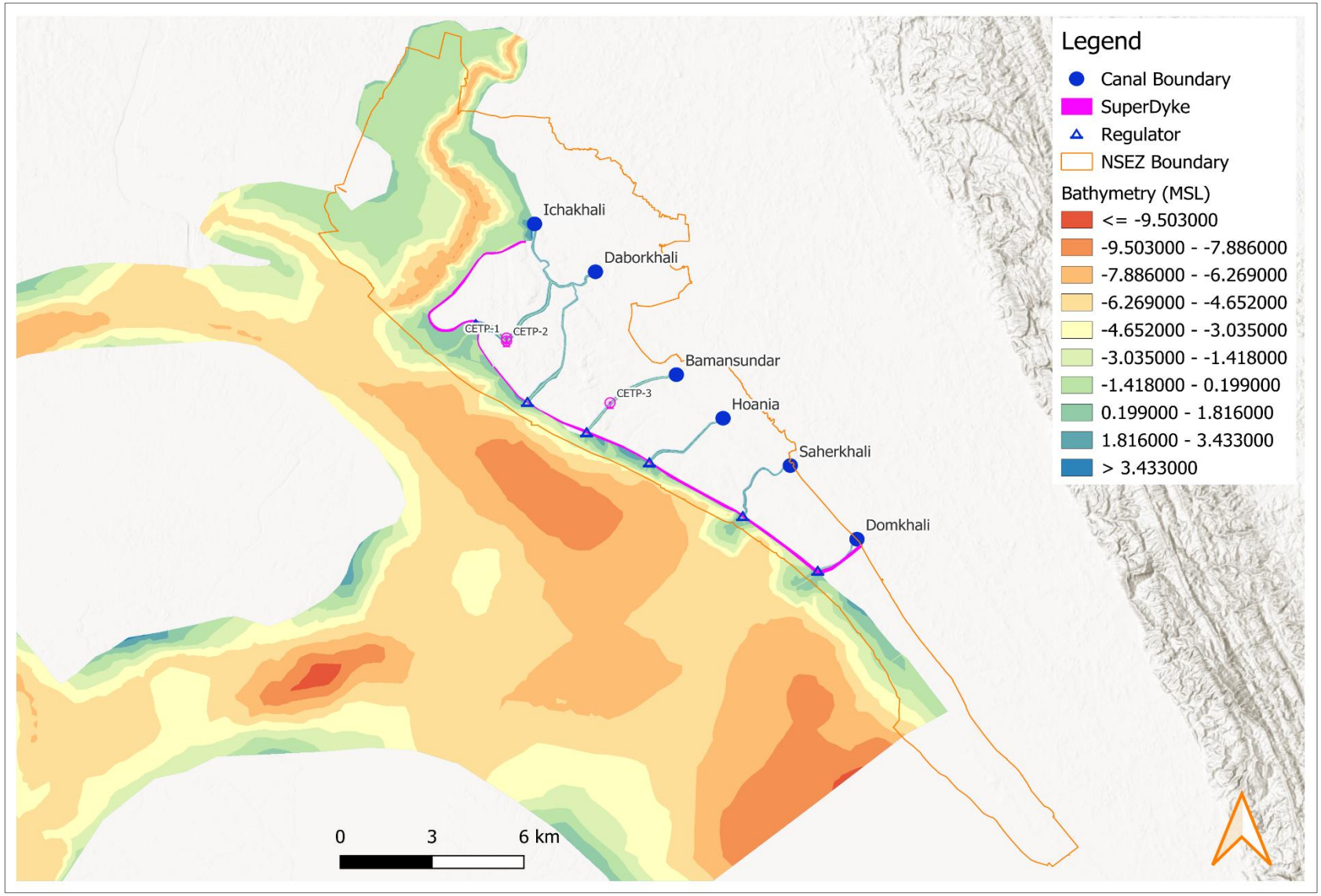
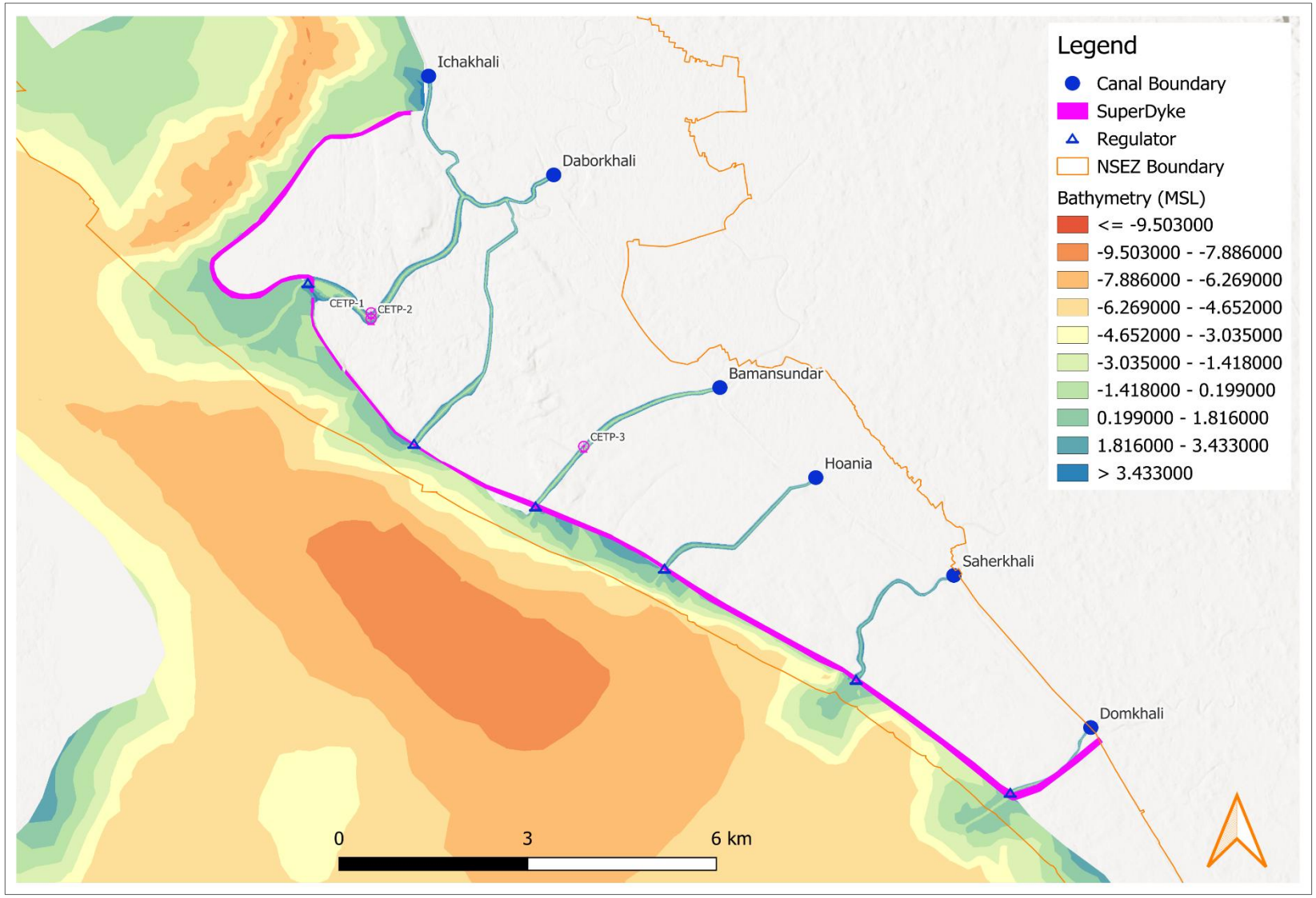


Figure-20: Mesh (Surface Elevation Model) File Showing Variation of Elevation in Model Area



3.3.2.2 Hydrodynamic Model Setup

Module Selection: The hydrodynamic module with inland flooding has been chosen for this study.

Solution Technique: The shallow water equations were chosen to be solved with high-order time integration and space discretization. The minimum time step, which was set to 0.001 second refers to the shortest time step the calculations are allowed to use in order to fulfill the critical CFL number, set to 0.8. The maximum time was set to the time step specified in the time setup, 60 s.

Flood and Dry: The advanced flood and dry (floodplain) type was chosen. The drying depth was set to 0.005 m and the wetting depth to 0.01 m. A lower value of the wetting depth was desired as this controls the limit for when the momentum equations are taken into consideration. However, this was as low as it was possible to go without experiencing violated CFL numbers, unrealistic velocity values, and crashed programs.

Coriolis Forcing: Domain varying options are selected; the Coriolis force has been calculated based on the geographical information given in the mesh file.

Wind Forcing: It is possible to consider the effect of the wind on the flow field, but wind force does not play a significant role here; for this reason, it is not included here.

Ice Coverage: it is not applicable to this area.

Tidal Potential: The tidal potential is a force generated by the variations in gravity due to the relative motion of the Earth, the moon, and the sun. The forcing acts throughout the computational domain. The forcing is considered as the sum of several harmonic terms, each representing a specific constituent, that is specified separately. The tidal potential is defined by the number of constituents that should be included, and each constituent is described by a number of parameters. The default is 11 constituents comprising M2, O1, S2, K2, N2, K1, P1, Q1, Mm, Mf and Ssa. There is no limit on the number of constituents that can be defined. The default and standard values for other constituents can be found in standard tidal books as for example, (*Pugh, 1987*) is used in this study.

Infiltration: it is not applicable to this study.

Eddy Viscosity: This was kept as the same value as default, 0.08 m2 /s.

Bed Resistance: The bed resistance was represented by Manning's number, M. The values have been chosen as the default value (m=45) normally used by the developer organization DHI. These values might not represent the actual values of M. In the calibration period, domain varying Manning's M has been used if it is necessary.

Precipitation – Evaporation: Precipitation data have not been used.

Boundary: In this study 2D model, land boundaries have been chosen based on considering the riverbank or Land part in the model domain area (Code-1). Code-2 and Code-3 are downstream of the model which represents the specified water level that is generated from the Global Tide model.

Code-4 to Code-11 Upstream boundary of this model represents inflow of 6 khals, Feni and Little Feni River respectively which represent inflow in the khal as shown in Figure-21 and Figure-22.

Structure: 6 regulators have been incorporated on the outlet of each channel along with the supper dyke. For the time being, the 2m width of each gate and 4 Nos gates are considered in each regulator. The sill level of each regulator is taken from the bed level of each khal.

Sources: it is not defined yet.

Initial Conditions: As in the FM model setup, the initial surface elevation, and initial u- and v-velocities have been set to 0.

Figure-21: Model Boundary Locations of this Model Study Area

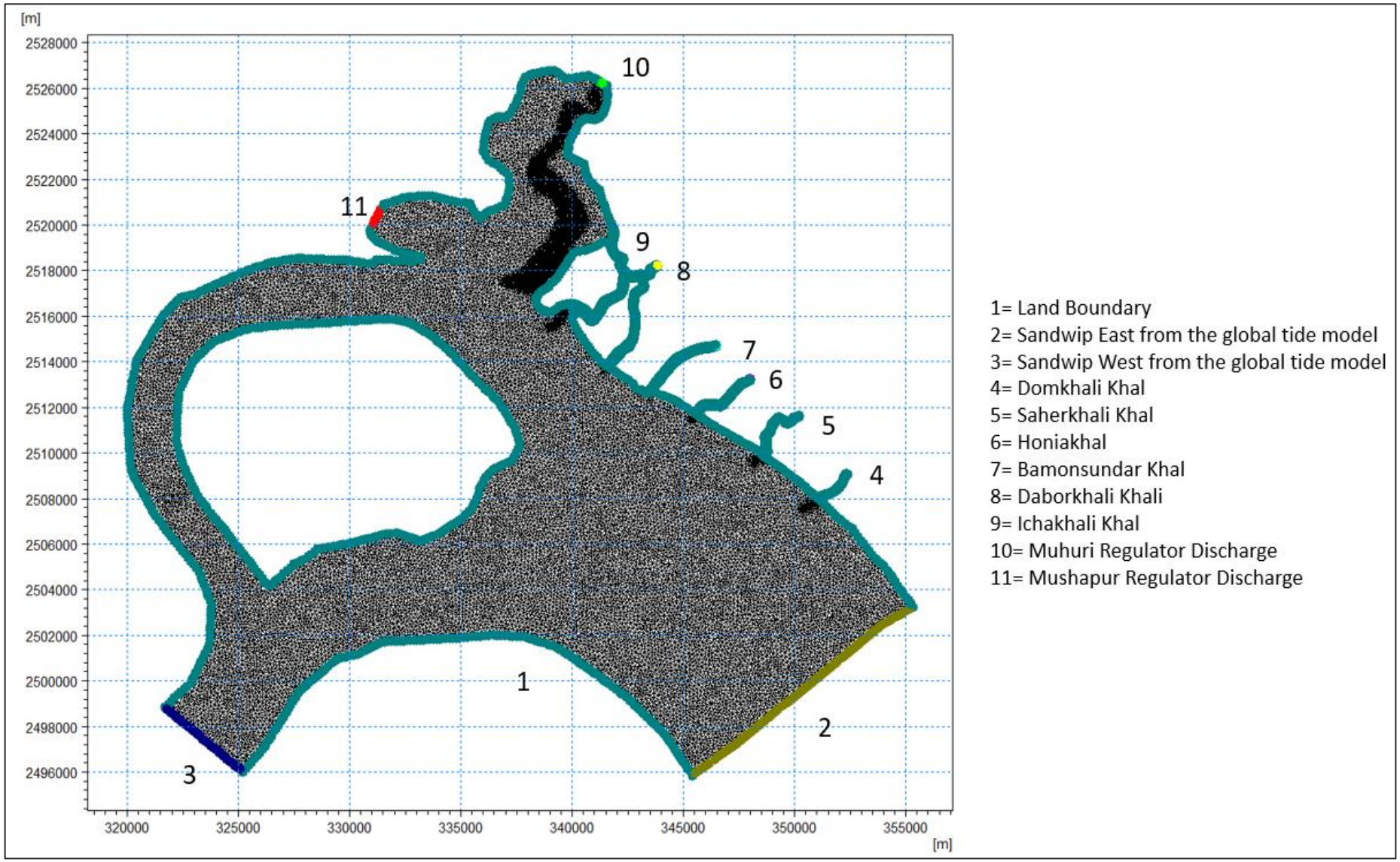
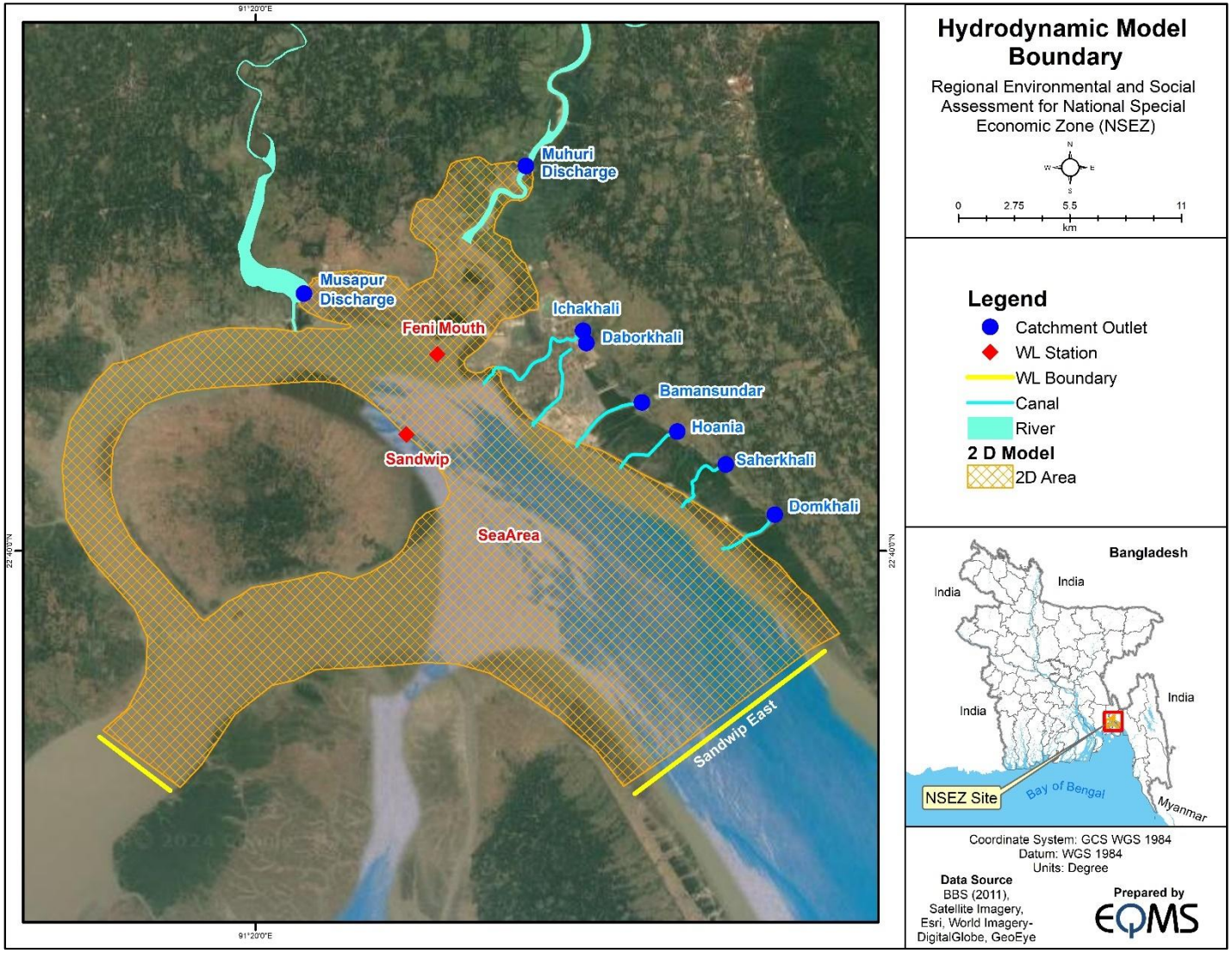


Figure-22: 2D Hydrodynamic Model Setup with Boundary Locations for the Water Quality Modelling



Source: BWDB and IWM, 2023

3.3.2.3 Model Calibration and Validation

The developed water quality model (hydrodynamic) has been simulated from 1st January 2018 to 31st December 2018 for calibration. Feni Mouth and Saidpur were the water level stations in the model domain. Feni Mouth is located at the confluence of Little Feni and Feni River. Saidpur is located near the downstream boundary of Sandwip East. Figure-23 shows the good agreement between the model simulated and observed water levels in Figure-23 and Figure-24**.** These figures represent the model calibration and validation for the hydrodynamic model domain stabling.

Figure-23: Water Level Comparison at Feni Mouth and Saidpur

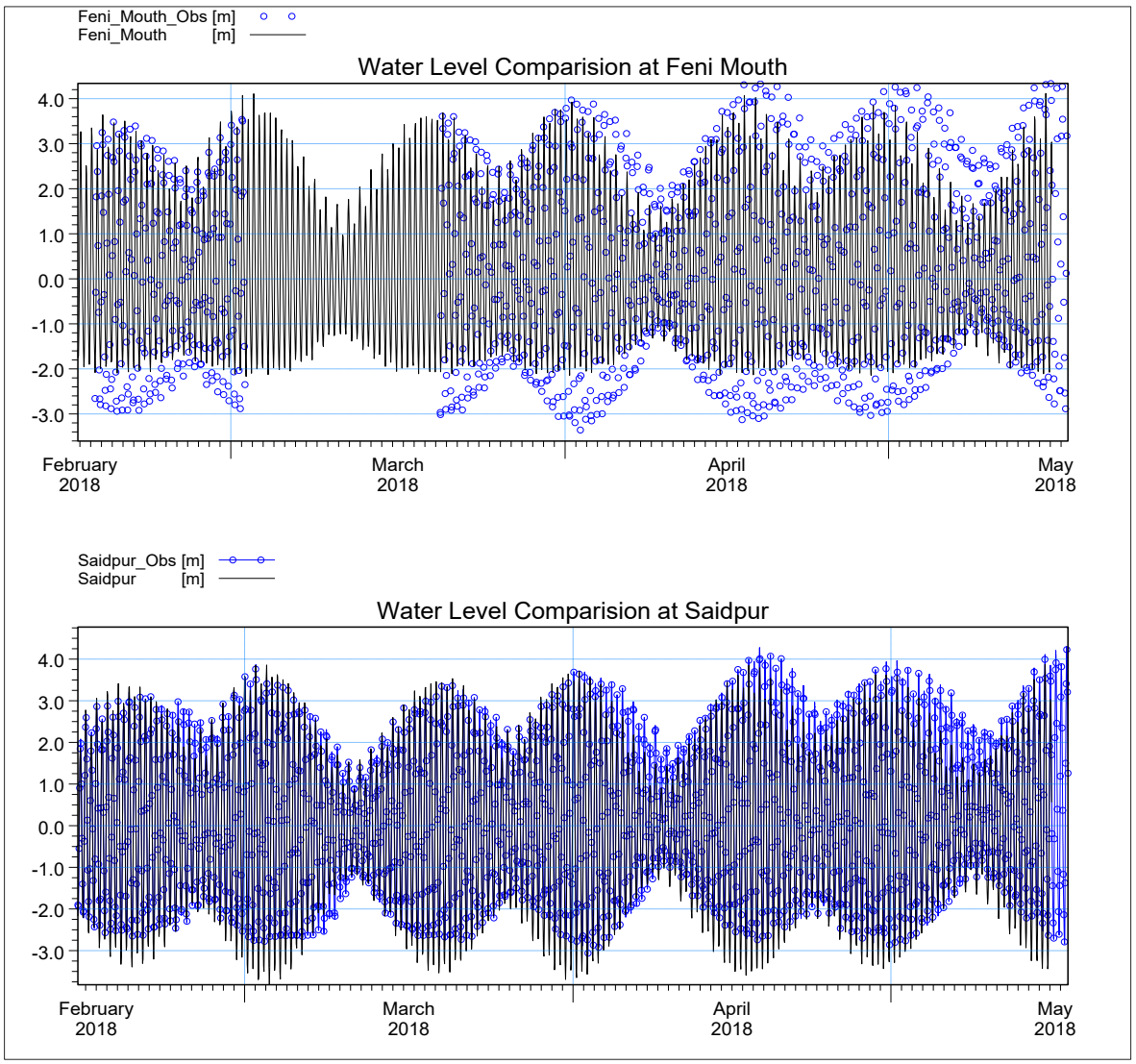
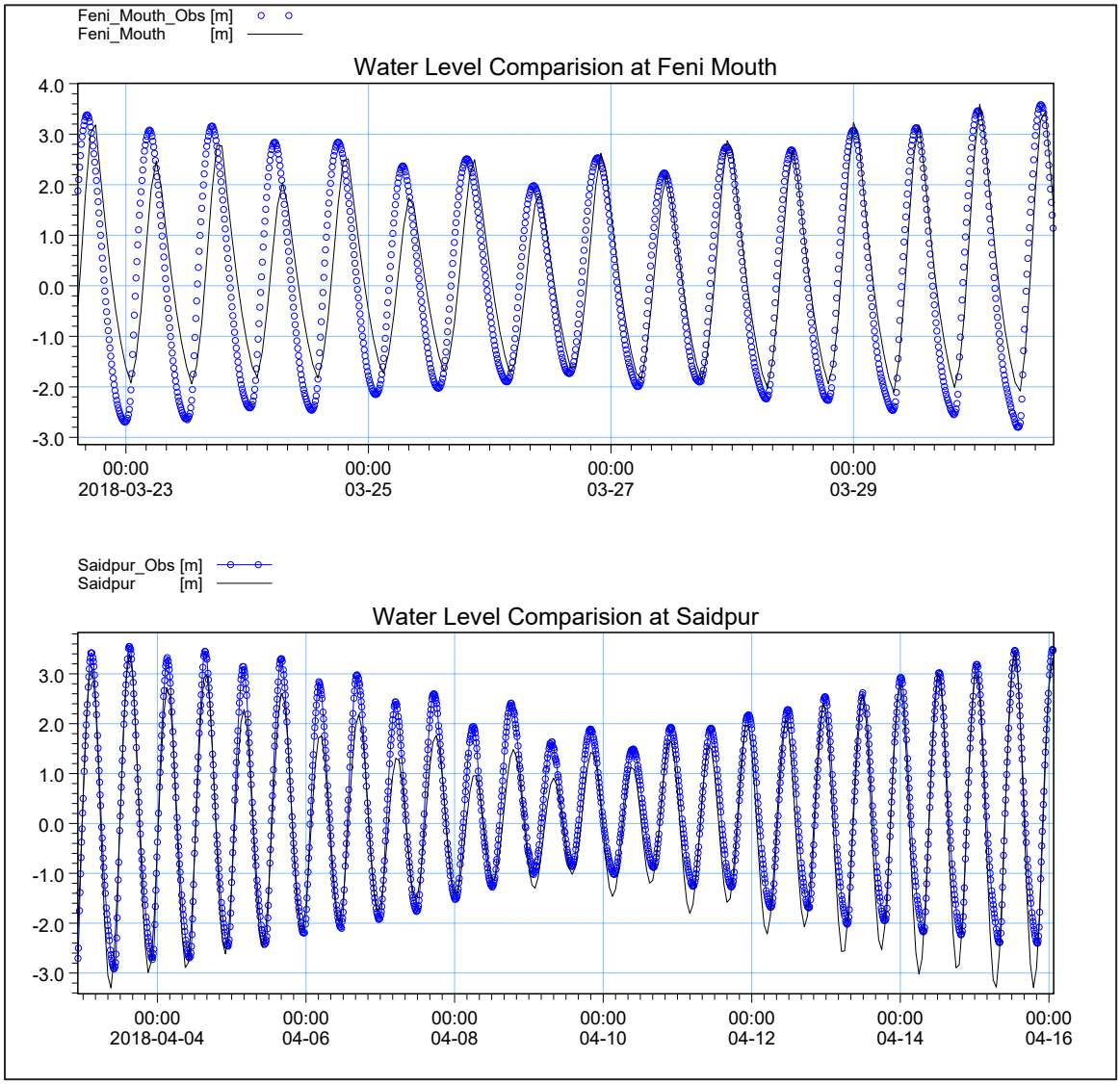


Figure-24: Water Level Comparison at Feni Mouth and Saidpur in Sandwip Channel



3.3.2.4 ECO Lab Module Setup

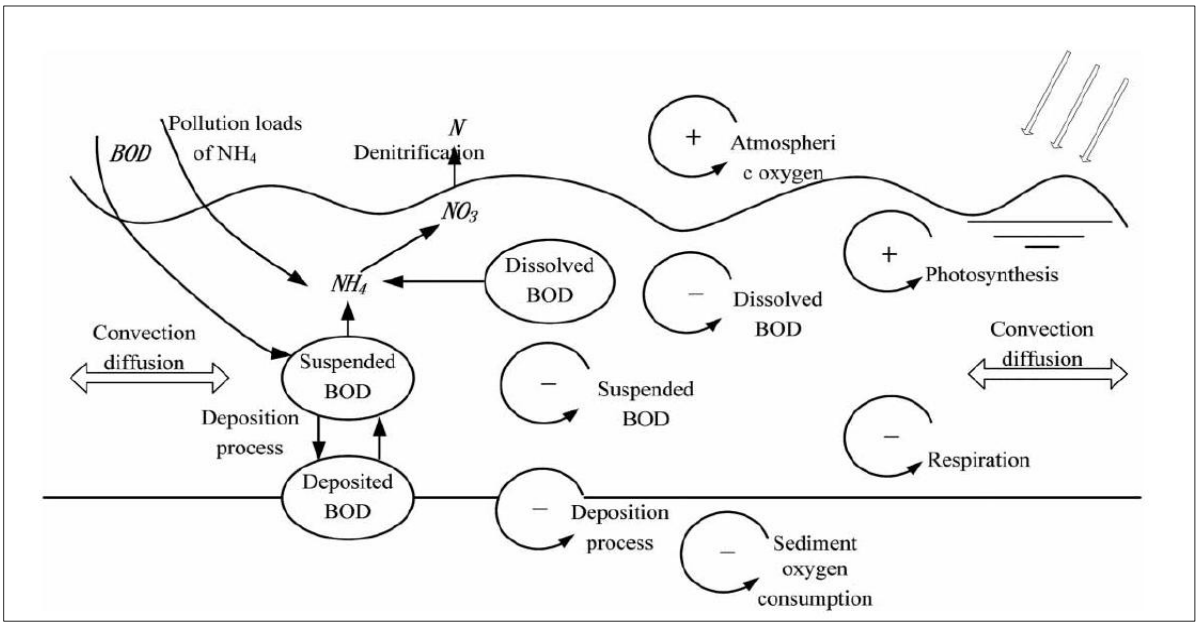
ECO Lab is a numerical model for ecological modelling. It is an open and generic tool for customizing aquatic ecosystem models to describe water quality, eutrophication, heavy metals, and ecology using process-oriented formulations. The MIKE 21 & MIKE 3 Flow Model FM ECO Lab Module is a state-of-the-art numerical tool for 2D and 3D ecological modeling of ecosystems. The combination of a user-friendly interface, open access to the governing equations, and the coupling of MIKE ECO Lab to the MIKE 21 & MIKE 3 Flow Model FM makes the MIKE ECO Lab Module a powerful tool. MIKE 21 & MIKE 3 Flow Model FM ECO Lab is typically applied in environmental water quality studies in coastal areas, estuaries, and lakes. The MIKE ECO Lab Module is capable of simulating the spatial distribution of state variable concentrations in a 2D or 3D domain based on processes such as:

The module is capable of simulating the spatial distribution of state variable concentrations in a 2D or 3D domain based on processes such as:

- Advective transport.
- Biological, physical, and chemical transformation processes.
- Settling, resuspension, and sediment process.

It is possible to describe state variables that are bound to the seabed, the water surface, and the sediment or can be found in the whole water column.

Figure-25: ECO-Lab Model of Water Quality Reaction Process



3.3.2.5 Balance equation for the parameter Chemical Oxygen Demand (COD)

Mike ECO-Lab doesn't have an inbuilt balance equation for COD. The balance equation (*Liang et al., 2018*) of COD is used as follows:

$$\frac{dCOD}{dt} = -K_{COD}COD\theta_{COD}^{(T-20)}\frac{DO^2}{K_s + DO^2} + S_{COD}/h_1 - K_{RE-COD}/h_1 \quad (4)$$

Since the COD variable includes not only organics, but also some inorganic substances, in response to water ecology, there is some overlap with other variables and it is difficult to divide, therefore the ECO Lab model has not considered COD as a measure acting on water quality reactions, and at present, there is no template. When considering the water quality of the environment, the evaluation of COD is usually an important indicator of pollution. This study used the BOD reaction equation-4 (above), using ECOLab to establish the COD reaction template.

3.3.2.6 Model Definition

The Model Definition consists of the selection of the template (Ecolab) file, which has formed the basis for the Water Quality Simulation. The ECO Lab file contains the definitions of the MIKE ECO Lab model. For this model, MIKE 11 WQ Level 6 and Coli template are used. The specification of the Solution Parameters includes the selection of the Integration Method for the coupled ordinary differential equations defined in the EcoLab file. At present the following three methods are available:

- Euler integration method
- Runge-Kutta 4th order
- Runge-Kutta 5th order with quality check

State Variables

This shows a summary of the State Variables defined in the MIKE ECO Lab model. For each State Variable, its initial value within the model area should be specified. State variables have been shown in Table-8.

Table-8: State Variable List in ECO Lab Module

SL#	Name	Unit	Description	Transport	Spatial Variation
1.	DO	mg/L	Dissolved Oxygen	AD	3D
2.	Temperature	Degrees	Temperature	AD	3D
3.	Ammonia	mg/L	Ammonia	AD	3D
4.	Nitrate	mg/L	Nitrate	AD	3D
5.	BOD (susp.)	mg/L	BOD suspended	AD	3D
6.	BOD (dis.)	mg/L	BOD dissolved	AD	3D
7.	BOD (sed.)	g/m2	BOD sediment		3D
8.	Faecal Coli	No/100 ml	Faecal coliform bacteria	AD	3D
9.	Total Coli	No/100 ml	Total coliform bacteria	AD	3D

Source: MIKE 21 FM, ECOLab module (EQMS, 2024)

Solution Technique

The simulation time and accuracy can be controlled by specifying the order of the numerical schemes which were used in the numerical calculations. Both the scheme for time integration and for space discretization have been specified. Either a lower-order scheme (first order) or a higher-order scheme can be selected. The lower-order scheme is faster but less accurate. In this model, a higher-order scheme has been used for both time integration and space. In this study, a higher order scheme was used for this modelling study.

Forcings

The Forcings are defined as any input parameter (physical property like salinity) in the MIKE ECO Lab model, which varies with time.

Dispersion

In 2D models, the dispersion usually describes transport due to non-resolved processes. In coastal areas, it can be transported due to non-resolved turbulence or eddies. Especially in the horizontal directions the effects of non-resolved processes can be significant, in which case the dispersion coefficient formally should depend on the resolution. The horizontal dispersion can be formulated in one of three ways.

- No dispersion.
- Dispersion coefficient formulation.
- Scaled eddy viscosity formulation.

Dissolved Oxygen, Temperature, Ammonia, Nitrate, BOD Suspended, BOD Dissolved, Fecal Coliform Bacteria, and Total Coliform Bacteria are state variables considered in horizontal dispersion. No dispersion has been used as a formulation technique.

Source

Point sources of dissolved components are important in many applications such as e.g. release of nutrients from rivers, intakes and outlets from cooling water or desalination plants, and local runoff that washes land and pollutants above the lands. In the ECO Lab Module, the source concentrations of each component in every source point can be specified. Source name, location, and discharge magnitude are defined in the hydrodynamic module. The type of sources can be specified in two ways:

- Specified concentration.
- Excess concentration.

Specified concentration is used in this model. When selecting the specified concentration option, the source concentration is the specified concentration if the magnitude of the source is positive (water is discharged into the ambient water). The source concentration is the concentration at the source point if the magnitude of the source is negative (water is discharged out of the ambient water). Table-9 shows the state variables and corresponding values used in the model as the CETP's outlet comes into the model domain.

Table-9: State Variable of Sources (CETP)

State Variables	Value
DO	10 mg/L
Temp	30 Degrees
Ammonia	5 mg/L
Nitrate	10 mg/L
BOD	10 mg/L
Phosphate	15 mg/L
Fecal Coliform	0.0
Total Coliform	1000

Source: BEZA, 2023

Initial Conditions

The initial conditions are the spatial distribution of the component concentration throughout the computational domain at the beginning of the simulation. Initial conditions must always be provided. The initial conditions can be the result from a previous simulation in which case the initial conditions effectively act as a hot start of the concentration field for each state variable.

The format of the initial concentration (in component unit) for the state variable can be specified as:

- Constant (in domain)
- Varying in domain
- Varying in domain and time

Constant initial concentration is used in the model. The following are the parameters and values used as initial conditions to simulate the model. Table-10 shows the state variables and their corresponding values.

Table-10: State Variable for Initial Condition of the Model

State Variables	Value
DO	5.5 mg/L
Temp	27 Degrees
Ammonia	0.16 mg/L
Nitrate	4.33 mg/L
BOD	2 mg/L
Phosphate	0.01 mg/l
Fecal Coli	0
Total Coli	1000

Source: BEZA, 2023

Boundary Conditions

Boundary conditions are only valid for AD-state variables (concentrations). If a particle leaves the domain, it is lost and cannot re-enter the simulation. Initially, the set-up editor scans the mesh file for

boundary codes (sections), displays the recognized codes, and suggests a default name for each. There are three boundary types:

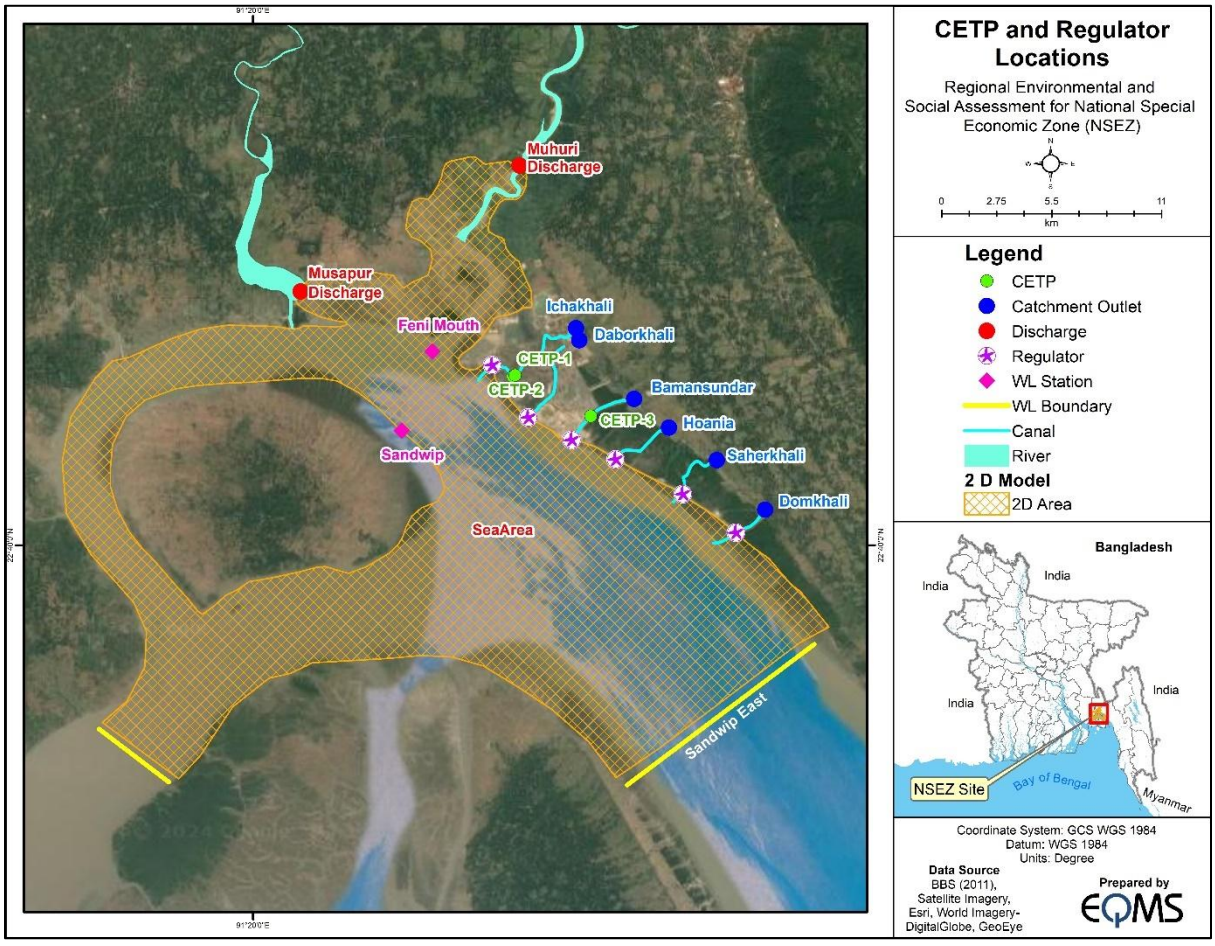
- Land
- Specified values (Dirichlet boundary condition)
- Zero gradient (Neumann boundary condition).

For the time being, to run the model state variable in the model set up boundaries in Figure-10, which has been used at each boundary condition of this water quality model.

4. Water Quality Model Simulation

The water quality model is being simulated for the 2022 to 2023 period with the initial condition of lab results of different parameters and three CETP conditions. Lab test results and model simulation interpretation have been given in the subsequent chapters of this report.

Figure-26: Three CETP and regulator locations in NSEZ



Source: BEZA, 2023

4.1 Present Condition of WQ Parameters

The set of parameters have been collected from the field that is used in the model as initial conditions. The present status of the water quality is given below with their spatial distribution within the model domain.

Recent water sampling and test results have been presented in Table-11. Sampling locations are mentioned in Table-1.

Table-11: Water quality test results from dry season sampling in December 2023

Sample ID: SW-1/1 (U/S), SW-1/2 (D/S), SW-1/3 (D/S), SW-2/1 (U/S), SW-2/2(D/S)

SL#	Testing Parameters	Unit	Test Result					WQ Standard (ECR)
			SW-1/1 (U/S)	SW-1/2 (D/S)	SW-1/3 (D/S)	SW-2/1 (U/S)	SW-2/2 (D/S)	
1.	pH	-	7.11	7.18	7.91	7.60	7.46	6-9
2.	Salinity	ppt	2.58	2.90	2.86	2.60	2.42	-
3.	DO	mg/L	5.7	6.2	6.3	6.1	6.8	≥5
4.	COD	mg/L	18	135	78	50	48	50
5.	BOD5 (at 20°C)	mg/L	3.6	5.8	4.5	3.2	4.0	≤6
6.	TSS	mg/L	129	125	144	130	175	-
7.	Ammonia	mg/L	0.44	0.65	0.30	2.99	1.86	0.3
8.	Phosphate	mg/L	1.3	0.4	1.0	2.7	2.6	0.5
9.	Nitrate (NO^{3-}-N)	mg/L	2.3	0.2	4.3	1.2	0.3	7.0
10.	Lead	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	0.1
11.	Mercury	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.004
12.	Total Coliform	n/100 ml	15	20	35	20	25	≤5000
13.	Fecal Coliform	n/100 ml	7	11	14	12	11	-
14.	Total Chromium	mg/L	0.004	0.001	0.008	0.001	0.001	0.05

Source: EQMS, December 2023

Sample ID: SW-3/1 (U/S), SW-3/2 (D/S), SW-4/1 (D/S), SW-4/2 (U/S), SW-5/1 (D/S)

SL#	Testing Parameters	Unit	Test Result					WQ Standard (ECR)
			SW-3/1 (U/S)	SW-3/2 (D/S)	SW-4/1 (D/S)	SW-4/2 (U/S)	SW-5/1 (D/S)	
1.	pH	-	7.92	7.64	7.62	7.65	7.65	6-9
2.	Salinity	ppt	1.96	2.61	3.23	4.21	2.46	-
3.	DO	mg/L	7.2	7.0	6.8	7.4	7.2	≥5
4.	COD	mg/L	28	31	38	42	31	50
5.	BOD5 (at 20°C)	mg/L	2.5	3.0	2.8	2.1	2.4	≤6
6.	TSS	mg/L	130	163	152	202	119	-
7.	Ammonia	mg/L	0.35	<0.01	0.27	0.02	1.61	0.3
8.	Phosphate	mg/L	2.5	3.5	2.3	2.1	3.9	0.5
9.	Nitrate (NO^{3-}-N)	mg/L	<0.01	0.3	0.9	0.2	3.0	7.0
10.	Lead	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	0.1
11.	Mercury	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.004
12.	Total Coliform	n/100 ml	35	40	25	15	15	≤5000
13.	Fecal Coliform	n/100 ml	13	27	14	7	9	-
14.	Total Chromium	mg/L	0.008	0.009	0.004	0.007	0.001	0.05

Source: EQMS, December 2023

Sample ID: SW-5/2 (U/S), SW-6/1 (D/S), SW-6/2 (D/S), SW-7/1 (U/S), SW-7/2 (D/S)

SL#	Testing Parameters	Unit	Test Result					WQ Standard (ECR)
			SW-5/2 (U/S)	SW-6/1 (D/S)	SW-6/2 (D/S)	SW-7/1 (U/S)	SW-7/2 (D/S)	
1.	pH	-	7.61	7.64	7.12	6.87	7.05	6-9
2.	Salinity	ppt	1.51	0.22	15.7	16.8	16.3	-
3.	DO	mg/L	7.7	7.6	6.6	6.0	6.3	≥5
4.	COD	mg/L	42	28	31	37	44	50
5.	BOD5 (at 20°C)	mg/L	2.7	3.1	2.5	2.3	2.4	≤6
6.	TSS	mg/L	167	199	208	130	132	-
7.	Ammonia	mg/L	1.11	0.92	<0.01	0.11	0.21	0.3
8.	Phosphate	mg/L	1.2	0.9	0.8	2.3	2.0	0.5
9.	Nitrate ($NO^{3-}N$)	mg/L	1.0	2.0	2.0	0.6	0.6	7.0
10.	Lead	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	0.1
11.	Mercury	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.004
12.	Total Coliform	n/100 ml	0	18	21	24	28	≤5000
13.	Fecal Coliform	n/100 ml	4	8	10	9	4	-
14.	Total Chromium	mg/L	0.007	0.003	0.001	0.001	0.002	0.05

Source: EQMS, December 2023

The present condition of the parameters has been shown in a spatial distribution within the model domain as shown in the below figures.

The surface water-quality parameters compared with Schedule-2 of the Environment Conservation Rules (ECR) 2023 are shown in Table-12.

Table-12: Standards for Inland Surface Water Quality under Bangladesh Environment Conservation Rules 2023, Schedule-2

SL#	Best Practice-Based Classification	Parameters											
		pH	DO	BOD	NO_3-N	NH_4-N	PO_4-P	Cr (Total)	Pb	Hg	TC	TDS	COD
		-	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	CFU/100 mL	mg/L	mg/L
1.	Source of drinking water for supply only after disinfecting	6.5 - 8.5	≥ 6	≤ 2	7.0	0.1	0.1	0.02	0.03	0.001	≤ 100	1000	10
2.	Water usable for recreational activity	6.5 - 8.5	≥ 5	≤ 3	7.0	0.3	0.5	0.2	0.05	0.001	≤ 50	1000	10
3.	Source of drinking water for supply after conventional treatment	6.0 - 9.0	≥ 5	≤ 3	7.0	0.3	0.5	0.02	0.03	0.001	≤ 5000	1000	25
4.	Water usable by fisheries	6.0 - 9.0	≥ 5	≤ 6	7.0	0.3	0.5	0.05	0.1	0.004	≤ 5000	1000	50
5.	Water usable by various process and cooling industries	6.5 - 8.5	≥ 1	12	-	2.7	-	0.1	0.1	0.05	-	1000	100
6.	Water usable for irrigation	6.5 - 8.5	-	≤ 12	5.0	1.5	2.0	0.1	0.1	0.002	≤ 50000	1000	100

Notes:

1. In water used for irrigation water, electrical conductivity is 2250 µS/cm (at a temperature of 25°C); Sodium is less than 26%; boron is less than 0.2%.

Source: Environmental Conservation Rules 2023, DOE

Based on the present water quality conditions the following spatial distribution of the water quality parameters like pH, Nitrate, Dissolved Oxygen (DO), Chemical Oxygen Demand (COD), Ammonia, Phosphate, Total Dissolved Solids (TDS), Total Chromium, Total Coliform, Biological Oxygen Demand (BOD), Mercury and Lead have been presented in the below figures.

Results of The Water Quality Modelling

The water quality modelling has been presented in two separate ways, for example, the effects of the combined action of STP and CETP in the NSEZ development area, inside khals of NSEZ, and the adjacent sea channel like Sandwip at the west side of the super dyke in the NSEZ, and the effects of climate change and CETP discharged effluents in the associated khals and Sandwip channel near the NSEZ development. The Normal condition of the CETP-STP Water quality model, effect of STP and CETP Failure, and effect of Climate Change on CETP & STP failure water quality model have been presented in the figures below with explanation.

1. Normal condition of the CETP-STP Water quality model
2. Effect of STP and CETP Failure on Water Quality
3. Effect of Climate Change and CETP & STP Failure Condition

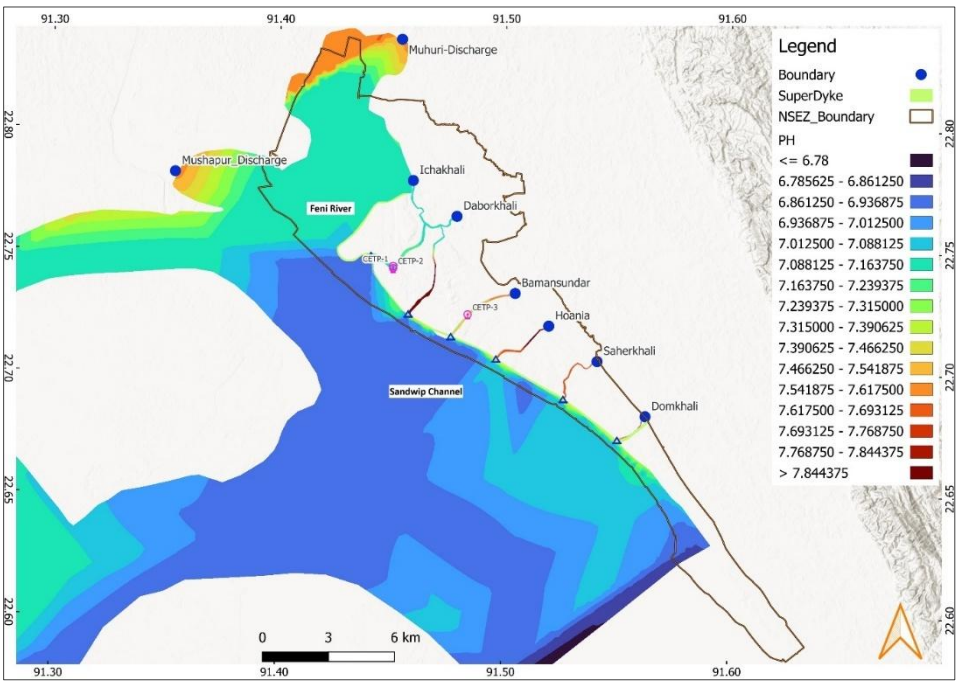
All the above three scenarios have been presented below.

4.2.1 Normal condition of the CETP-STP Water quality model

4.2.1.1 pH

pH is a measure of how acidic or basic a solution is and is an important parameter in assessing water quality. The pH levels influence the health and survival of aquatic organisms. Many aquatic species have specific pH ranges within which they can thrive. pH dispersion is shown in Figure-27. From this figure, it is observed that the maximum pH ranges above 7.84 and the minimum pH ranges around 6.72 or below it.

Figure-27: Spatial variation of pH in the different khals of NSEZ along with the Sandwip Channel

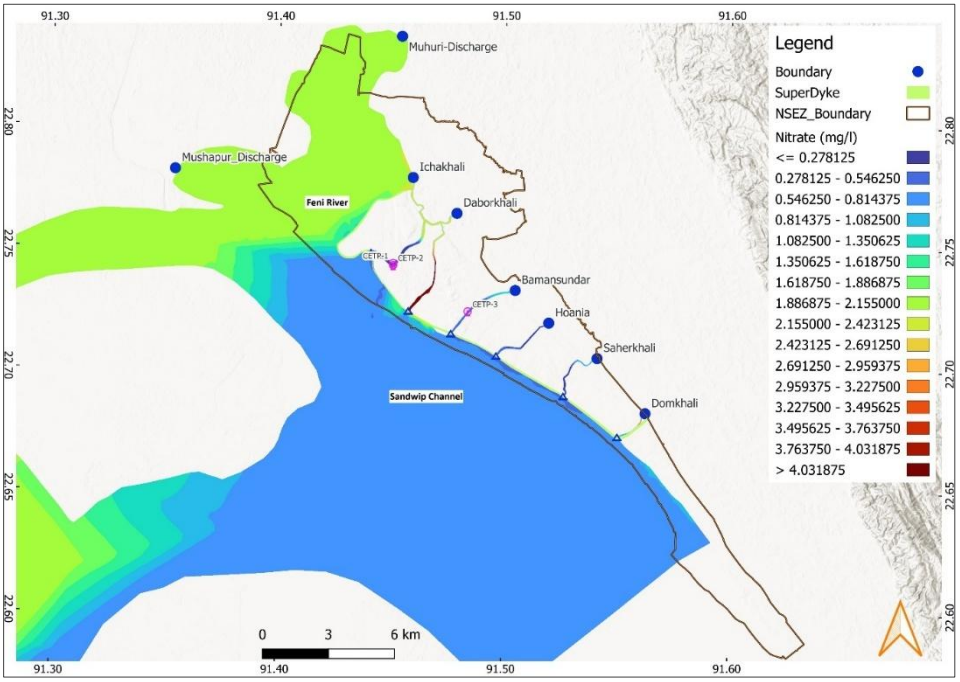


Source: EQMS, 2023

4.2.1.2 Nitrate

Figure-28 shows Nitrate variation in the different khals along the Sandwip channel, which indicates that Nitrate concentration is not more than 4.00 mg/l which is safe for the water ecosystem (Nitrate concentration is less than 7.0 mg/l is safe for fish and aquatic plants as per ECR 2023.

Figure-28: Spatial variation of Nitrate concentration in the different khals of NSEZ along with the Sandwip channel.

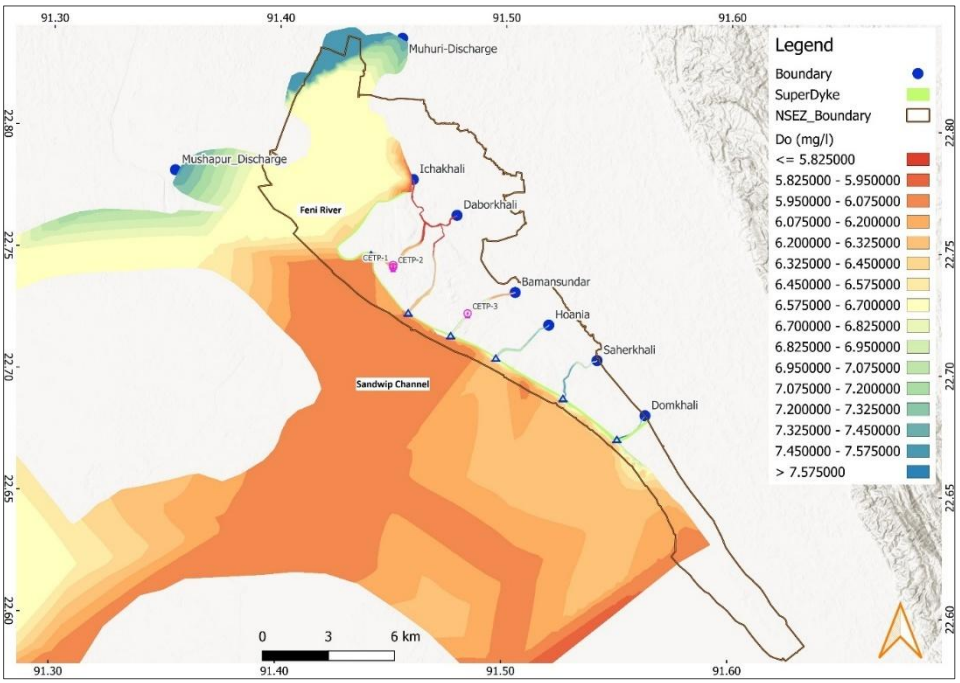


Source: EQMS, 2023

4.2.1.3 Dissolved Oxygen (DO)

The minimum Dissolved Oxygen required for fisheries and aquatic environments is more than 5.0 mg/l which prevails everywhere in the model domain and is shown in Figure-29. From this figure, it is observed that the DO ranges between 5.55 mg/l to above 7.65 mg/l.

Figure-29: Spatial variation of DO in the different khals of NSEZ along with the Sandwip Channel.

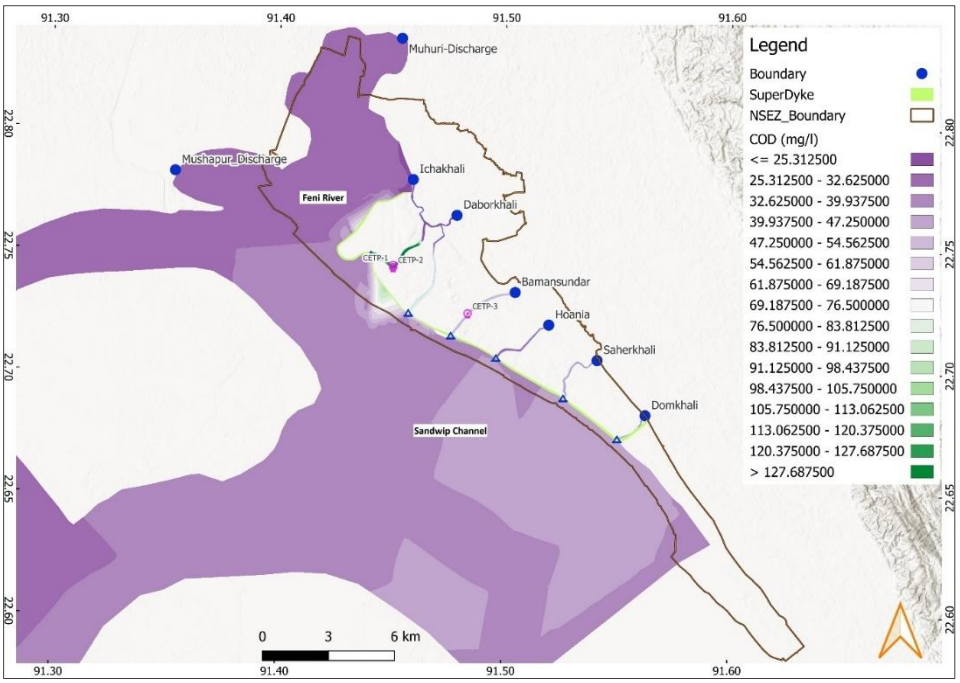


Source: EQMS, 2023

4.2.1.4 Chemical Oxygen Demand (COD)

Chemical Oxygen Demand is a key parameter used to measure the amount of organic compounds in water that can be oxidized by chemical reactions. It is an important indicator of water quality and can have significant impacts on aquatic ecosystems and human health. COD is widely used as a measure of the susceptibility to oxidation of the organic and inorganic materials present in water bodies and municipal and industrial wastes. At present condition, both Ichakhali and Daborkhali Khals have exceeded the 100 mg/l limit which is not suitable for industrial and other purposes, the spatial distribution of the COD is shown in Figure-30. The ranges of COD spatial distribution are between 16 mg/l to above 128 mg/l.

Figure-30: Spatial variation of COD in the different Khals of NSEZ along with the Sandwip Channel

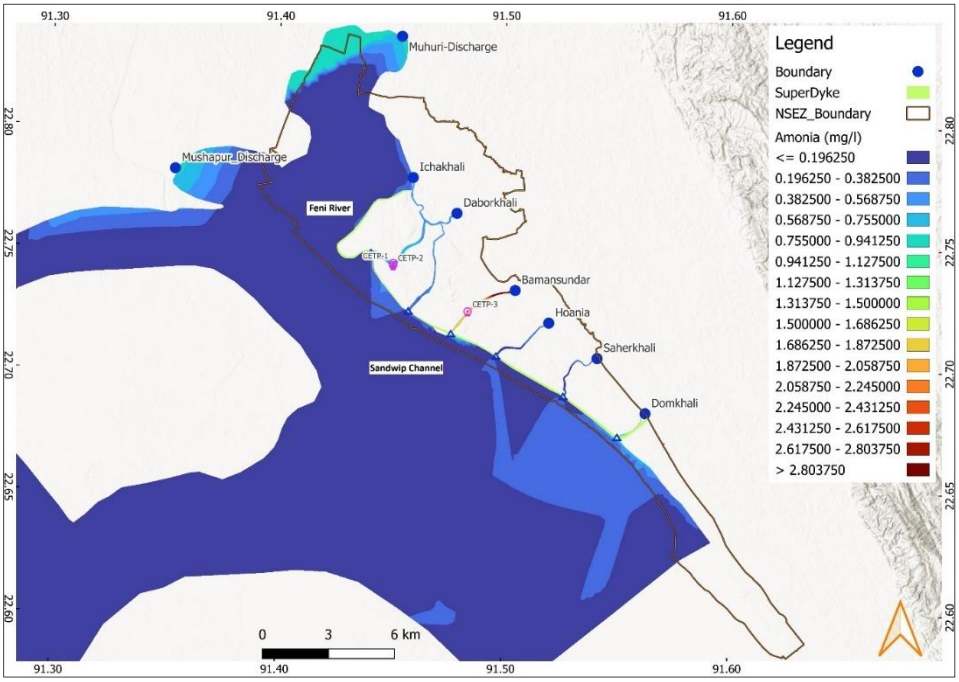


Source: EQMS, 2023

4.2.1.5 Ammonia

Ammonia is also one of the most important pollutants because it is relatively common but can be toxic, causing lower reproduction and growth, or death. The neutral, unionized form (NH4) is highly toxic to fish and other aquatic life. Figure-31 shows that changes in ammonia concentration are not significant, and it is within the limit of almost all purposes like fisheries (the limit is less than 0.3mg/l as per ECR 2023). At the Bamansundar Khal, Ammonia is high ranges 1.6-2.0 mg/l.

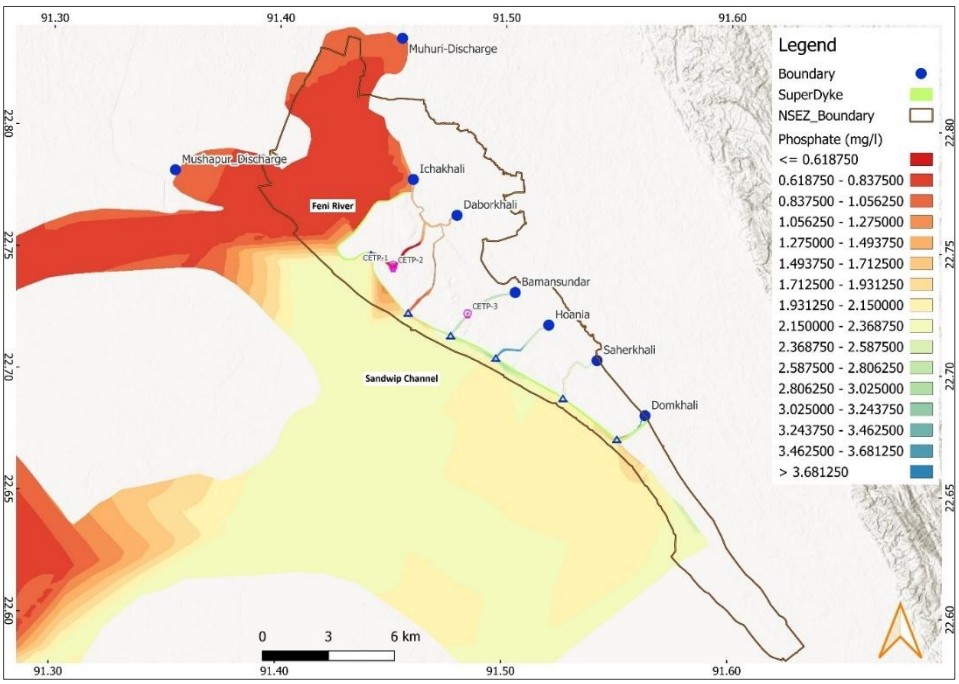
Figure-31: Spatial variation of Ammonia in the different khals of NSEZ along with the Sandwip Channel



Source: EQMS, 2023

4.2.1.6 Phosphate

Phosphate is an essential nutrient for plants and animals. Excessive phosphate in surface water can cause explosive growth of aquatic plants and algae. This can lead to a variety of water-quality problems, including low dissolved oxygen concentrations, which can cause fish kills and harm other aquatic life. Figure-32 shows the variation of Phosphate in the EZ area along with the Sandwip Channel. At present condition, the Phosphate concentration has exceeded the allowable limit in the Saherkhali, Bamansundar, Hoania, and Domkhali khals. From the figure, it is observed that Phosphate spatial distribution ranges between below 0.25 mg/l to 3.5 mg/l.



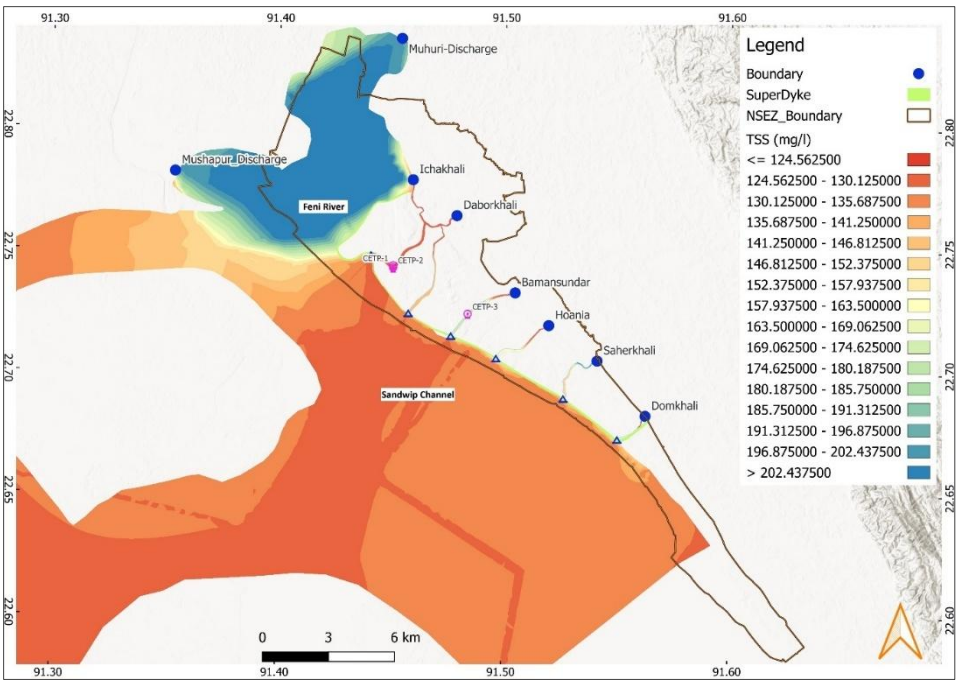
Source: EQMS, 2023

4.2.1.7 Total Suspended Solids (TSS)

Total Suspended Solids (TSS) are an important indicator of water quality. It refers to the amount of solid particles suspended in the water, such as sediment, silt, algae, and organic matter. High levels of TSS in water can reduce water opacity, hindering sunlight penetration, increasing algal bloom, and decreasing dissolved oxygen levels. Furthermore, TSS carries pathogens and contaminants through particle binding mechanisms, which also increases the possibility of organo-metal complexity in the natural water systems. This can harm aquatic plants that rely on photosynthesis and disrupt the food chain. High TSS can make water unpleasant to taste and odor and can clog filters in treatment plants. It can also indicate pollution from sources like soil erosion, industrial waste, or sewage discharge.

The total suspended solid concentration from CETP is 100 mg/l and the present status of TSS in every channel has been found to be around 130 mg/l. In such a situation, water coming from CETP does not increase the TSS value and it will decrease the TSS value in the khal a little bit in the dry period. Figure-33 shows the high and low tide condition water TSS conditions. From this figure, it has been observed that the CETP does not have so much impact on the khal for TSS results from the laboratory testing. In monsoon time, TSS value will increase more, when the upstream flow increases from upstream.

Figure-33: Spatial variation of TSS in the different khals and Sandwip Channels during High and Low tide time.

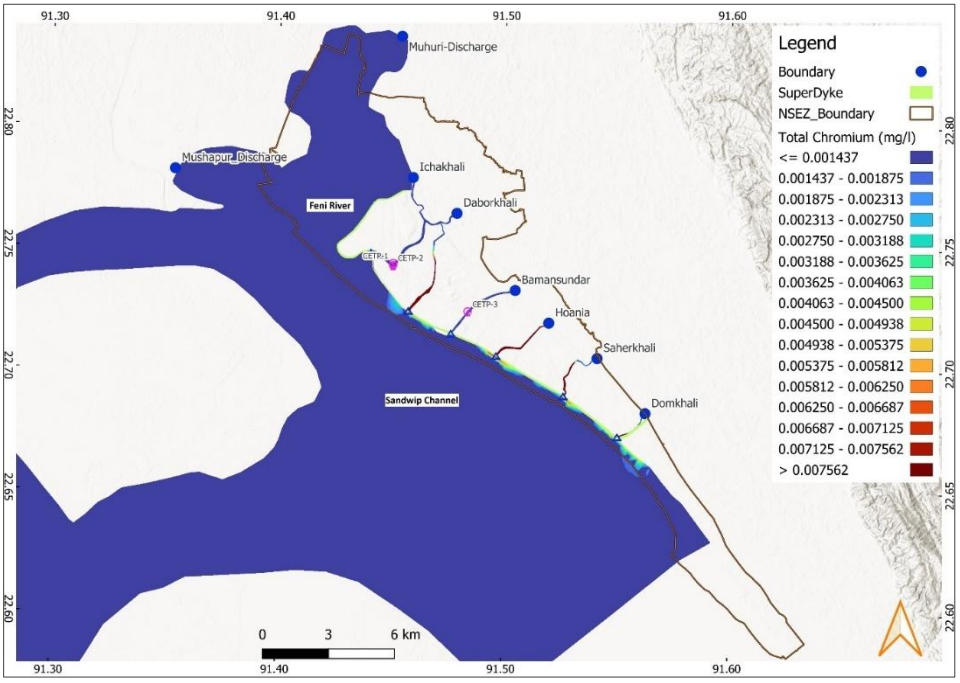


Source: EQMS, 2023

4.2.1.8 Total Chromium

Figure-34 shows that the present chromium concentration in water is less than 0.05 mg/L, which indicates that the water is acceptable for all purposes like industrial use, recreation, fisheries, etc. Total Chromium ranges between 0.001 mg/L to 0.008 mg/L.

Figure-34: Spatial variation of Total Chromium in the different khals of NSEZ along with the Sandwip Channel

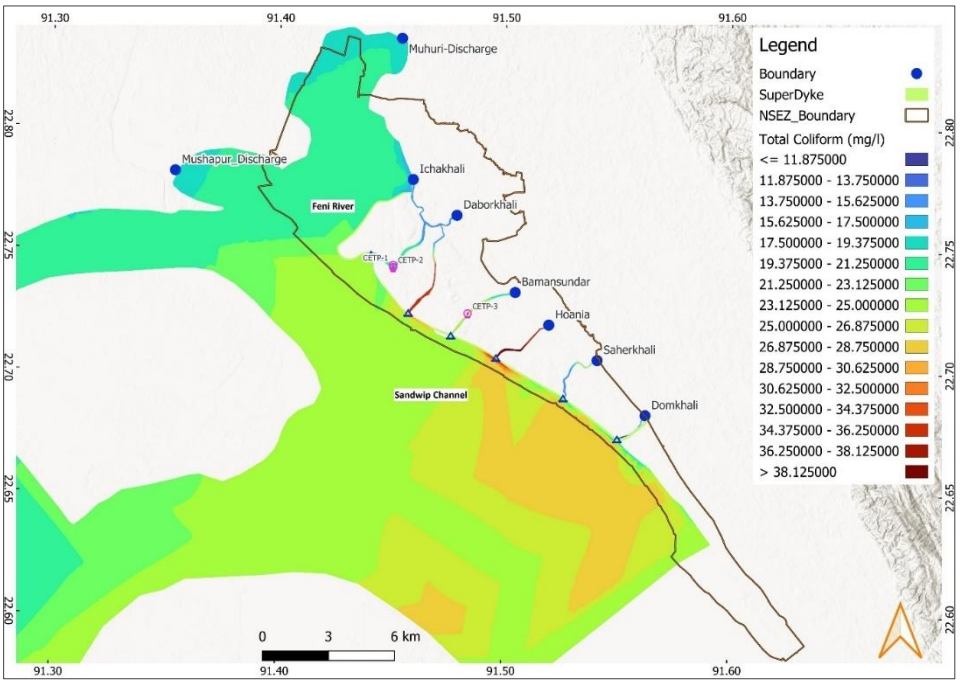


Source: EQMS, 2023

4.2.1.9 Total Coliform

Figure-35 shows the present status of total coliform does not exceed more than 50.0 CFU/100 ml in any khal or Sandwip channel, which is permitted for recreational or fisheries purposes, and it is allowable for drinking water after treatment. Total Coliform ranges between 10 to above 38 CFU/100ml.

Figure-35: Spatial variation of Total Coliform Bacteria in the different khals of NSEZ along with the Sandwip channel

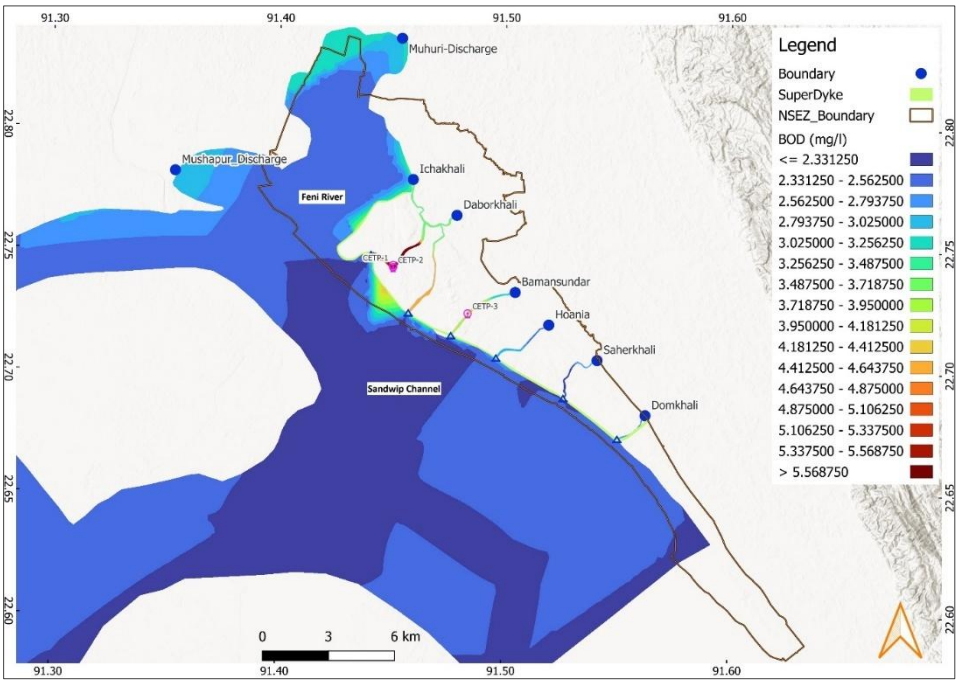


Source: EQMS, 2023

4.2.1.10 Biological Oxygen Demand (BOD)

The Biochemical Oxygen Demand (BOD) is a crucial environmental index for determining the relative oxygen requirements of wastewater, effluents, and polluted water. It's observed that BOD at present is less than 6.0 mg/l as shown in Figure-36. According to Environment Conservation Rules (ECR) 2023, the present water inside the EZ area and near the Sandwip Channel is safe for fisheries, recreation, aquatic ecosystems, and industrial use purposes and allowable for drinking after treatment.

Figure-36: Spatial variation of BOD in the different khals of NSEZ along with the Sandwip Channel

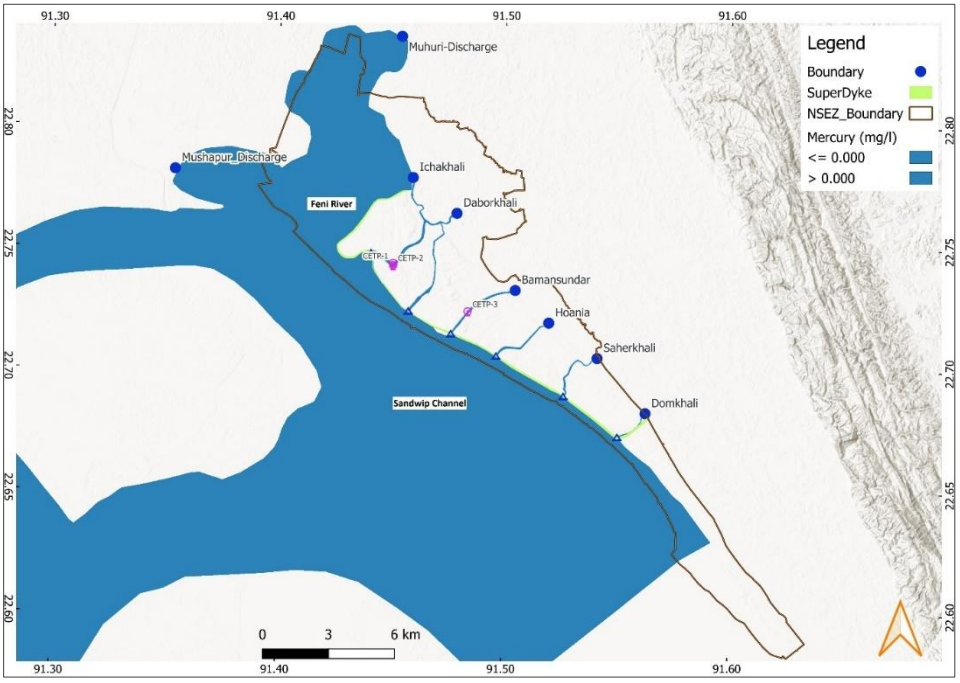


Source: EQMS, 2023

4.2.1.11 Mercury and Lead

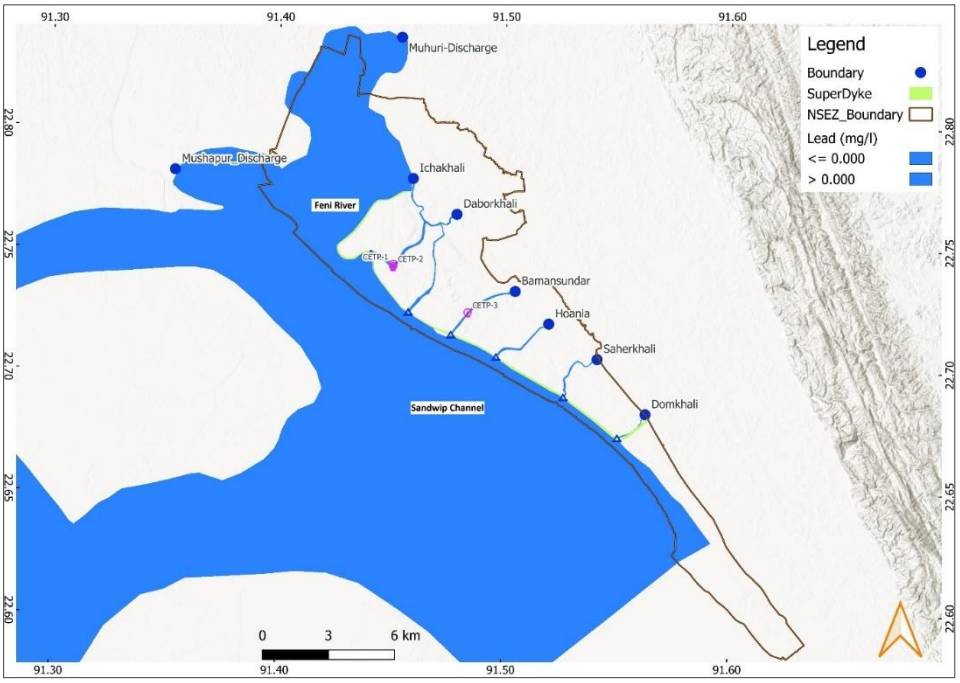
At present condition, Mercury and lead are constant everywhere in the model domain and both values have been found 0.001 mg/l and 0.01 mg/l respectively. Both values are within the limit of Environment Conservation Rules (ECR) 2023.

Figure-38: Spatial distribution of Mercury in the different khals of NSEZ along with the Sandwip Channel



Source: EQMS, 2023

Figure-38: Spatial distribution of Lead in the different khals of NSEZ along with the Sandwip Channel



Source: EQMS, 2023

Summary of the Water Quality Model in Normal Condition

The summary of the model results with the normal operation condition scenario has been depicted in Table-14.

Table-14: Summary of the Water Quality Model in Normal Condition

Parameters	Model Result	Ichakhali	Daborkhali	Bamansundar	Hoania	Saherkhali	Domkhali	Sandwip Channel	Remarks
pH	6.78->7.84	7.1-7.3	7.6-7.8	7.39-7.69	7.69-7.84	7.39-7.6	7.2-7.3	7.08-7.2	All are within limit
Nitrate (mg/l)	0.27->4.03	0.27-2.1	1.8-4.03	0.27-1.35	0.54-1.35	0.54-0.81	1.61-2.1	0.81-1.08	All are within limit
DO (mg/l)	5.82-7.57	5.95-6.5	6.07-6.32	6.32-6.7	6.82-7.07	6.82-6.95	6.95-7.07	5.82-6.7	All are within limit
COD (mg/l)	25.3-127.6	25.3-39.93	47.2-69.1	54.5-76.5	47.2-61.8	61.8-76.5	54.5-61.8	47.2-61.8	Most cases exceed the limit
Ammonia (mg/l)	0.19-2.8	0.38-.56	0.19-0.56	1.6-2.8	0.38-0.75	0.38-0.75	1.3-1.5	0.38-0.75	Most cases exceed the limit
Phosphate (mg/l)	0.61-3.68	0.83-1.05	1.05-1.27	2.3-2.5	2.58-2.80	2.80-3.02	2.80-3.02	1.71-2.15	exceed the limit in all cases
TSS (mg/L)	124.5-202.4	124.5-130.1	130.1-135.6	157.9-174.6	163.5-169.0	163.5-191.3	185.7-191.3	146.8-163.5	--
Total-Cr (mg/l)	0.0014-0.0075	0.0014-0.0018	0.0018-0.0075	0.0014-0.0023	0.0071-0.0075	0.0036-0.0075	0.0014-0.0075	0.0036-0.0045	All are within limit
Total Coliform (CFU/100 ml)	11.87-38.12	13.75-17.5	17.5-36.25	17.5-25.0	32.5-36.25	21.25-25.0	23.12-25.0	23.1-36.25	All are within limit
BOD (mg/l)	2.33-5.56	3.48-4.41	3.25-4.64	3.48-3.95	2.56-3.25	2.33-3.25	2.56-3.02	2.56-4.18	All are within limit
Mercury (mg/l)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--
Lead (mg/l)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--

Table-14 represents the normal condition scenarios from the CETP and STP water quality model, found that most of the cases the water quality dispersion remains within the limit. All the effects have been considered in comparison with the ECR 2023 suitability for fisheries/recreational purposes that may impact on the ecosystem services of the NSEZ and related facilities.

4.2.2 Effect of STP and CETP Failure on Water Quality

In this sub-component of water quality modelling, a simulated scenario has been generated to present the dry season (01 December 2022 to 31 March 2023) to observe the combined effect of STP and CETP failure in the study area of Mirsharai and Sandwip of Chattogram, Bangladesh. The dry season has been selected to present the worst conditions of the water quality dispersion.

All the parameters of water quality have taken a long time to disperse and settle down in a stable state during the model simulation condition setup. For this reason, this model has been running for a long duration (minimum 3 months of continuous data). The spatial distribution of all major parameters (e.g., pH, Nitrate, DO, COD, Ammonia, Phosphate, TSS, Chromium, TC, BOD, Mercury, and Lead) dispersion after mixing from the discharge from the Central Effluent Treatment Plants (CETPs) and Sewerage Treatment Plants (STPs) in the NSEZ have been described to understand the STP and CETP failure water quality dispersion system in the khals and Sandwip channel.

Table-15 shows the state variables used in the STPs and CETPs failure condition input in the water quality modelling in EcoLab module software.

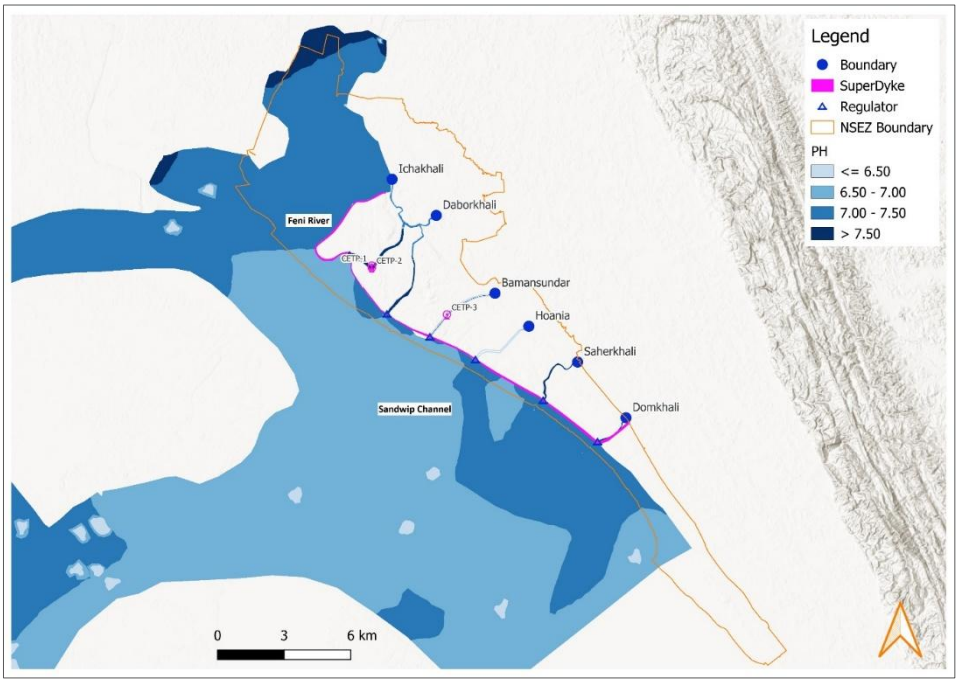
Table-15: State Variables Used in the STPs and CETPs Failure Condition

SL#	State Variables	Treated Value	CETP Failure Value	STP Failure Value
1.	pH	8	9	9
2.	Nitrate	10 mg/l	30	50
3.	DO	8 mg/l	3	3
4.	COD	50 mg/l	1260	125
5.	Ammonia	5 mg/l	50	50
6.	Phosphate	15 mg/l	15	15
7.	Total Suspended Solid (TSS)	100 mg/l	600	100
8.	Total Chromium	0.5 mg/l	2	2
9.	Total Coliform	1000	1000	1000
10.	Fecal Coliform	0	1000	1000
11.	BOD	10 mg/l	600	30
12.	Mercury (Hg)	0.01 mg/l	0.01	0.01
13.	Lead (Pb)	0.1 mg/l	1	0.1
14.	Temp	40 Degrees	46	30

4.2.2.1 pH

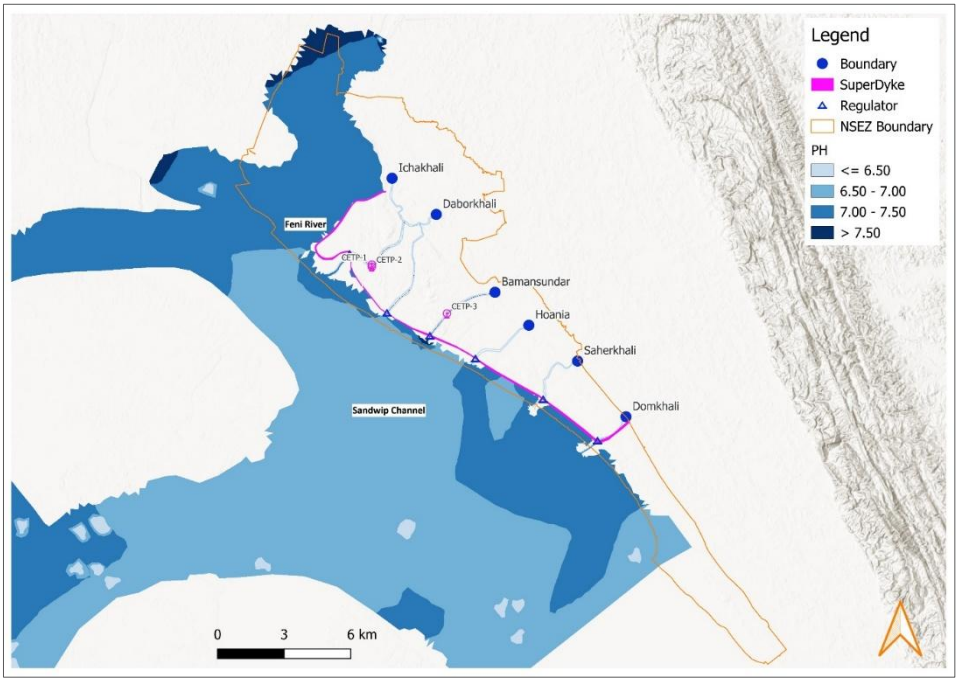
Over the model area, pH values prevail within the standard range after failure scenarios of CETP and STP water discharge. pH ranges between 6.0 to 8.0 in the low and high tide times as well. pH value prevailed close to 9 in Daborkhali, Ichakhali Khal, and Bamansundar Khal. Which is to touch the upper limit for safe limit. Over the model area pH dispersion after mixing STP and CETP is shown in Figure-39 & Figure-40.

Figure-39: pH dispersion in the study area due to CETP and khal water during High Tide



Source: EQMS, 2023

Figure-40: pH dispersion in the study area due to CETP and khal water during Low Tide

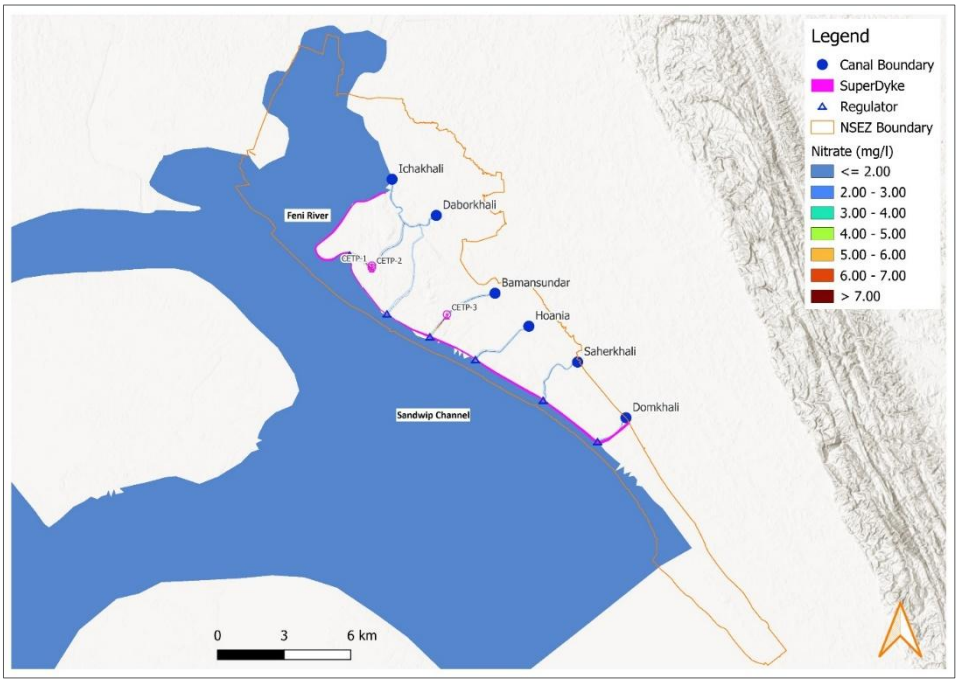


Source: EQMS, 2023

4.2.2.2 Nitrate

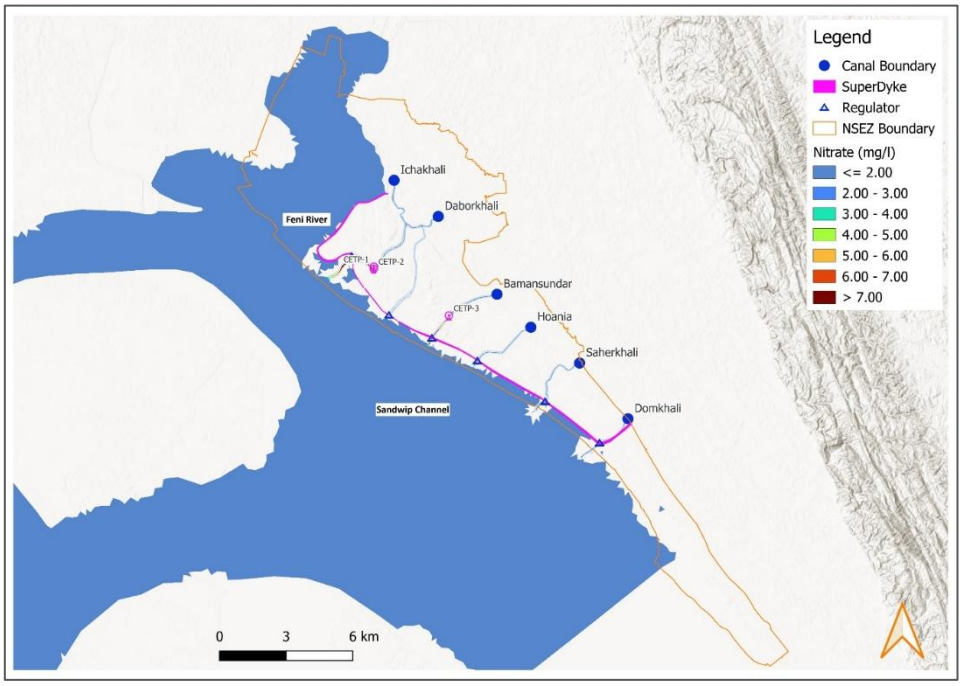
Nitrate variation in the khals and along with the Sandwip channel due to the STP and CETP failure water has been shown in Figure-41 and Figure-42 for high and low tide times. Nitrate variation ranges between 1.0 - 6.375 mg/l in low and high tide time, which is safe for fisheries, agriculture, and other purposes except Bamansundar Khal and Daborkhali, Ichakhali Khal where it exceeds the limit of 7.0 mg/l and it spread up to 1.23 km from the Daborkhali khal regulator during low tide and it becomes normal during high tide time.

Figure-41: Nitrate dispersion in the study area due to CETP and khal water during High Tide



Source: EQMS, 2023

Figure-42: Nitrate dispersion in the study area due to CETP and khal water during Low Tide

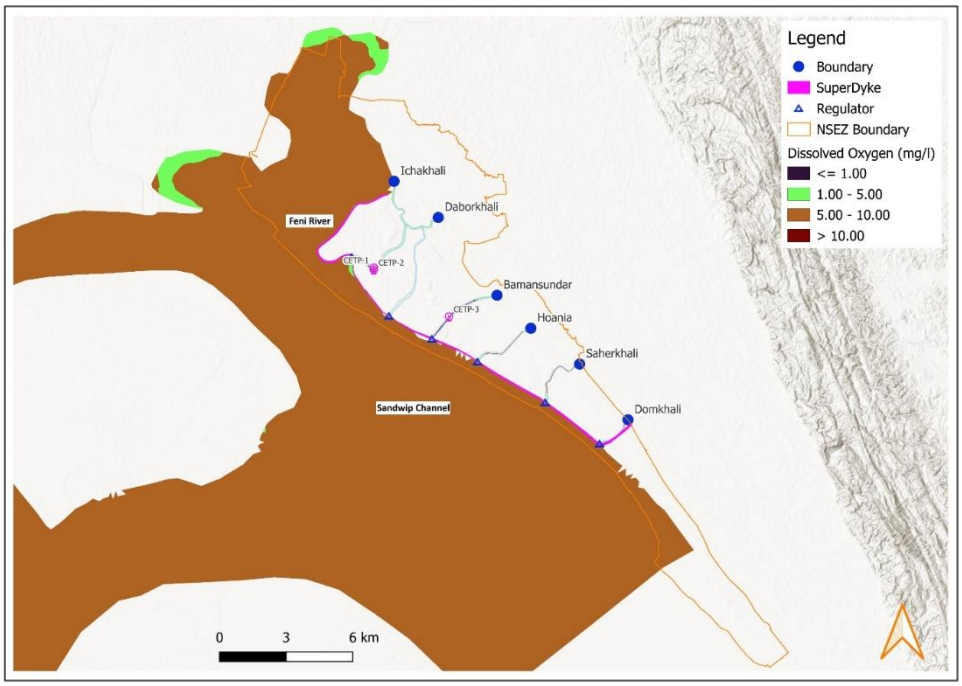


Source: EQMS, 2023

4.2.2.3 Dissolved Oxygen (DO)

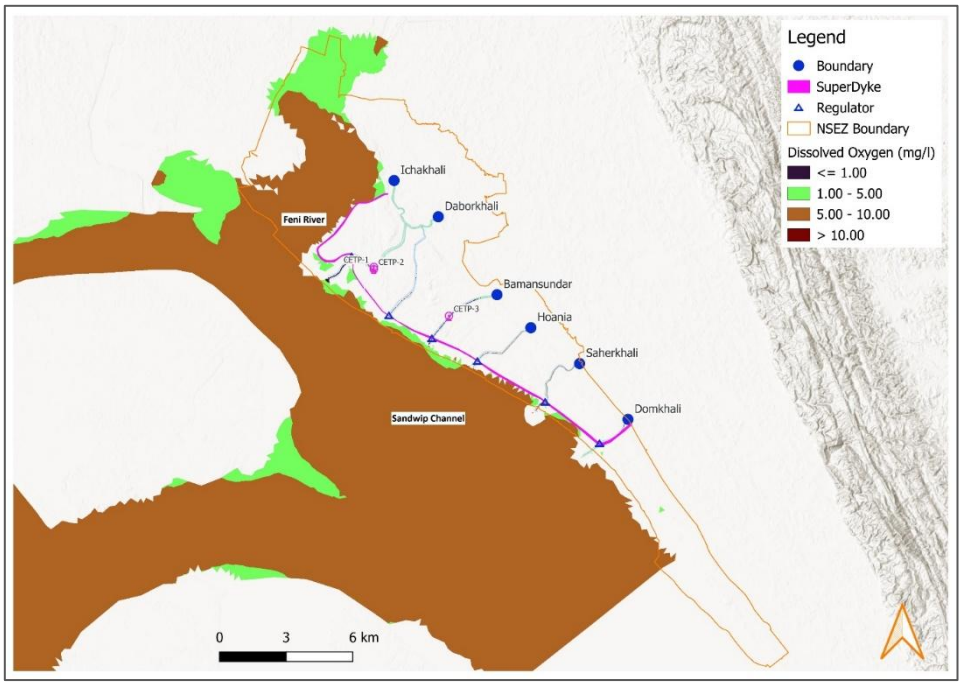
Allowable (5 mg/l or more) DO is prevail in the Sandwip channel along the super dyke area after mixing of CETP and STP failure water from Ichakhali and Bamansundar khal during high tide time, but in low tide time it disperses up to 1.53 and 1.67 km into the Sandwip Channel from Bamansundar regulator gate location and from Ichakhali khal respectively, where it values is less than the allowable limit which has shown in Figure-43 and Figure-44.

Figure-43: DO dispersion in the study area due to CETP and khal water during High Tide



Source: EQMS, 2023

Figure-44: DO dispersion in the study area due to CETP and khal water during Low Tide

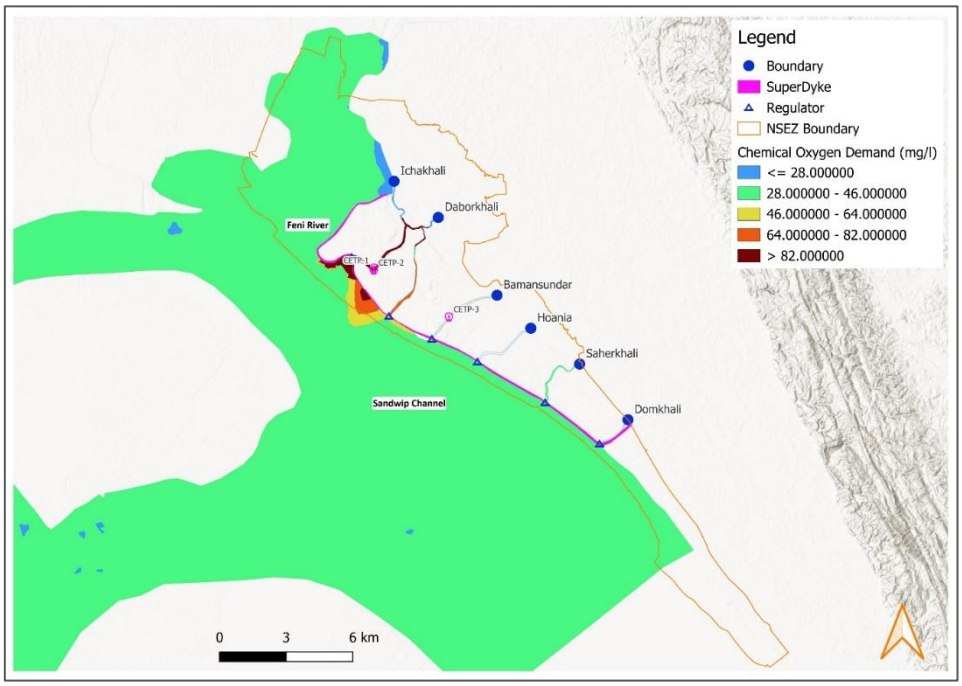


Source: EQMS, 2023

4.2.2.4 Chemical Oxygen Demand (COD)

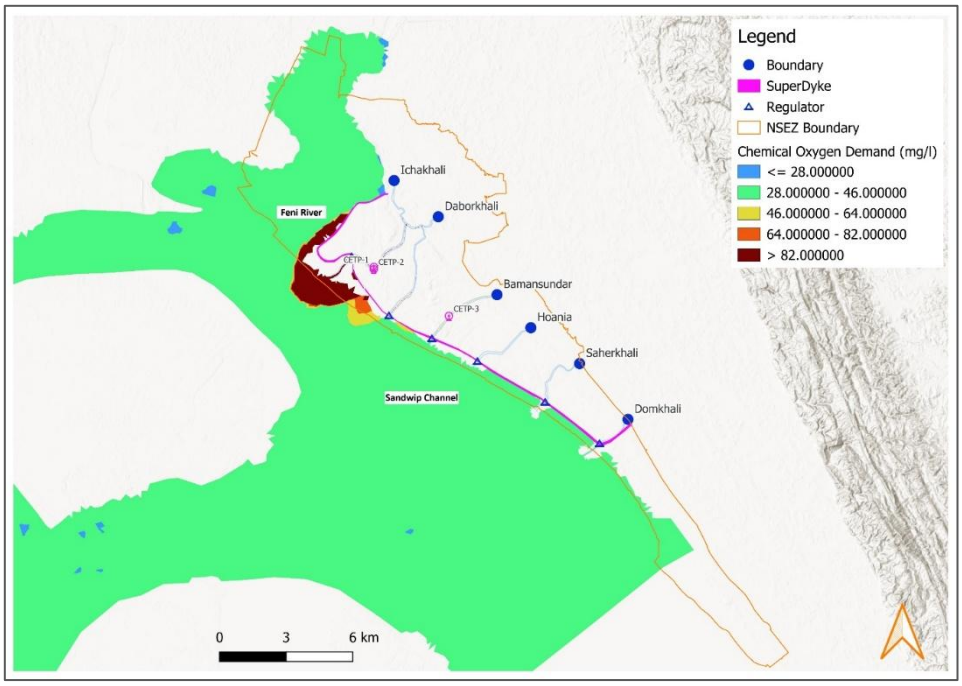
COD values have been found above 50.0 mg/l and spread up to 2.86 km into the Sandwip channel during the low tide and during high tide time it becomes less than 50.0 mg/L. COD value always prevails more than 50 mg/l in the Ichakhali and Bamansundar khals. Figure-45 and Figure-46 show the variation of COD during high and low tide time respectively.

Figure-45: COD dispersion in the study area due to CETP and khal water during High Tide



Source: EQMS, 2023

Figure-46: COD dispersion in the study area due to CETP and khal water during Low Tide



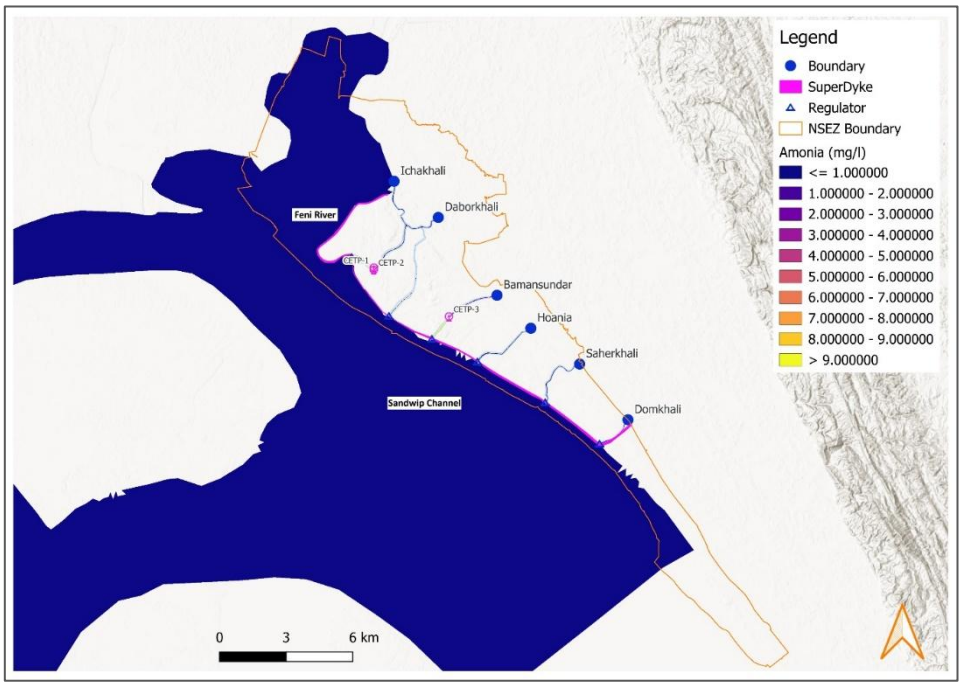
Source: EQMS, 2023

4.2.2.5 Ammonia

Ammonia is the preferred nitrogen-containing nutrient for plant growth. Ammonia can be converted to Nitrite (NO_2) and Nitrate (NO_3) by bacteria and then used by plants. Nitrate and ammonia are the most common forms of nitrogen in aquatic systems. Ammonia is also one of the most important pollutants because it is relatively common but can be toxic, causing lower reproduction and growth, or death. The neutral, unionized form of Ammonia (NH_3) is highly toxic to fish and other aquatic life. Figure-47 and Figure-48 show that changes in Ammonia concentration are significant in the Ichakhali and

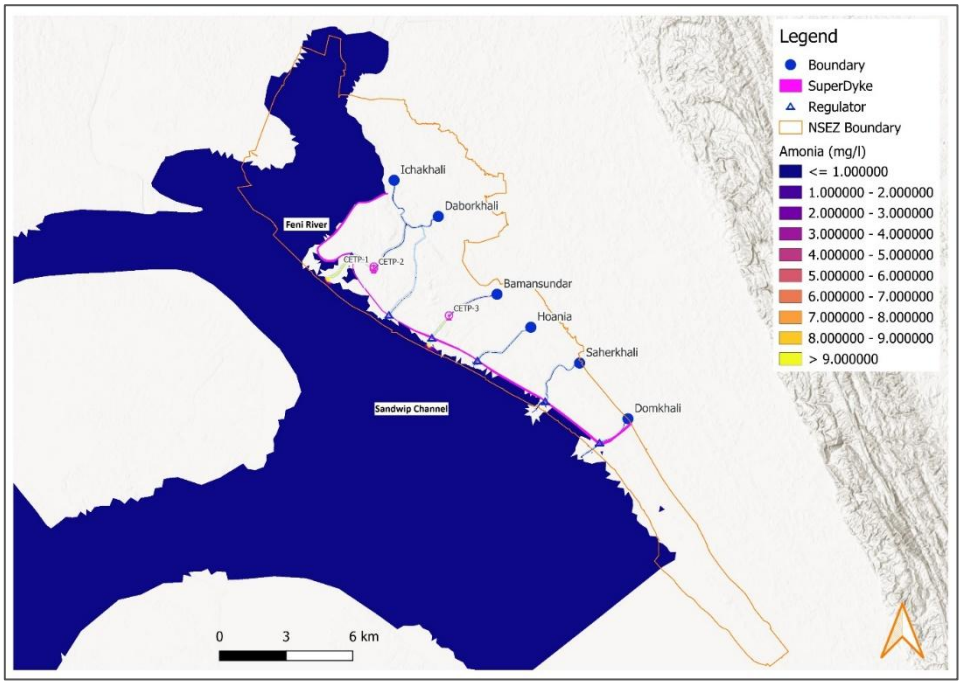
Bamansundar khals due to CETP and STP failure. During the low tide time, it propagates 3.6 km in the Sandwip channel from the Ichakhali regulator gate. Ammonia dispersion ranges from 1.0 - 15 mg/l in high and low tide time as per the figures from the modelling.

Figure-47: Ammonia concentration dispersion in the study area due to CETP and khal water during High Tide



Source: EQMS, 2023

Figure-48: Ammonia concentration dispersion in the study area due to CETP and khal water during Low Tide

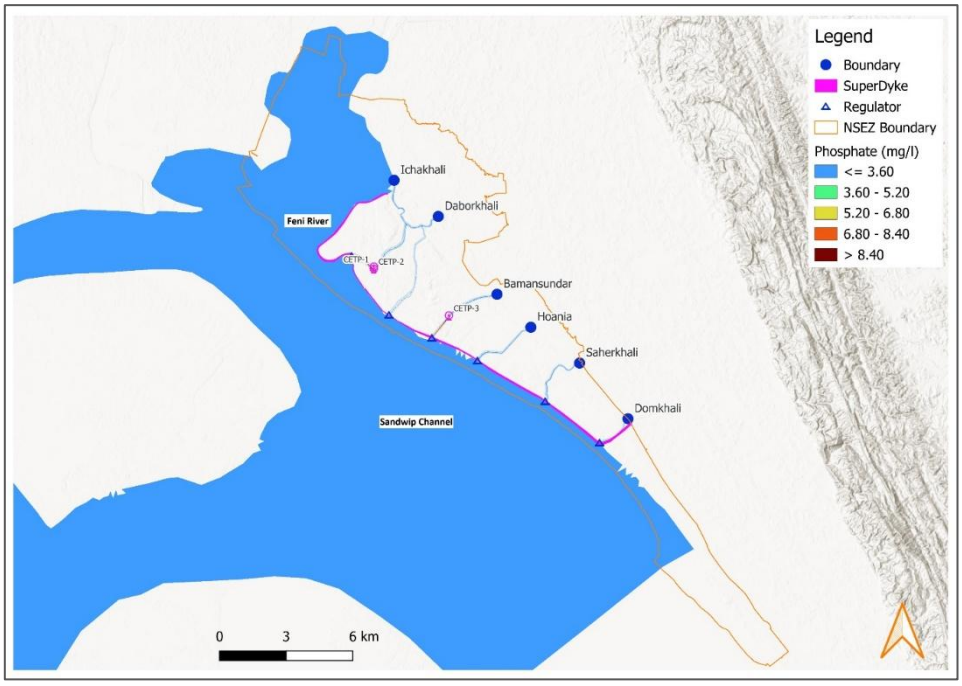


Source: EQMS, 2023

4.2.2.6 Phosphate

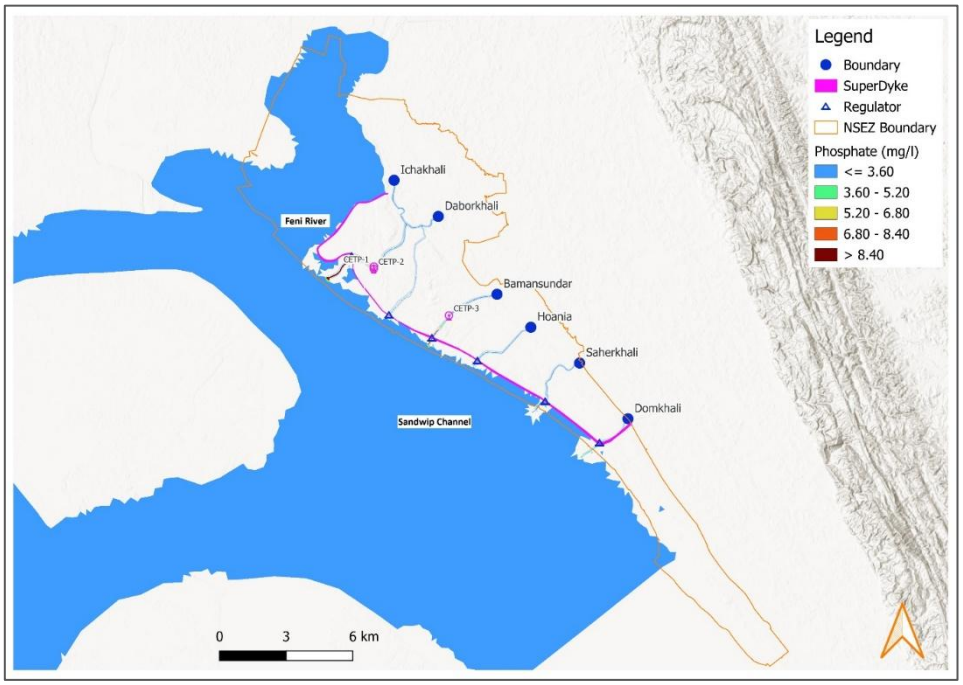
Phosphate is an essential nutrient for plants and animals. However, excessive phosphate in surface water can cause explosive growth of aquatic plants and algae. This can lead to a variety of water-quality problems, including low dissolved oxygen concentrations, which can cause fish kills and harm other aquatic life**.** Figure-49 and Figure-50 show the variation of Phosphate concentration in all the khals and along with the Sandwip channel as well. It is observed that Phosphate propagates up to 1.7 kilometers into the Sandwip channel from the Ichakhali khal and it crosses the limit of fisheries and other purposes during high and low tide time. Especially inside the Ichakhali khal and Bamansundar khal, concentration has crossed the 10.0mg/l limit as from the model, which will make adverse conditions for any aquatic life.

Figure-49: Phosphate concentration dispersion in the study area due to CETP and khal water during High Tide time



Source: EQMS, 2023

Figure-50: Phosphate concentration dispersion in the study area due to CETP and khal water during Low Tide time



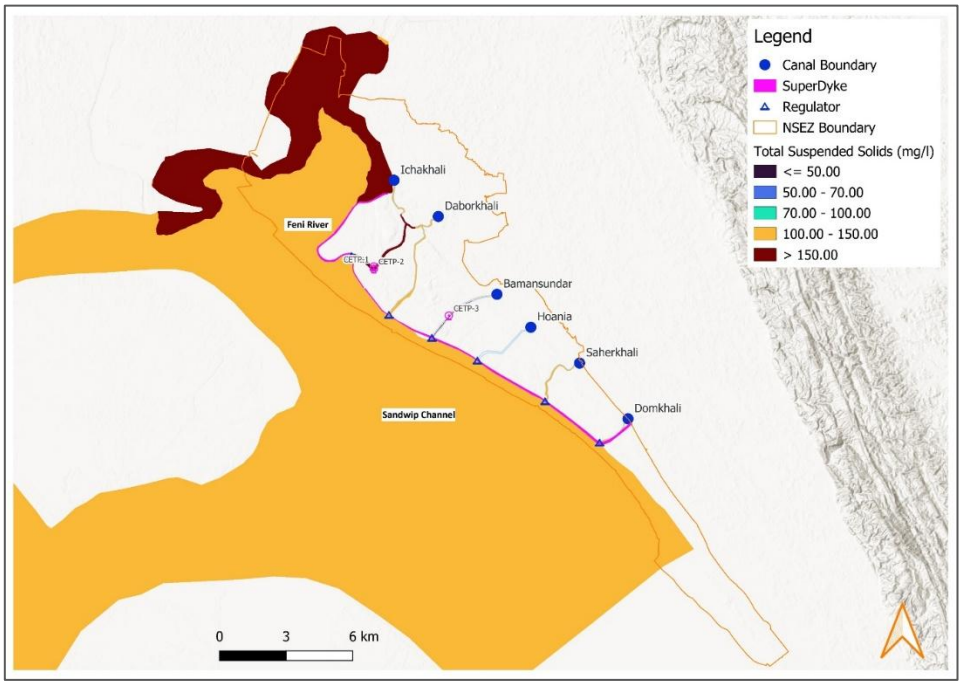
Source: EQMS, 2023

4.2.2.7 Total Suspended Solids (TSS)

Total Suspended Solids are dispersed u 1.83 km from the super dyke area with a maximum intensity of 131 mg/l from Ichakhali khal and Bamansundar khal during the low tide time due to the STP and CETP failure.

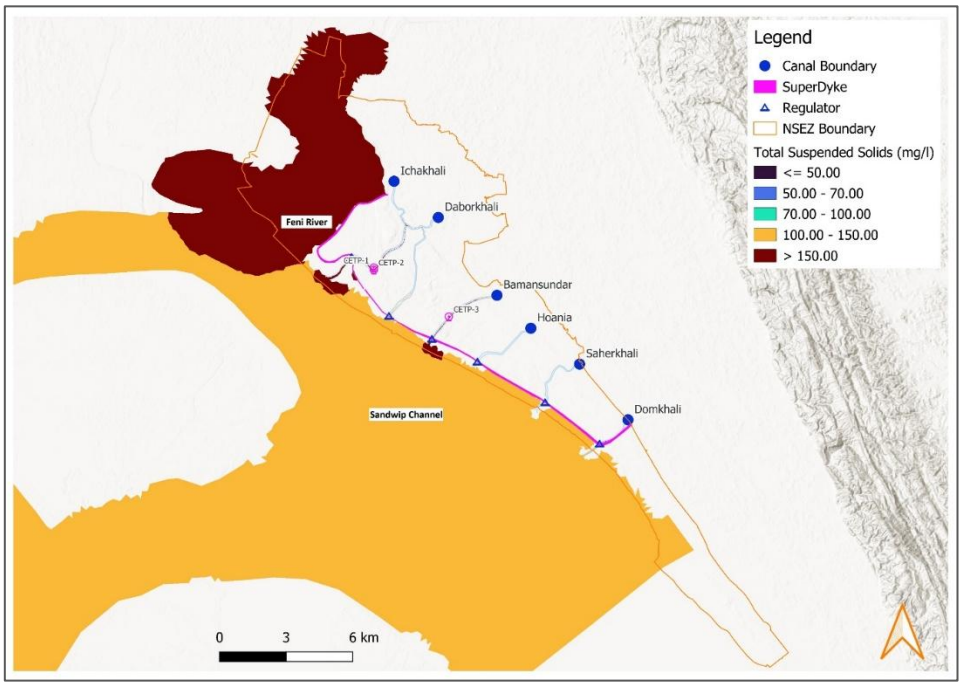
Inside the Ichakhali and Bamansundar khals, the TSS value will cross 200 mg/L which is very high, where the upper limit of the standard value is 80 mg/l for fisheries purposes. Figure-51 and Figure-52 show the Total Suspended Solids (TSS) dispersion during high and low tide time respectively.

Figure-51: TSS dispersion in the study area due to CETP and STP failure conditions during High Tide time



Source: EQMS, 2023

Figure-52: TSS dispersion in the study area due to CETP and STP failure conditions during Low Tide time



Source: EQMS, 2023

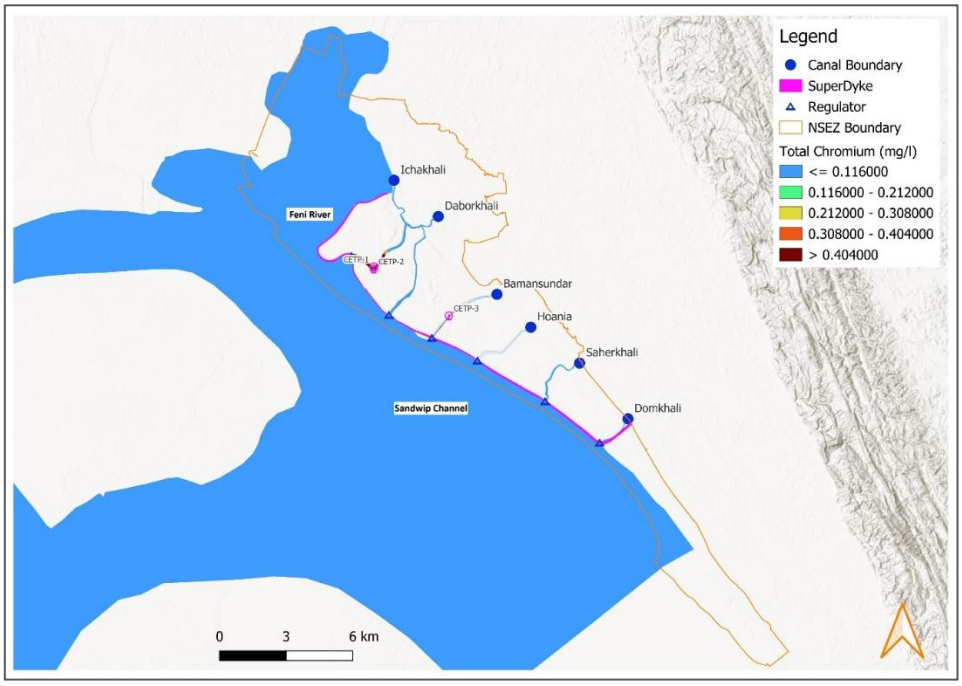
4.2.2.8 Total Chromium (Cr-Total)

Total Chromium in water can be present in two main forms: Chromium (III): this form is generally considered beneficial or at least non-toxic to humans and is even an essential nutrient in trace amounts. Chromium (VI): this form, hexavalent chromium, is a known carcinogen (cancer-causing agent).

Monitoring Total Chromium helps ensure drinking water meets safety standards and minimizes potential exposure to harm.

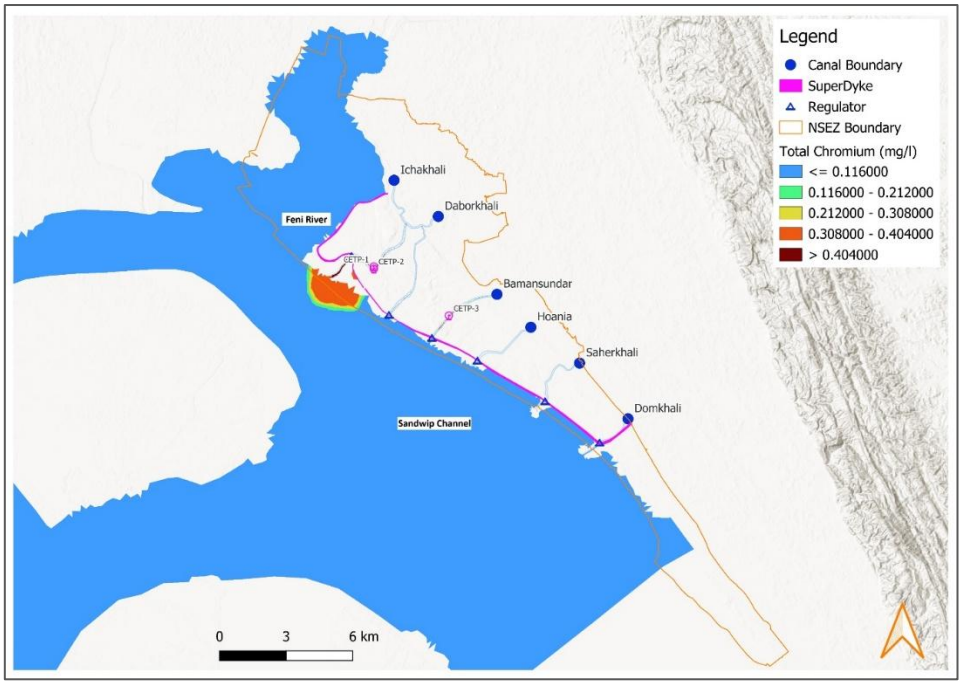
Total chromium is dispersed up to .8 km from the super dyke area with a maximum intensity of 0.50 mg/L from Ichakhali and Bamansundar Khals during the low tide time, which value is a little bit high for fisheries due to the STP and CETP failure condition as per the model output. Figure-53 and Figure-54 show the Total Chromium dispersion during high and low tide respectively.

Figure-53: Total Chromium dispersion in the study area due to CETP and khal water during High Tide



Source: EQMS, 2023

Figure-54: Total Chromium dispersion in the study area due to CETP and khal water during Low Tide



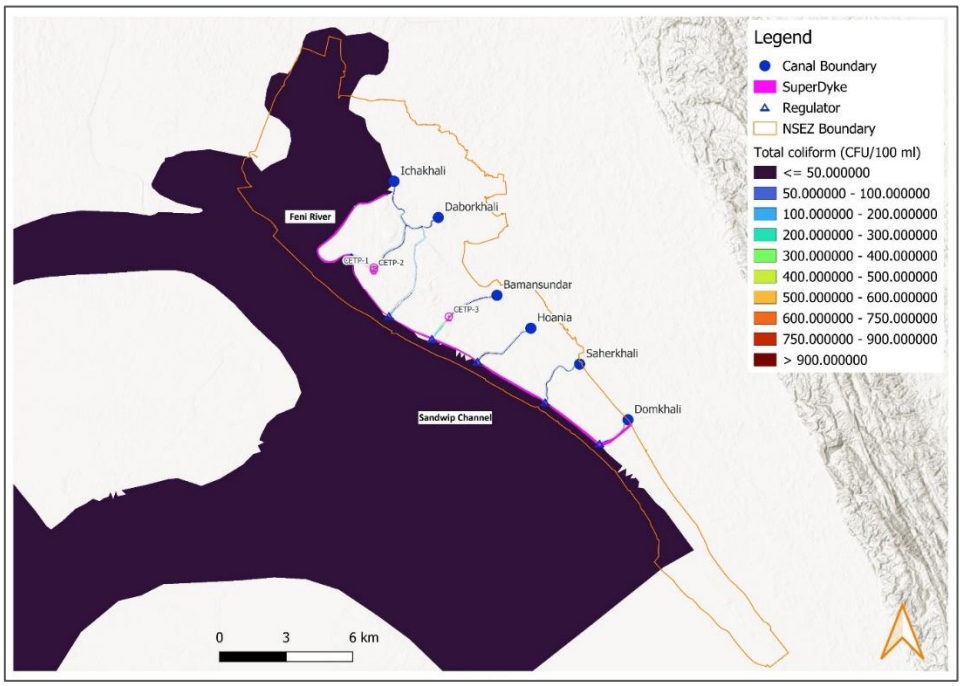
Source: EQMS, 2023

4.2.2.9 Total Coliform Bacteria

Total coliform bacteria are a group of bacteria commonly found in the environment, including soil, vegetation, and water. They are used as indicators of water quality and are often associated with fecal contamination, although not all coliform bacteria are harmful to humans. Monitoring the levels of total coliform bacteria in water bodies such as coastal khals and shorelines is important for assessing the potential risks to human health and the environment. In coastal areas, the presence of total coliform bacteria can indicate contamination from various sources, including sewage discharges, agricultural runoff, and wildlife feces. High levels of total coliform bacteria in coastal khals and shorelines may pose a risk to the ecosystem.

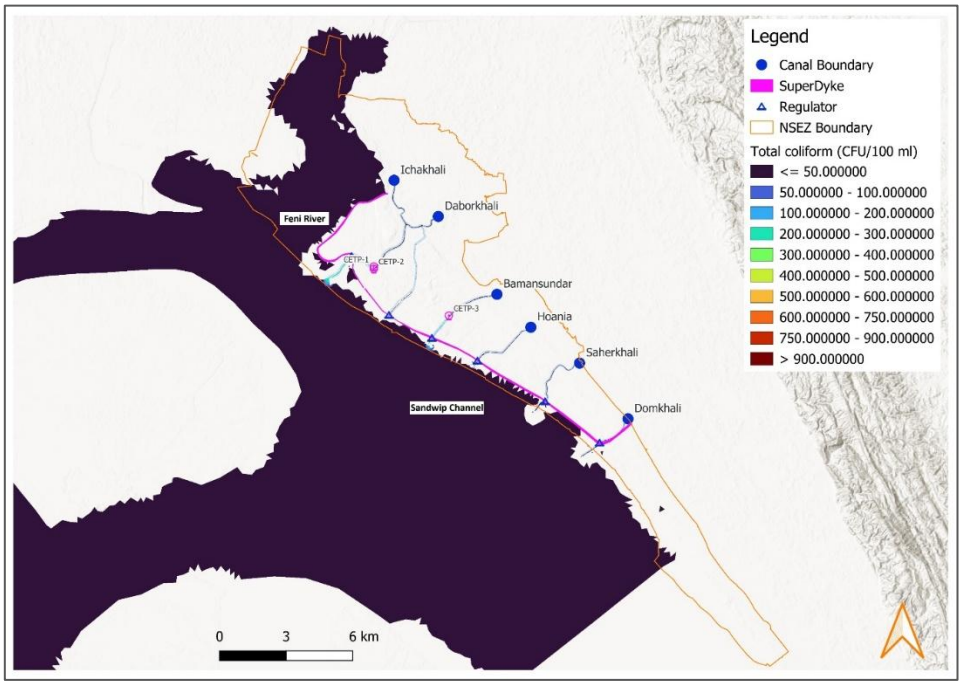
Figure-55 and Figure-56 show that the total coliform does not exceed more than 50.0 CFU/100 ml in the Sandwip channel part during high tide but in the low tide period the total coliform limit exceeds, and it spreads 2.6 km from the Ichakhali Khal (khal). It's quite similar to the normal condition as no input value has changed in the failure condition as well.

Figure-55: Total coliform dispersion in the study area due to CETP and khal water during High Tide



Source: EQMS, 2023

Figure-56: Total coliform dispersion in the study area due to CETP and khal water during Low Tide



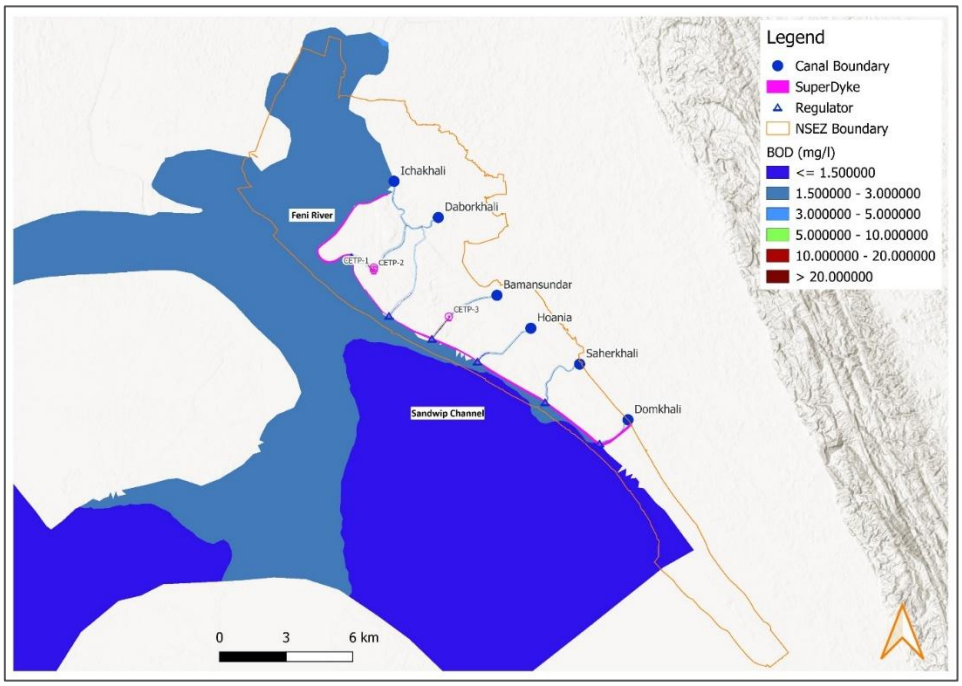
Source: EQMS, 2023

4.2.2.10 Biochemical Oxygen Demand (BOD)

The Biochemical Oxygen Demand (BOD) is a crucial environmental index for determining the relative oxygen requirements of wastewater, effluents, and polluted water. It refers to the quantity of oxygen required by bacteria and other microorganisms in the biochemical degradation and transformation of organic matter under aerobic conditions. The BOD is also interpreted as a measure of the concentration of organic material that can serve as a substrate to support the growth of microorganisms.

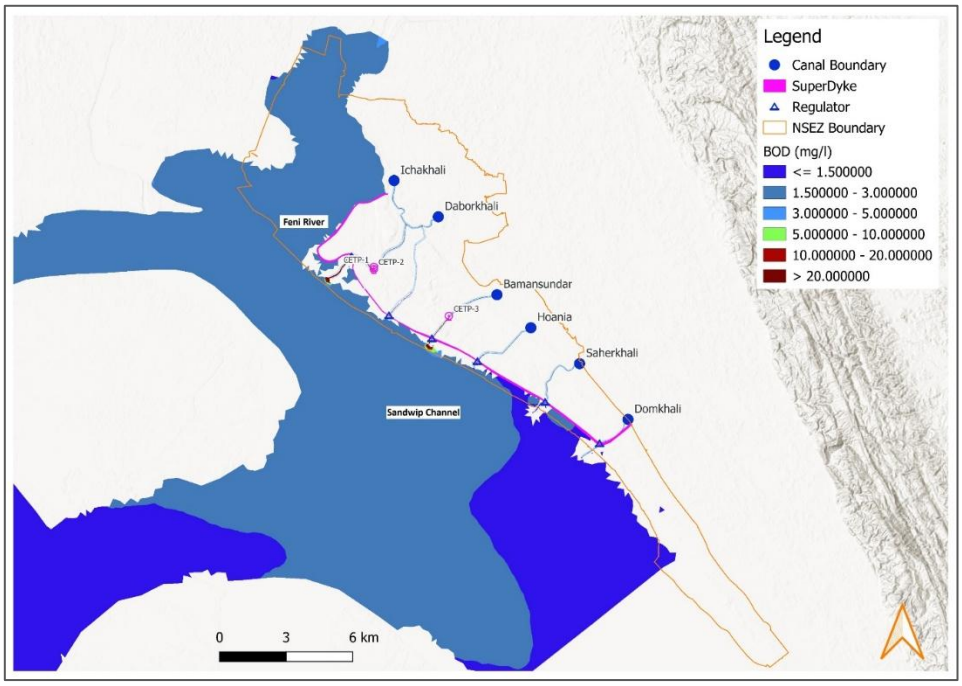
Figure-57 and Figure-58 show the BOD variation in the study area. It's observed that BOD affects the Ichakhali, Bamansundar Khal, and Sandwip channel's water and crosses the allowable limit for all purposes of water use. BOD disperses up to 2.14 km in low tide time and 0.51 km in high tide time from the Ichakhali regulator gate due to the failure of STP and CETP mixing water.

Figure-57: BOD dispersion in the study area due to CETP and khal water during High Tide



Source: EQMS, 2023

Figure-58: BOD dispersion in the study area due to CETP and khal water during Low Tide



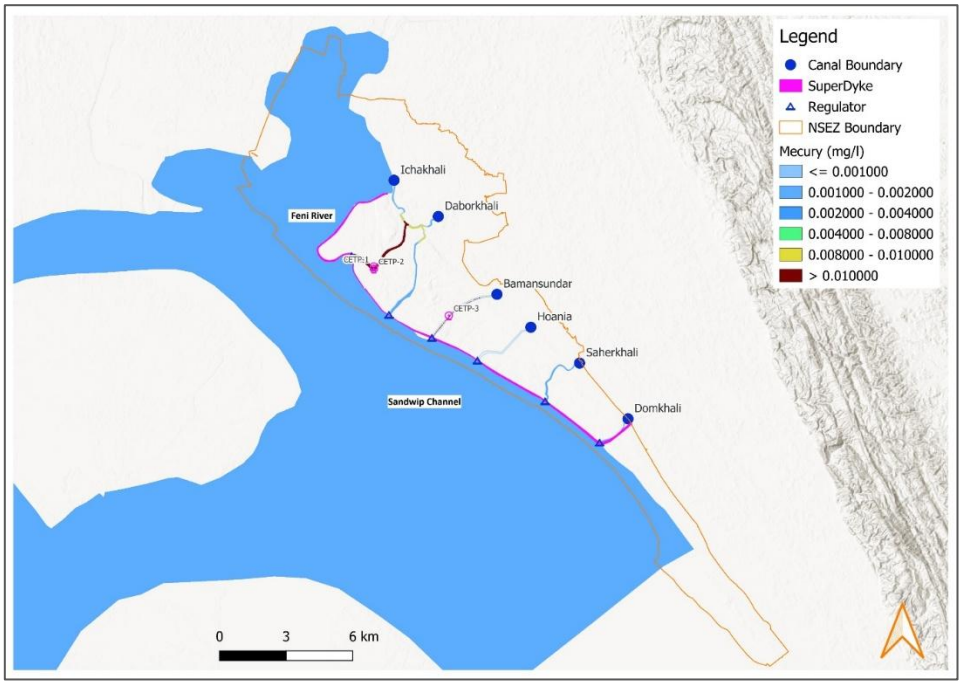
Source: EQMS, 2023

4.2.2.11 Mercury

Mercury has no beneficial value in water and can be quite harmful. Mercury accumulates in the food chain, meaning fish that live in contaminated water can have much higher concentrations. Consuming contaminated fish is the primary way humans are exposed to mercury. Over the model domain, Mercury concentration was found within the limit except for Ichakhali Khal and Bamansundar Khal due to the high concentration of Mercury from CETP mixing.

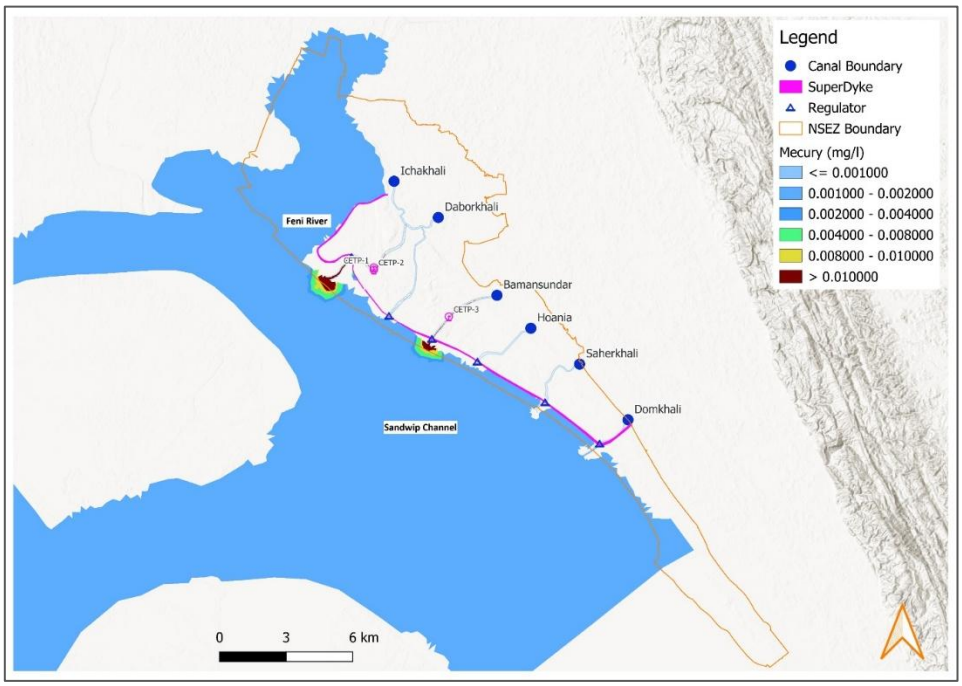
Over the model domain, Mercury concentration was found within the limit except for Ichakhali Khal and Bamansundar Khal, and the Sandwip channel also has the same conditions. Figure-59 and Figure-60 show the Mercury dispersion during high and low tide time respectively.

Figure-59: Mercury dispersion in the study area due to CETP and khal water during High Tide



Source: EQMS, 2023

Figure-60: Mercury dispersion in the study area due to CETP and khal water during Low Tide



Source: EQMS, 2023

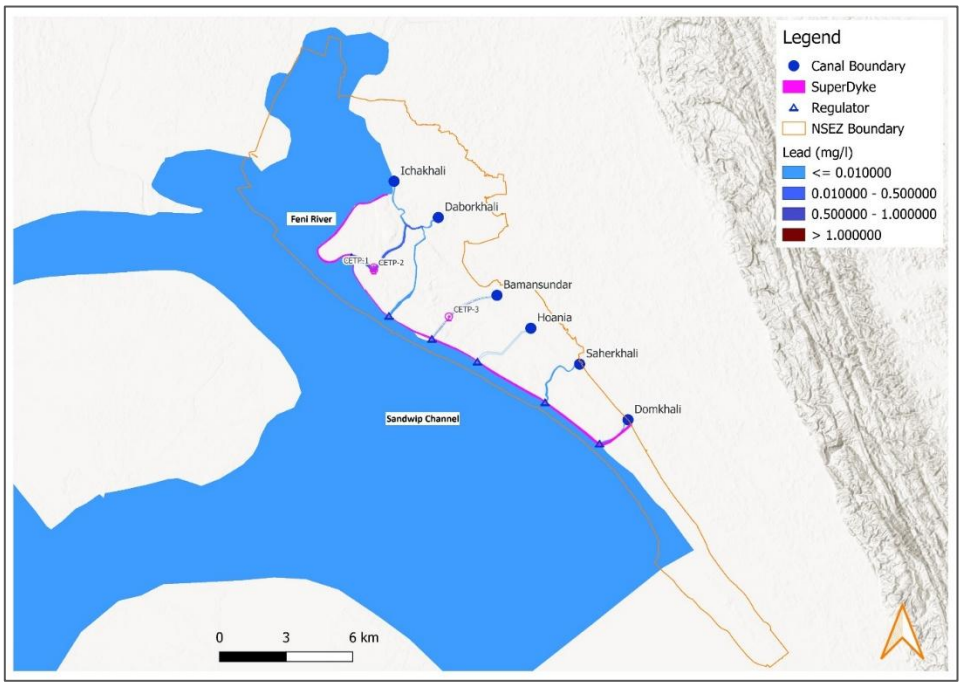
4.2.2.12 Lead

Lead poses a significant threat to both aquatic life and human health when present in water. Lead exposure can be detrimental to the development of fish and other aquatic organisms. It can hinder growth, impair reproduction, and cause birth defects. Similar to mercury, lead bioaccumulates in the

food chain. This means smaller organisms absorb lead from the water, and larger predators like fish accumulate even higher concentrations by consuming these smaller organisms. This can lead to poisoning in fish populations. Lead can enter surface river water and coastal waters from various sources, both natural and anthropogenic. Industrial activities such as metal smelting, mining, manufacturing, and waste disposal can release lead into water bodies through direct discharges or runoff. Stormwater urban runs off from streets, highways, parking lots, and rooftops can carry lead from vehicle emissions, tire wear, brake pads, and lead-based paints into rivers and coastal waters. Point sources of lead pollution, such as wastewater treatment plants, sewage discharges, and industrial outfalls, can release lead directly into surface water bodies. These are the main sources of lead contamination in the NSEZ khals and Sandwip Channel.

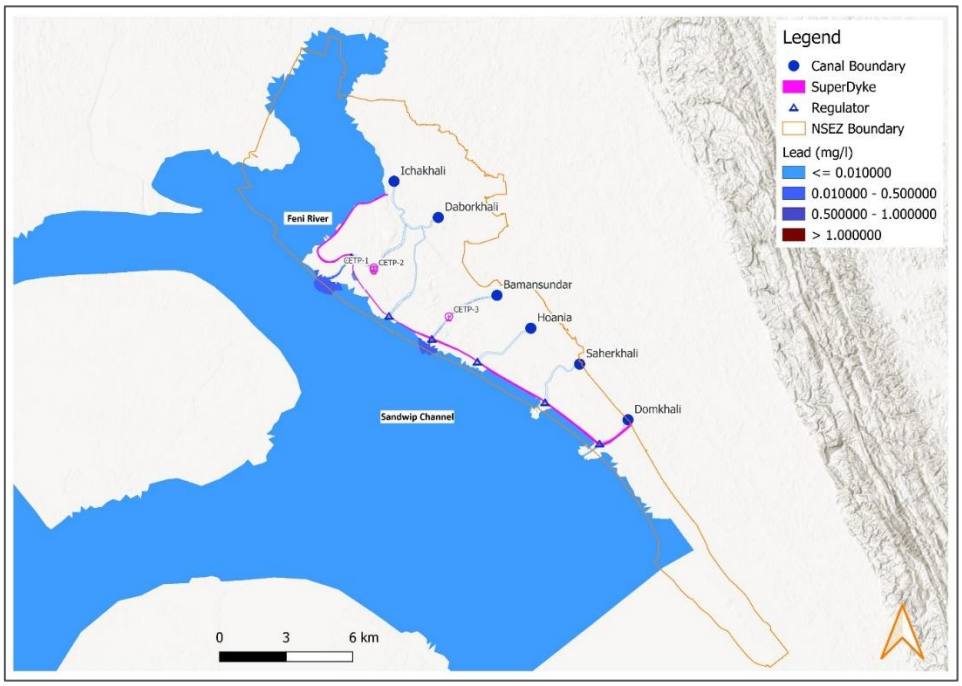
Due to STP and CETP failure, lead concentration crosses the allowable limit of all water quality parameters in Ichakhali Khal, Bamansundar Khal, and Sandwip channel (1.89 km from the Ichakhali regulator). STP and CETP mixing failure condition have shown in Figure-61 and Figure-32, where both the figure show the variation of Lead concentration, and high concentration dispersion spread over up to 2.55km in the Sandwip channel from the super dyke area due to the high concentration of lead.

Figure-61: Lead dispersion in the study area due to CETP and khal water during High Tide



Source: EQMS, 2023

Figure-62: Lead dispersion in the study area due to CETP and khal water during Low Tide



Source: EQMS, 2023

Summary of the Model Output

The summary of the model results with the worst-case scenario has been depicted in Table-16.

Table-16: Summary of the Model Results Under the CETP and STP Failure Condition

Parameters	Model Result	Ichakhali	Daborkhali	Bamansundar	Hoania	Saherkhali	Domkhali	Sandwip Channel	Remarks
pH	6.0-8.0	9.0	9.0	9.0	within limit	within limit	within limit	within limit	Exceeds during low tide time
Nitrate (mg/l)	1-6.375	>7.0	>7.1	>7.2	within limit	within limit	within limit	within limit	Spreads up to 1.23 km from the Daborkhali khal during low tide
DO (mg/l)	5.0	<5.0	within limit	<5.0	within limit	within limit	within limit	within limit	Disperses up to 1.67km in the Sandwip Channel except for two 2 khals
COD (mg/l)	50 - >100	>100.0	within limit	>50.0	within limit	within limit	within limit	within limit	Spreads up to 2.86 km
Ammonia (mg/l)	1.0-15.0	5-10.0	within limit	5-10.0	within limit	within limit	within limit	within limit	Spreads up to 3.6 km in low tide
Phosphate (mg/l)	2.0 - >10.0	>10.0	4.0-6.0	>10.0	4.0-6.0	4.0-6.0	4.0-6.0	<=2.0	All khals exceed the limit and propagate up to 1.7 km
TSS (mg/l)	50-200	>200	100-150	>200	100-150	100-150	100-150	100-150	Dispersed up to 1.83 km
Cr (mg/l)	0.02-0.5	>0.5	0.02-0.05	>0.5	<0.02	0.02-0.05	0.02-0.06	<0.02	Dispersed up to 0.8 km
TC (CFU/100 ml)	50	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	Does not exceed 50.0 CFU
BOD (mg/l)	1.5->20.0	10->20	1.5-.3.0	10->20	1.5-.3.0	1.5-.3.0	1.5-.3.0	5.0-10.0	Disperses up to 2.14km in low tide and 0.51km in high tide
Mercury (mg/l)	0.001-0.010	>=0.004	<0.004	>=0.004	<0.004	<0.004	<0.004	>=0.004	exceeds during high tide
Lead (mg/l)	0.01->1.0	0.01-0.05	0.01-1.0	0.01-1.0	<0.05	<0.05	<0.05	<=0.01	disperses up to 1.89 km

Table-16 represents the worst-case scenarios, either from the dry season or monsoon season, found during the STP and CETP failure conditions inside the NSEZ khals and the Sandwip channel at the west side of the super dyke area. All the effects have been considered in comparison with the ECR 2023 suitability for fisheries/recreational purposes that may impact on the ecosystem services of the NSEZ and related facilities.

4.2.3 Effect of Climate Change and CETP & STP Failure Condition

In this sub-component of water quality modelling, a simulated scenario has been generated to present the monsoon season (01 July 2022 to 30 September 2023) water quality dispersions to observe the combined effect of climate change and mixing of STP and CETP water quality discharged in the khals and sea channel of Mirsharai and Sandwip island area of Chattogram, Bangladesh.

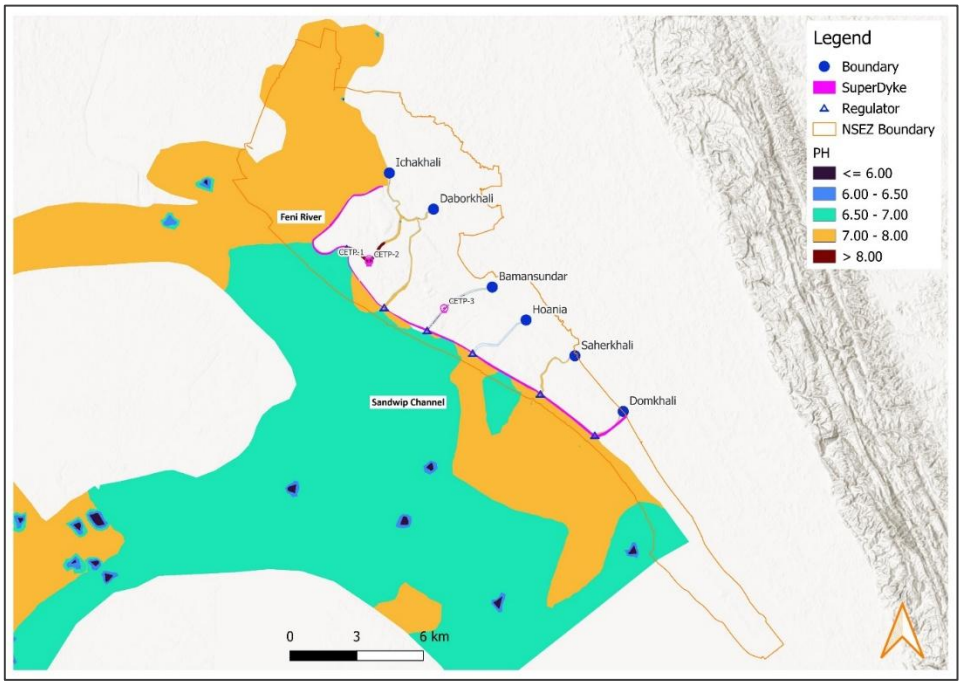
The combined effect of more water from the upstream catchment area (rainfall-runoff) and mean sea level rise due to climate change and global circulation effects have also been considered during the simulation time. Upstream catchment runoff has been simulated by the developed hydrological model based on Bangladesh Delta Plan 2100 and considering Representative Concentration Pathways (RCP) 8.5 climate change scenarios. The mean rainfall has increased 83.19 mm (considering the 2040 to 2059 base) on the base period (1991 to 2020).

The downstream boundaries (sea water level) of the hydrodynamic model have been increased 380 mm based on the predicted year 2046 to year 2064. All the parameters of the water quality have taken time to disperse and settle down in a stable state during the model simulation setup and warmup time. For this reason, this water quality model has been running for a long duration (minimum 3 months continuous data) in the monsoon period to observe water quality dispersion in high flow conditions. The spatial distribution of all major parameters (like pH, Nitrate, DO, COD, Ammonia, Phosphate, TSS, Chromium, TC, BOD, Mercury, and Lead) dispersion after mixing from the discharge from the Central Effluent Treatment Plant (CETP) and Sewerage Treatment Plant (STP) in the NSEZ development area have described below.

4.2.3.1 pH

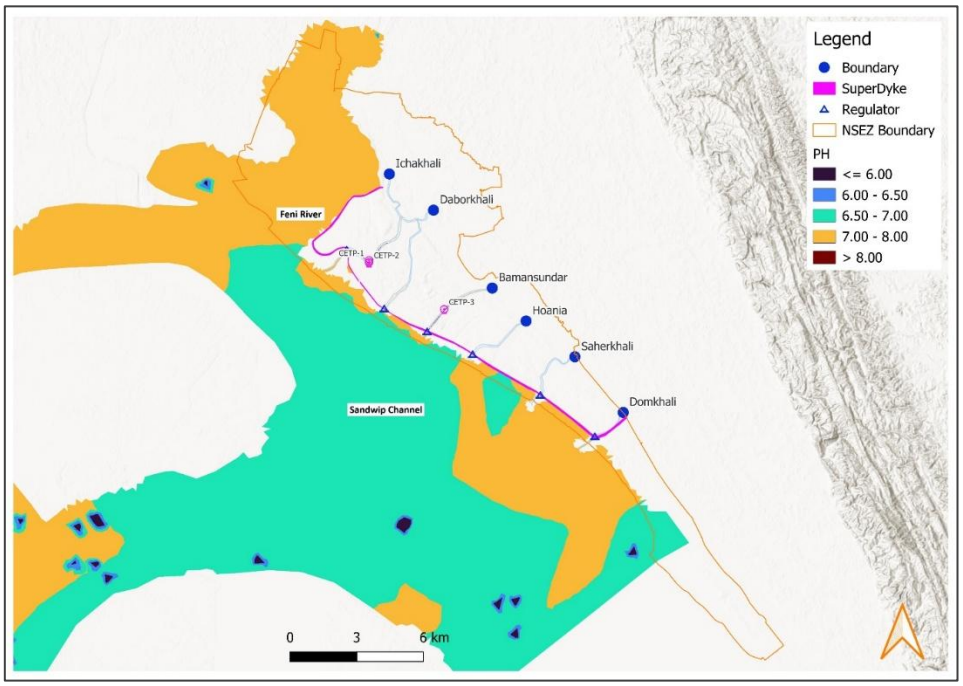
pH dispersion is higher than the present situation due to the increase of upstream flow and mean sea level under the climate change scenario, but it is within the limit (pH ranges between 6.0 to 8.0). Over the model area, the pH value within the range mixing the CETP water is shown in Figure-63 and Figure-64.

Figure-63: pH dispersion in the study area due to climate change effect and CETP discharge water during High Tide



Source: EQMS, 2023

Figure-64: pH dispersion in the study area due to climate change effect and CETP discharge water during Low Tide

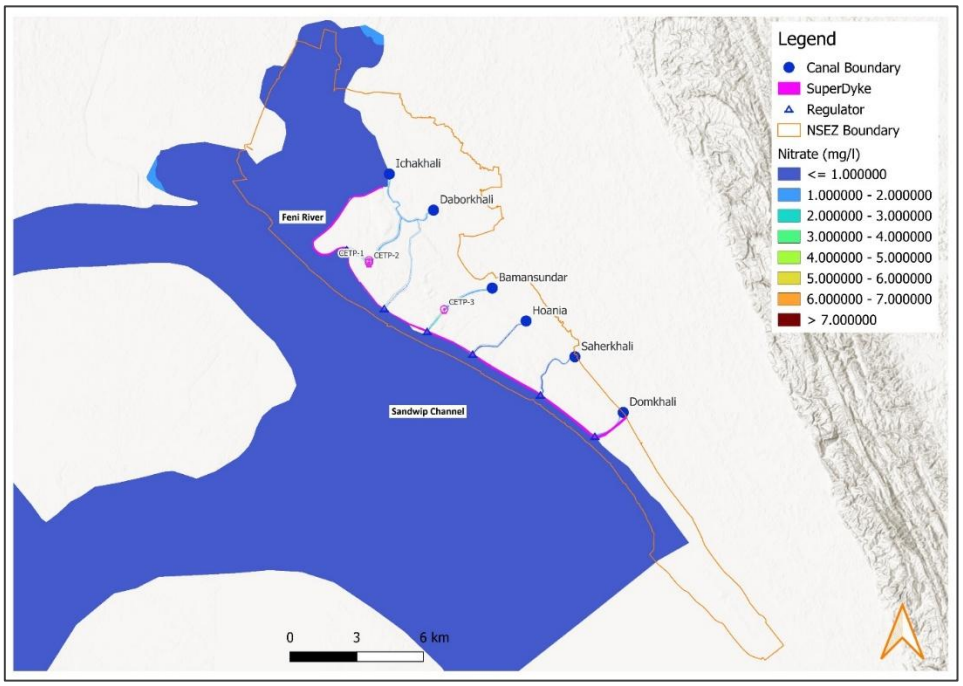


Source: EQMS, 2023

4.2.3.2 Nitrate

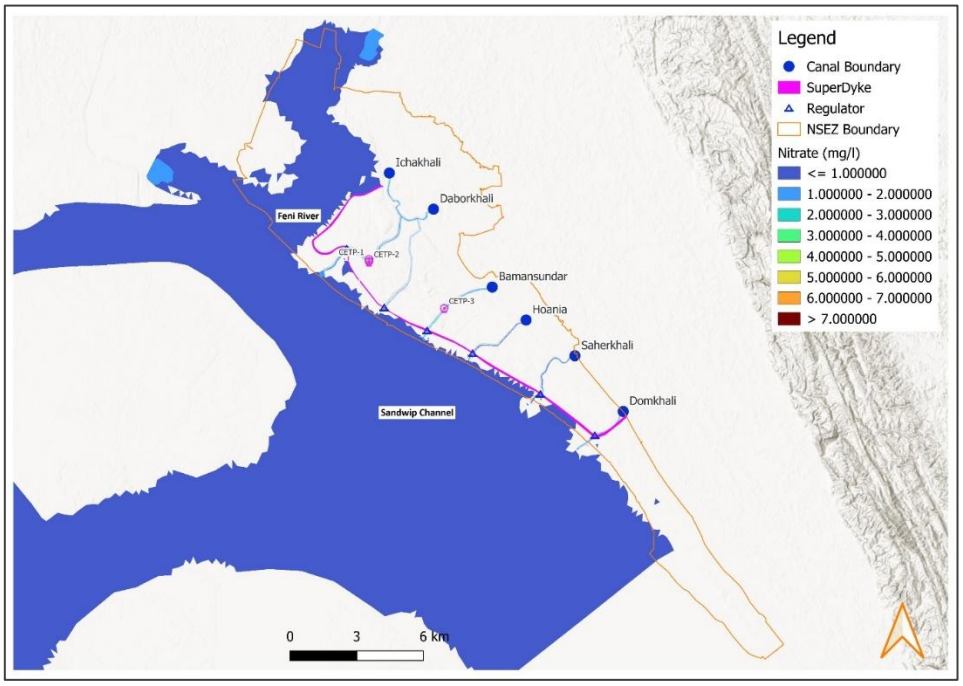
Figure-65 and Figure-66 show the Nitrate variation in the khals and along with the Sandwip channel due to climate changes and the mixing of CETP water. Due to more upstream flow and sea level rise, it spread in more areas but Nitrate variation ranges from 1.0 – 6.375 mg/L in low and high tide time.

Figure-65: Nitrate dispersion in the study area due to CETP and khal water during High Tide



Source: EQMS, 2023

Figure-66: Nitrate dispersion in the study area due to CETP and khal water during Low Tide

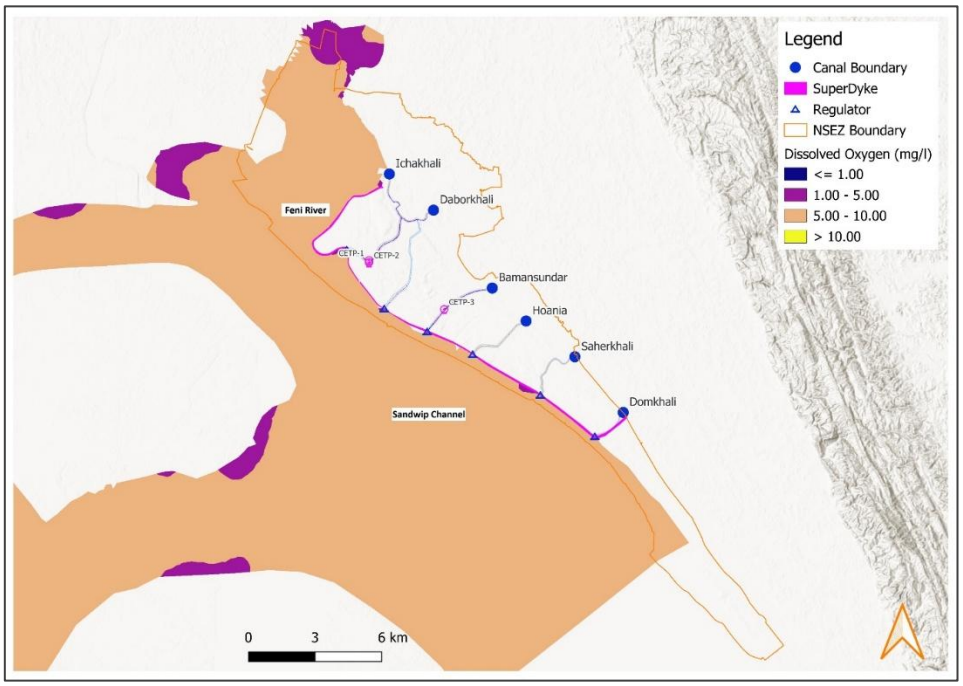


Source: EQMS, 2023

4.2.3.3 Dissolved Oxygen (DO)

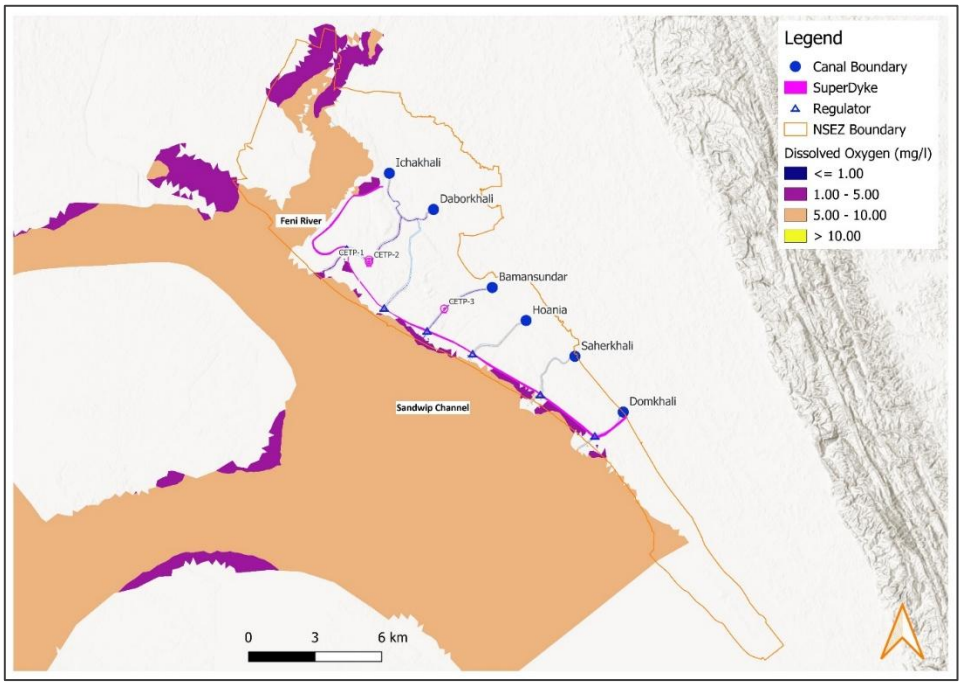
The minimum Dissolved Oxygen required for fisheries is more than 5.0 mg/l, which exists in the Sandwip channel along the super dyke area after mixing CETP water from Ichakhali and Bamansundar Khal during high tide. Its value is lower than the limit near the Ichakhali and Bamansundar regulatory gate due to high flow from upstream through the khal and in low tide time it disperses more area than in the present condition, where its value is less than 5.0 mg/l shown in Figure-67 and Figure-68.

Figure-67: DO dispersion in the study area due to CETP and khal water during High Tide



Source: EQMS, 2023

Figure-68: DO dispersion in the study area due to CETP and khal water during Low Tide

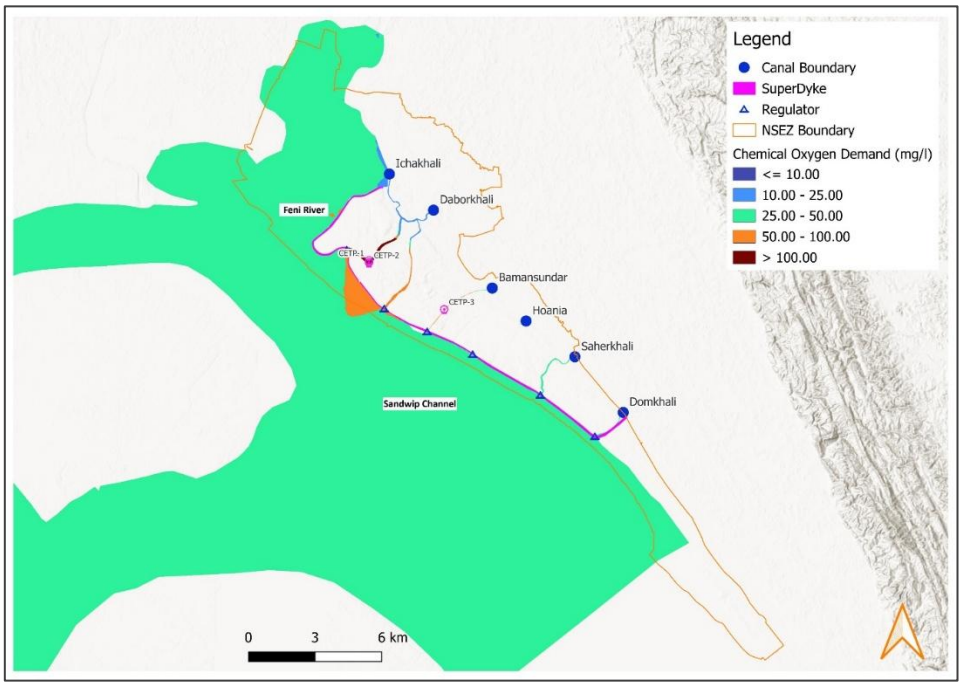


Source: EQMS, 2023

4.2.3.4 Chemical Oxygen Demand (COD)

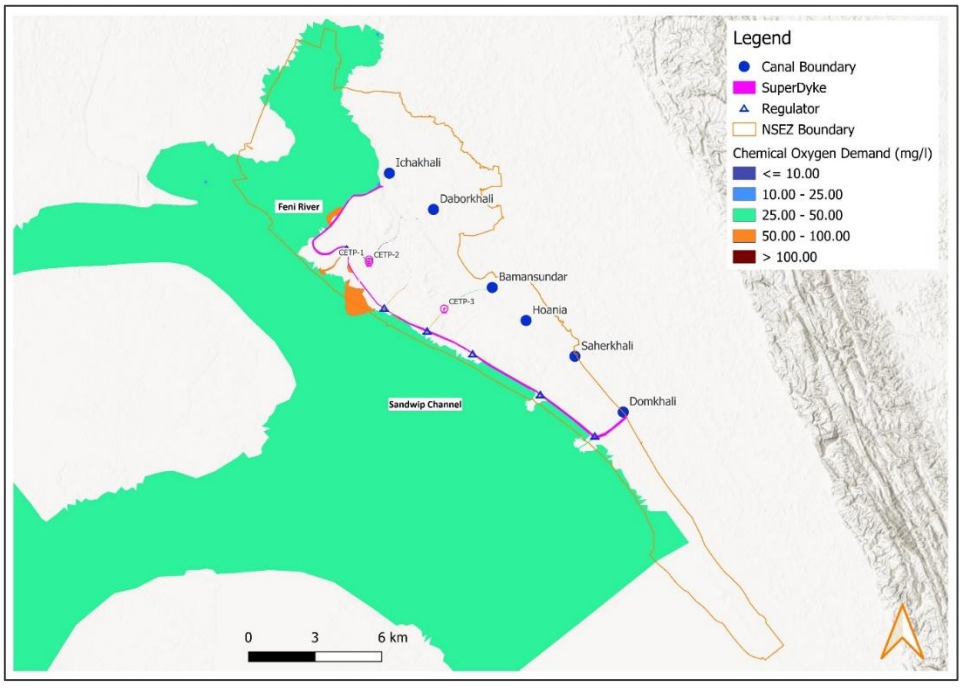
COD value is above 50.0 mg/l and spread up to 1.0 km more than normal conditions in the Sandwip channel during the low tide and high flow conditions due to climate changes and during high tide time COD dispersion is noticeable but less than low flow. COD value always prevails more than 50.0 mg/l in the Ichakhali and Bamansundar khal (khals). Figure-69 and Figure-70 show the variation of COD during high and low tide time respectively.

Figure-69: COD dispersion in the study area due to CETP and khal water during High Tide



Source: EQMS, 2023

Figure-70: COD dispersion in the study area due to CETP and khal water during Low Tide

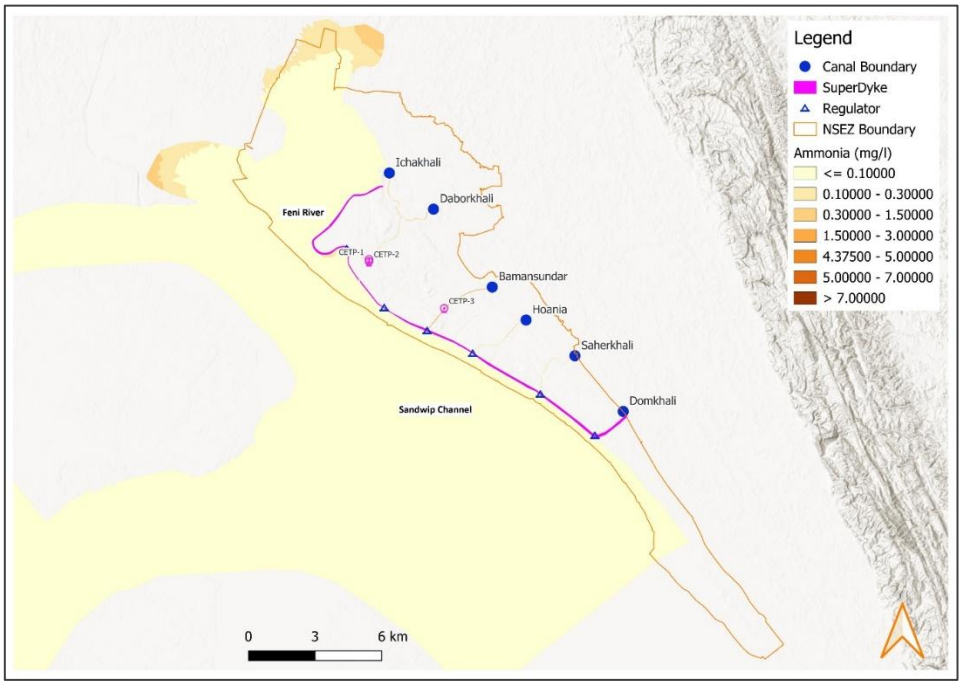


Source: EQMS, 2023

4.2.3.5 Ammonia

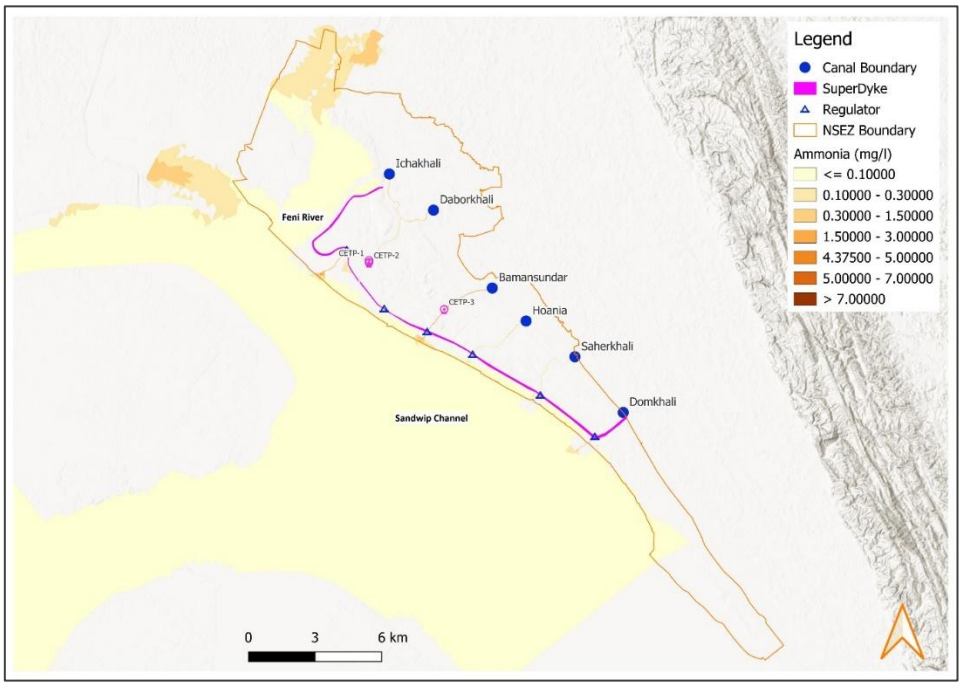
Figure-71 and Figure-72 show that the dispersion of Ammonia concentration is significant in Ichakhali and Bamansundar khals due to CETP water mixing and sea level rises and extreme hydrological conditions due to climate change. Ammonia dispersion ranges from 1.0 – 5 mg/L in high and low tide time as per the figures from the modelling and it disperses up to 4.1km into the Sandwip channel from the super dyke area.

Figure-71: Ammonia concentration dispersion in the study area due to CETP and khal water during High Tide



Source: EQMS, 2023

Figure-72: Ammonia concentration dispersion in the study area due to CETP and khal water during Low Tide



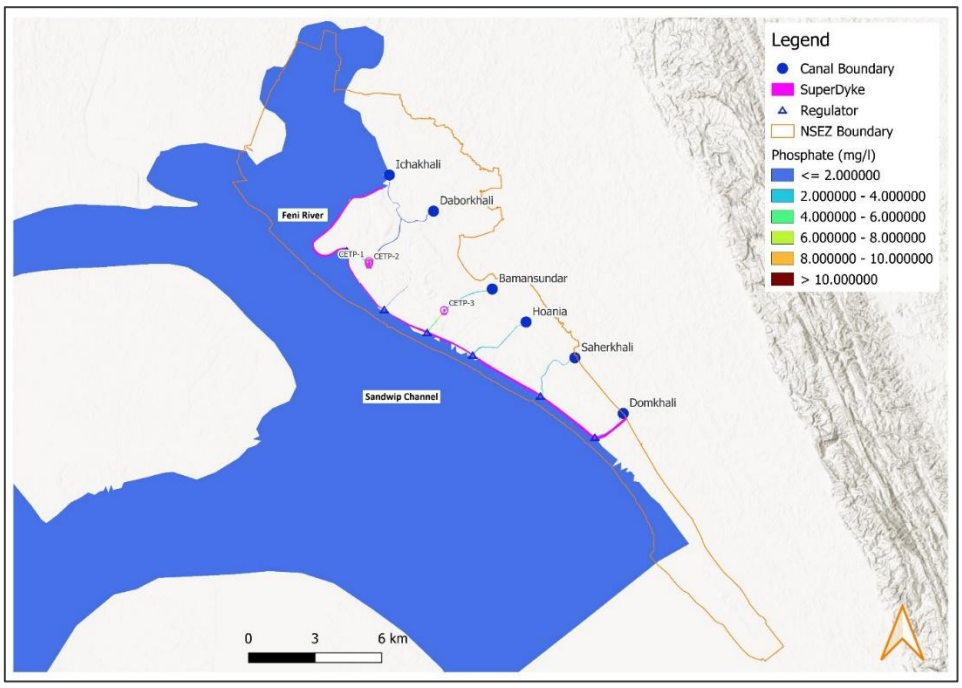
Source: EQMS, 2023

4.2.3.6 Phosphate

Figure-73 and Figure-74 show the variation of Phosphate concentration in all the khals inside the NSEZ development and along with the Sandwip channel under the climate change scenarios. It is observed that Phosphate propagates up to 1.78 kilometers in the Sandwip channel from the Ichakhali khal

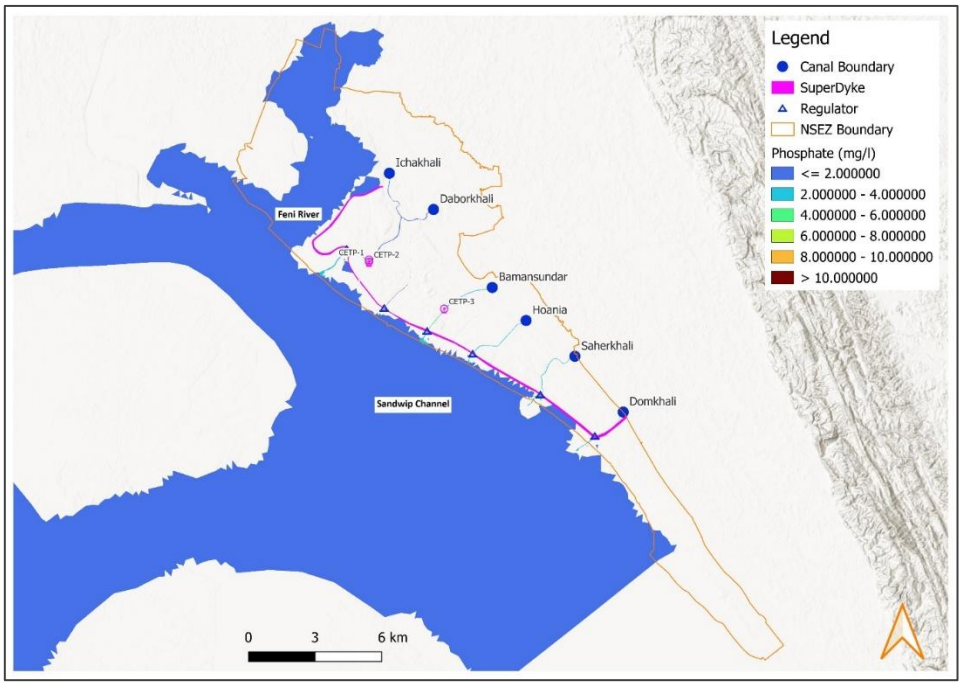
regulatory gate and it crosses the limit of fisheries and other purposes during high and low tide times. Inside the Ichhakahli and Bamansundor khal, it crosses the limits for fisheries purposes.

Figure-73: Phosphate concentration dispersion in the study area due to CETP and khal water during High Tide time



Source: EQMS, 2023

Figure-74: Phosphate concentration dispersion in the study area due to CETP and khal water during Low Tide time



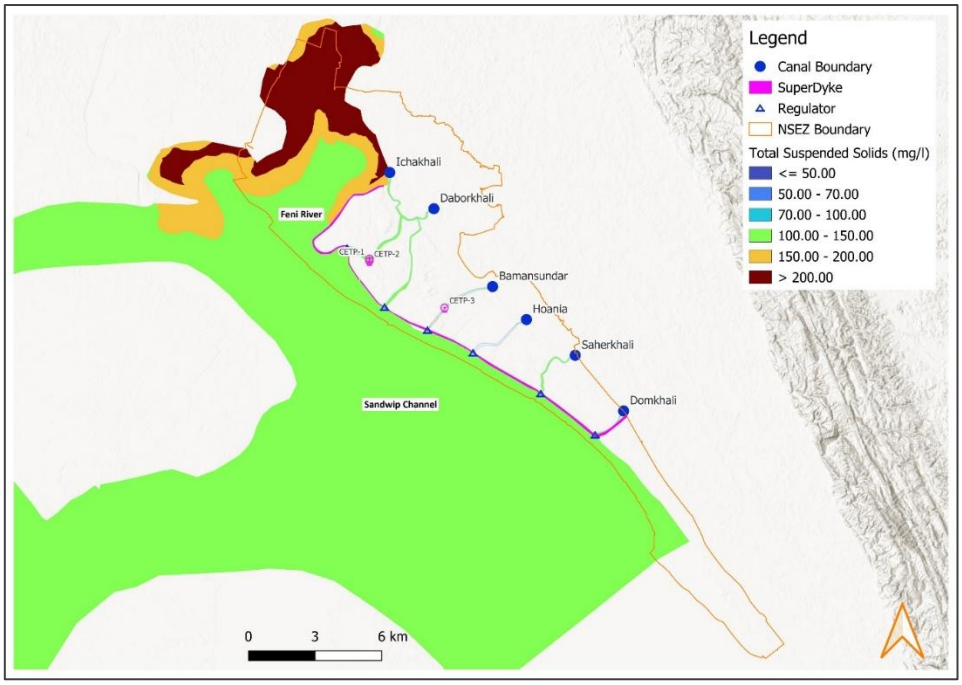
Source: EQMS, 2023

4.2.3.7 Total Suspended Solids (TSS)

In climate change scenarios, no significant change has been found due to climate change and CETP discharge conditions, compared to the base case scenario. The main reason for the dispersion is the

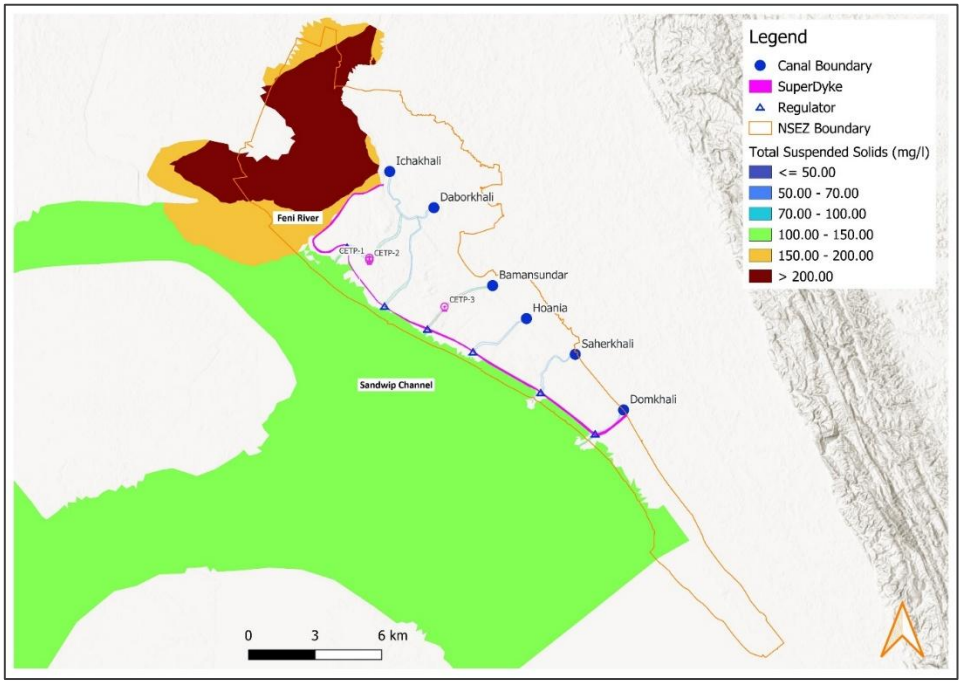
presence of Total Suspended Solids (TSS) from CETP is 100 mg/l. The present status of TSS in every channel has been found around 130.0 mg/l. In such a situation, water coming from CETP does not increase the TSS value in the khal's water. Rather TSS value will be decreased in the khal a little bit in this scenario. Figure-75 and Figure-76 show the Total Suspended Solids (TSS) dispersion during high and low tide time respectively.

Figure-75: TSS dispersion in the study area due to climate change effect with CETP discharge in High Tide time



Source: EQMS, 2023

Figure-76: TSS dispersion in the study area due to climate change effect with CETP discharge in Low Tide time

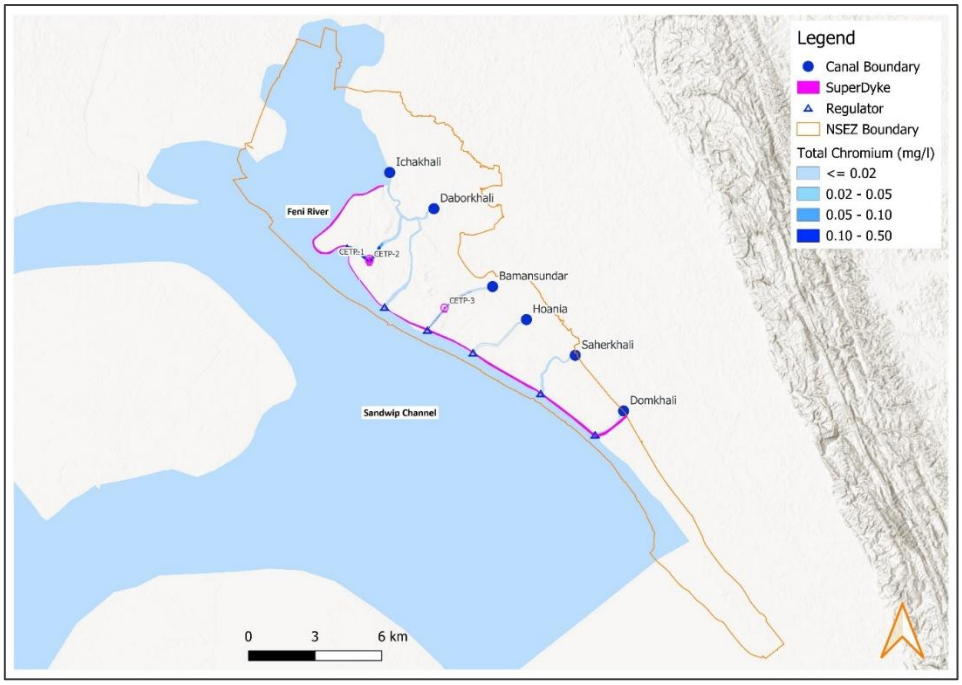


Source: EQMS, 2023

4.2.3.8 Total Chromium (Cr-Total)

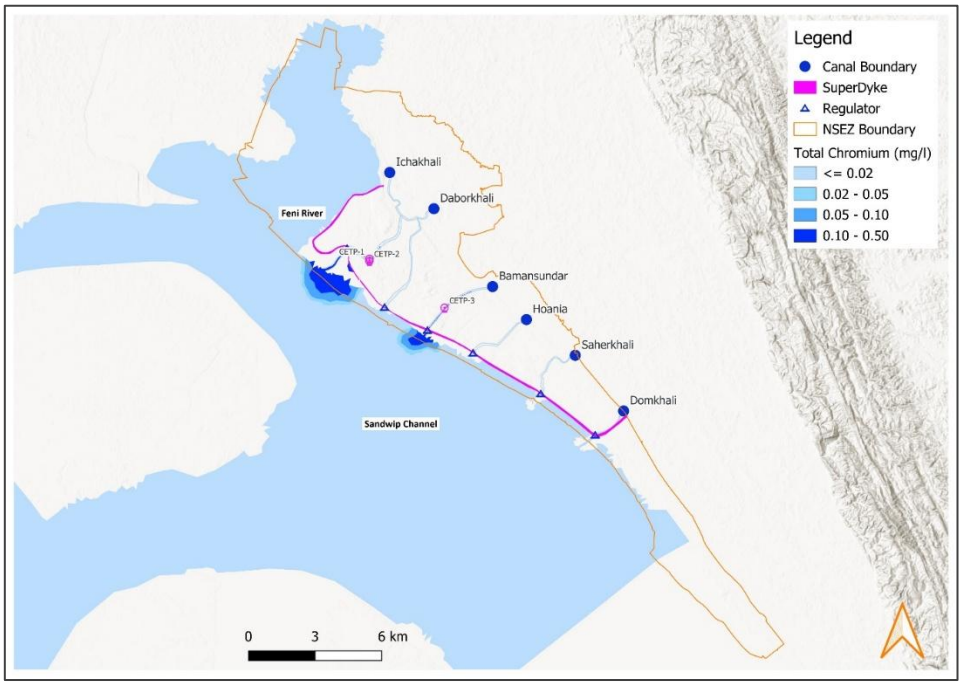
Total chromium ranges from 0.02 mg/L to more than 0.5 mg/L during low and high tide times as per the model output. Total chromium will disperse up to 4.33km from the super dyke area with a maximum intensity of 0.02 mg/L, which is allowable for fisheries purposes. Total chromium spreads up to 0.6m more due to the high flow from the upstream catchment under the climate change scenarios. Figure-77 and Figure-78 show the Total Chromium dispersion during low and high tide respectively.

Figure-77: Total Chromium dispersion in the study area due to CETP and khal water during High Tide



Source: EQMS, 2023

Figure-78: Total Chromium dispersion in the study area due to CETP and khal water during Low Tide

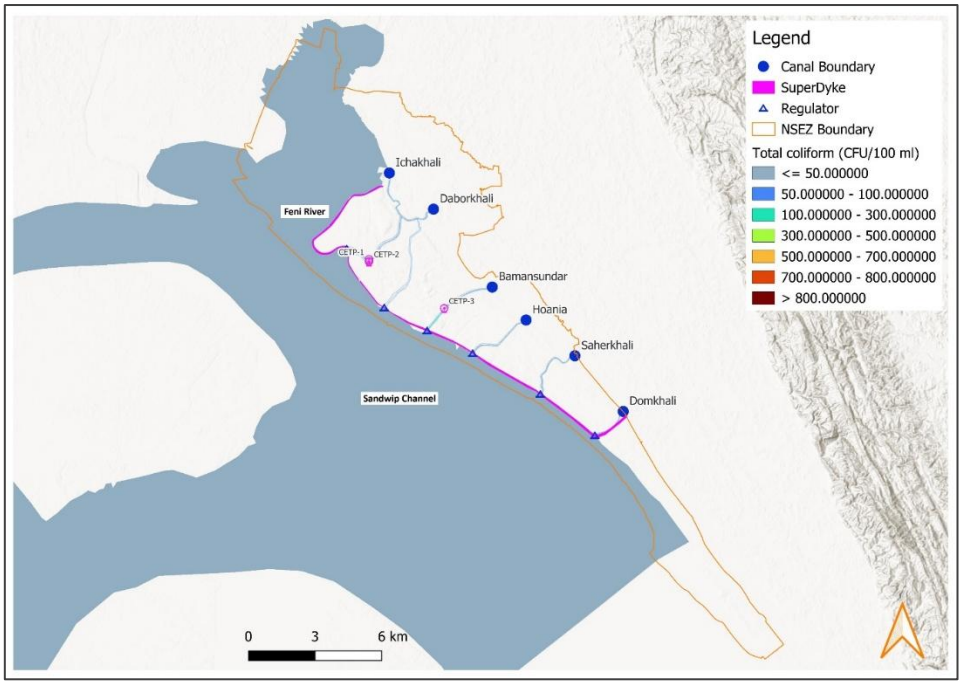


Source: EQMS, 2023

4.2.3.9 Total Coliform Bacteria

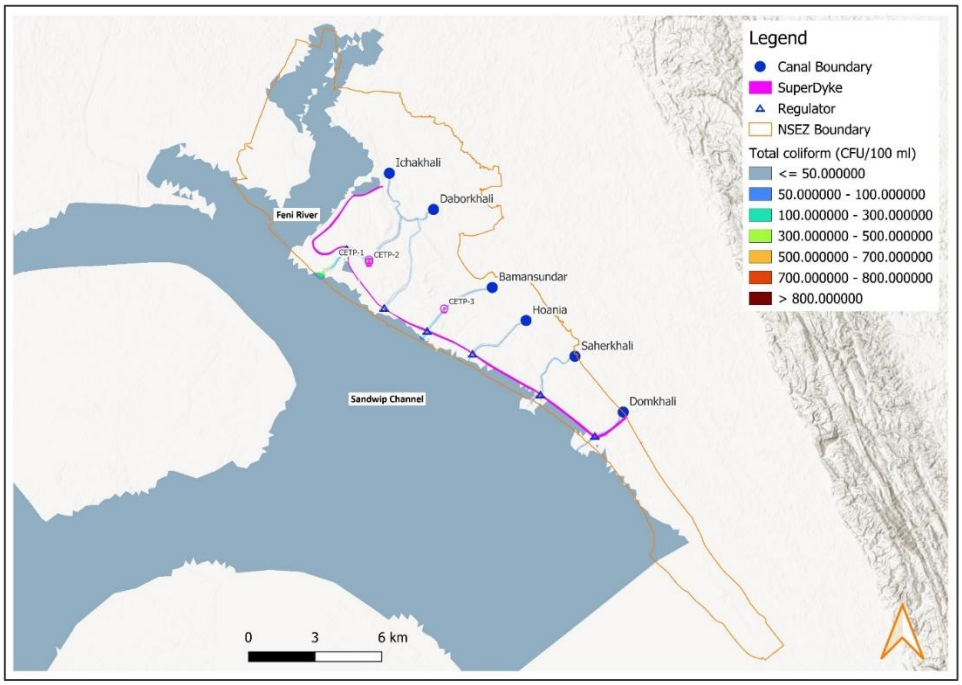
Figure-79 and Figure-80 show that total coliform bacteria numbers exceed more than 50.0 CFU/100mL in the Sandwip channel during high tide time, only about 0.34 km, and in the low tide time the total coliform limit exceeds and spreads about 3.06km from the Ichakhali khal due to mean sea level rise and more flow receive from the upstream catchments.

Figure-79: Total coliform dispersion in the study area due to CETP and khal water during High Tide



Source: EQMS, 2023

Figure-80: Total coliform dispersion in the study area due to CETP and khal water during Low Tide

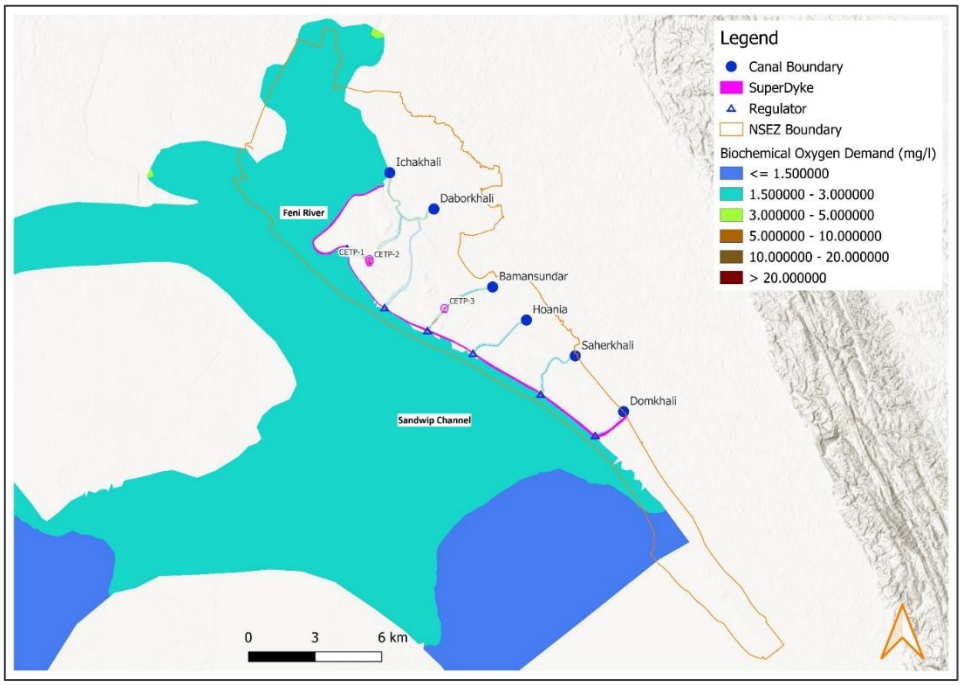


Source: EQMS, 2023

4.2.3.10 Biochemical Oxygen Demand (BOD)

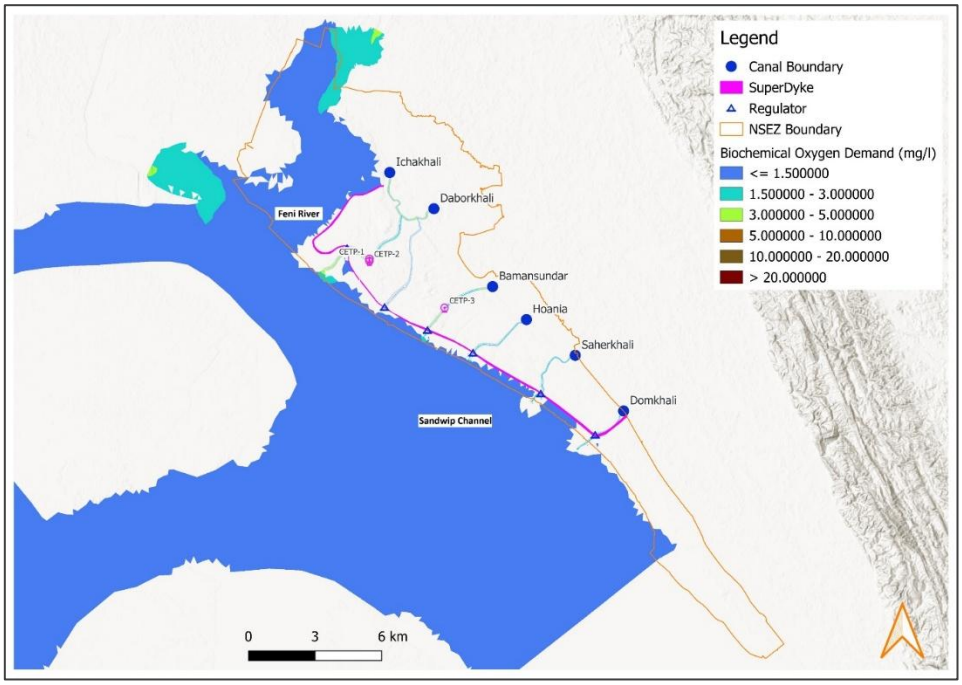
Figure-81 and Figure-82 show the BOD variation in the study area. It's observed that the BOD affects the Ichakhali, Bamansundar, and Sandwip channel's water and crosses the allowable limit of all purposes of water use as per the ECR (2023) of Bangladesh. BOD spreads more than the normal condition due to the high flow push of the CETP water into the Sandwip channel.

Figure-81: BOD dispersion in the study area due to CETP and khal water during High Tide



Source: EQMS, 2023

Figure-82: BOD dispersion in the study area due to CETP and khal water during Low Tide

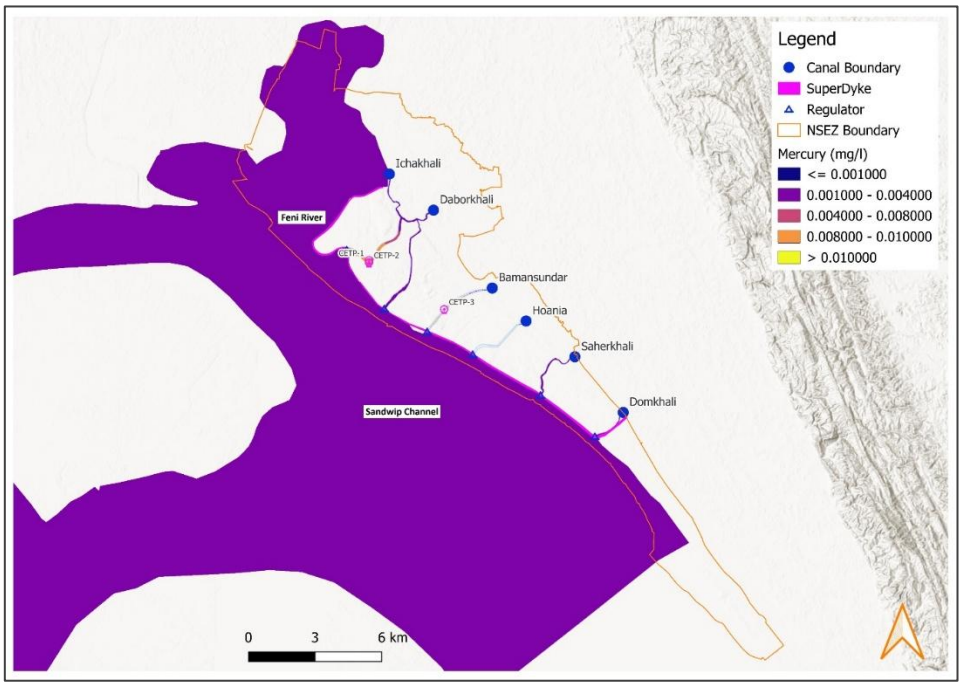


Source: EQMS, 2023

4.2.3.11 Mercury

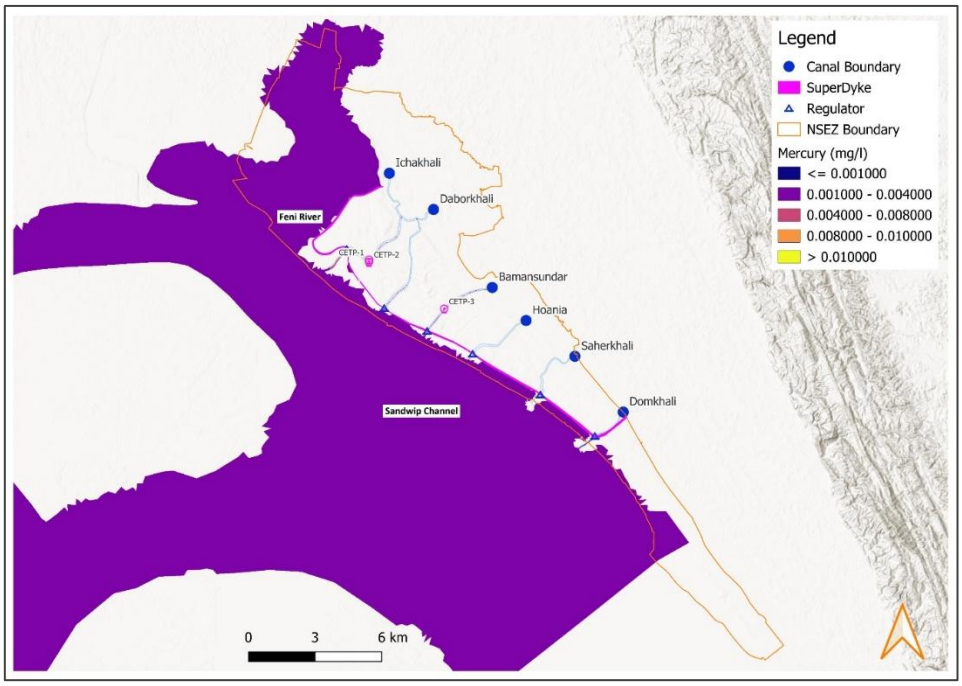
Over the model domain, Mercury concentration was found within the limit except for the Ichakhali Khal, Bamansundar Khal, and Sandwip Channel just near to Ichakhali and Bamansundar regulator gate. The dispersion area is higher than the normal condition. Figure-83 and Figure-84 show the Mercury dispersion during low and high tide time respectively.

Figure-83: Mercury dispersion in the study area due to CETP and khal water during High Tide



Source: EQMS, 2023

Figure-84: Mercury dispersion in the study area due to CETP and khal water during Low Tide

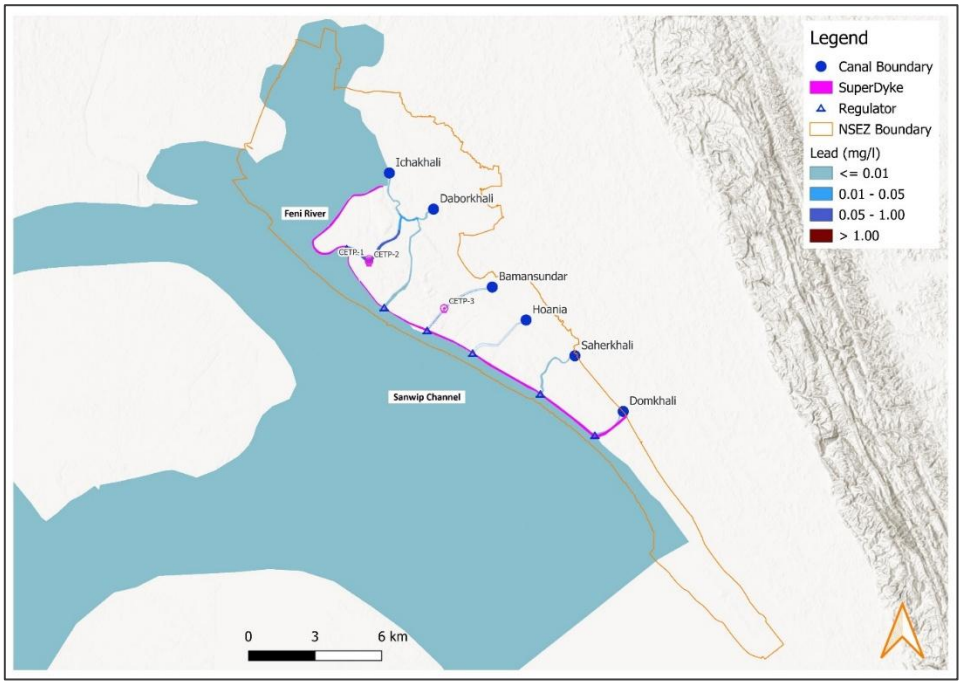


Source: EQMS, 2023

4.2.3.12 Lead

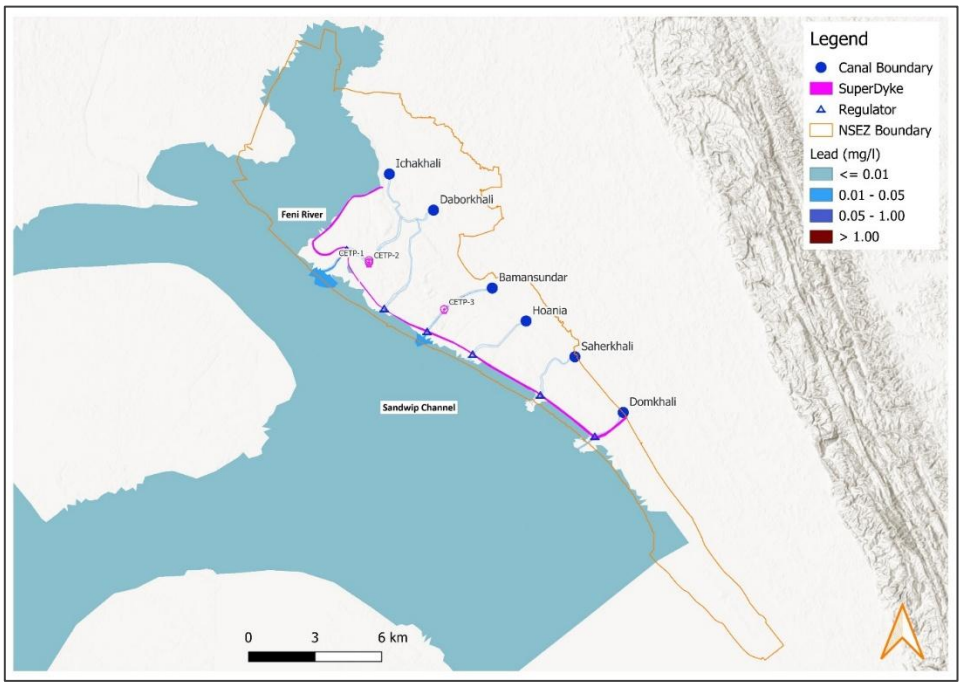
Figure-85 and Figure-86 both figures are showing the variation in Lead concentration and high concentration is dispersed 3.85 km into the Sandwip channel from the super dyke area due to climate changes.

Figure-85: Lead dispersion in the study area due to CETP and khal water during High Tide



Source: EQMS, 2023

Figure-86: Lead dispersion in the study area due to CETP and khal water during Low Tide



Source: EQMS, 2023

Summary of the Model Output

The summary of the model results with climate change and CETP discharge condition scenario has been depicted in Table-17.

Table-17: Summary of the model results under the Climate change and CETP discharge conditions

Parameters	Model Result	Ichakhali	Daborkhali	Bamansundar	Hoania	Saherkhali	Domkhali	Sandwip Channel	Remarks
pH	6.0-8.0	>=8.0	7.0-8.0	<8.0	6.0-6.5	7.0-8.0	7.0-8.0	6.0-8.0	Dispersion spreads, within the limit
Nitrate (mg/l)	1.0-6.375	1.0-2.0	3.0-4.0	1.0-2.0	1.0-2.0	1.0-2.0	1.0-2.0	1.0-2.0	Dispersion spreads, within the limit
DO (mg/l)	1.0-10.0	<5.0	1.0-5.0	<5.0	5.0-10.0	5.0-10.0	5.0-10.0	1.0-10.0	Disperses in low tide with high flow model
COD (mg/l)	10-100.0	>100.0	>50.0	50-100.0	10-25.0	10-25.0	10-25.0	10-50.0	Spreads up to 1.0 km
Ammonia (mg/l)	1.0-5.0	1.5-3.0	1.5-3.0	3.0-5.0	0.1-0.3	0.1-0.3	0.1-0.3	0.1-3.0	Disperse up to 4.1 km
Phosphate (mg/l)	<2.0-6.0	<2.0	<1.5	2.0-6.0	2.0-4.0	2.0-4.0	2.0-4.0	<2.0	Disperse up to 1.78 km
TSS (mg/l)	100.0-130.0	130.0	130.0	70.0-100.0	50.0-100.0	100-130.0	100-130.0	100-130.0	No significant change
Cr (mg/l)	0.02-0.50	0.1-0.50	<0.02	0.10-0.50	<0.02	<0.02	<0.02	0.02-0.50	Disperse up to 4.33 km
TC (CFU/100 ml)	>50.0	50-100.0	50-100.0	50-100.0	50-100.0	50-100.0	50-100.0	50-100.0	Max spread up to 3.06 km
BOD (mg/l)	1.5-10.0	5-10.0	1.5-3.0	5-10.0	1.5-3.0	1.5-3.0	1.5-3.0	5-10.0	Low dispersion
Mercury (mg/l)	0.001-0.01	0.008-0.01	0.001-0.004	0.008-0.01	<0.001	0.001-0.004	<0.004	0.008-0.01	High dispersion at high tide
Lead (mg/l)	0.01-1.0	>0.05	>0.05	0.05-1.0	<0.01	<0.01	<0.01	0.01-0.05	Dispersed up to 3.85 km

Table-17 represents the worst-case scenarios, either from the dry season or monsoon season, found during the climate change and CETP discharged conditions inside the NSEZ khals and the Sandwip channel. All the effects have been considered in comparison with the ECR 2023 suitability for fisheries/recreational purposes that may impact on the ecosystem services of the NSEZ and related facilities.

References

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2. Rasmussen E, Petersen O, Thompson J, Flower R, Ahmed M (2009). Hydrodynamic-ecological model analyses of the water quality of Lake Manzala (Nile Delta, northern Egypt). Hydrobiologia 622(1): 195–220.
3. Zhang Q, Ye X, Werner A, Li Y, Yao J, Li X, Xu C (2014). An investigation of enhanced recessions in Poyang Lake: comparison of Yangtze River and local catchment impacts. J Hydrol 517:425–434.
4. Payandeh A, Zaker NH, Niksokhan MH (2015). Numerical modeling of pollutant load accumulation in the Musa estuary, Persian Gulf. Environ J Earth Sci 73(1):185–196.
5. Pugh, D. (1987) Tides, Surges and Mean Sea Level: A Handbook for Engineers and Scientists. John Wiley & Sons, Chichester, 472 p.
6. Liang, J., Yang, Q., Sun, T., Martin, J. D., Sun, H., & Li, L. (2015). MIKE 11 model-based water quality model as a tool for the evaluation of water quality management plans. Journal of Water Supply: Research and Technology-Aqua, 64(6), 708–718. doi:10.2166/aqua.2015.048.

APPENDIX G

Appendix G: Air Quality Modelling Report

1.1 Introduction

The air quality modelling is done as a part of the Regional Environmental and Social Assessment (RESA) for the National Special Economic Zone (NSEZ) to understand the spatial and temporal situation of ambient air quality under different pathways of development with respect to the existing and future situation. The study region is directly influenced by the seasonal wind flow, physiographic features, regional weather pattern (temperature, rainfall, humidity, sunshine hour, etc.), and sources of pollution (point, line, area, volume). To assess the air quality of the study region, every relevant feature in the airshed has been included in the regional modelling study.

1.2 Methodology

The air dispersion modelling input data consisted of meteorological data, detailed information on the physical environment, and design details for all emission points on-site. Using this input data, the model predicts ambient ground level concentrations beyond the site boundary for each hour of the modelled meteorological years. The model post-processes the data to identify the location and concentration of the worst-case ground-level concentrations.

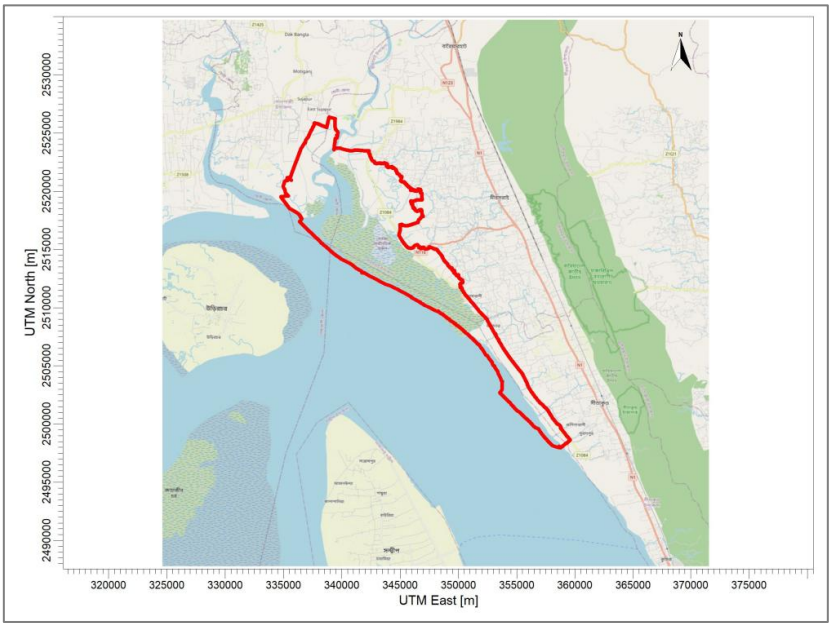
Air dispersion has been modelled using the AERMOD dispersion model (Version 13.0.0) which has been developed by the United States Environmental Protection Agency (USEPA). The model is a steady-state Gaussian plume model used to assess pollutant concentrations associated with industrial sources. The model has been designated the regulatory model by USEPA for modelling emissions from industrial sources in both flat and complex terrain. Resulting ground-level concentrations (GLCs) were determined specifically for NO_2 -24 hr. and annual average, SO_2 -24 hr. and annual average, and PM- 24 hr. and annual average.

The resultant NO_2 concentrations are largely driven by the ambient chemical environment (i.e., the reaction of NO with ambient ozone to form NO_2) and the initial NO_2/NO_x ratio of the emissions. The model has been run for NO_2 considering Tier 1 (NO_2/NO_x ratio 1:1) to determine the worst condition.

1.2.1 Model Area

Modelling of air quality was undertaken for a 50 x 50 km (2,500 km^2) area which incorporates the NSEZ and surrounding areas. Model area covers part of the Mirsharai, Sitakunda, Hathazari, Fatikchhari, Sonagazi, Companiganj, Noakhali Sadar, and Sandwip upazilas. The study region is presented in Figure 1.

Figure 1: Study Region



1.2.2 Model Scenario

Currently, seven industries are operational in NSEZ, of which only four have air pollution sources, with the 100 MW HFO-based power plant being the most significant contributor. For the baseline scenario, emissions from these four industries, road traffic along the Dhaka-Chattogram highway and NSEZ Access Road, as well as 17 brick kilns within the model domain, were considered in the air dispersion modeling. Additionally, future scenario modeling was conducted using assumptions, considering the planned development of 132 industries in NSEZ between 2025-2030 (Table 1). Since the specific layout and pollution sources are yet to be identified/finalized, estimated emission factors and industry categories were used to predict potential air quality impacts. The model was run for both baseline and future scenarios together, providing a comprehensive assessment of the cumulative air pollution impact.

Table 1: Proposed Industry Category in NSEZ

Industry Category	No of Industries
Chemical Industry/Pharmaceutical/Paints	12
Garments/Textile/Dyeing	65
Plastic/Household	9
Power/ Electrical	16
Steel Industry	7
Food/Beverage	6
Other Industries	17
Total	**132**

1.2.3 Emission Source

For modelling, all major sources (point, line sources) were included in the emission inventories:

- 61-point sources (1 power plant, 8 chemicals, 17 brick kilns, 7 steel, 1 Glass, 2 cements, 3 paints, and 1 petroleum refinery) (major sources are listed in Table 2).
- 2-line sources (Dhaka-Chattogram highway and approach road from Dhaka-Chattogram highway to NSEZ) were taken into account.

Table 2: Emission of Criteria Pollutants from Point Sources

Industry	Stack No.	UTM Coordinate		Emission Rate (g/s)				Fuel Type	Source
		East	North	$PM_{2.5}$	PM_{10}	NO_2	SO_2		
B-R Powergen 100 MW Power Plant	9	341888.50	2518434.36	3.76	4.7	245.2	13.89	HFO	B-R Powergen Ltd.
Jinyuan Chemical Industry Ltd.	1	342368.58	2518528.14	0.4	0.5	4.28	2.78	NG	AP-42: Stationary Sources
Bashundhara Chemical Industry Ltd.	1	343777.00	2513409.00	0.04	0.05	4.28	2.78	NG	AP-42: Stationary Sources
Asian Paints Boiler	2	342566.10	2518219.56	0.00105	0.0014	0.0061	0.039	NG	Asian Paints
Asian Paints Generator	2	342446.24	2518313.79	0.000225	0.003	0.011	0.039	NG	Asian Paints
PHP Glass Industry	1	364927.00	2496186.00	0.035	0.04	6.7	11.8	NG	NILU
GPH Ispat	1	366317.32	2492862.19	0.98	1.4	15.3	0.4	NG	AP-42: Stationary Sources
Brick Kiln	17	Figure 2		3.52	6.4	0.214	6.67	Coal	NILU and AP-42
Bashundhara Steels	1	342974.07	2513614.52	10.5	15.0	99.9	0.3	NG	AP-42: Stationary Sources
BSRM	1	345314.23	2512318.57	10.5	15.0	99.9	0.4	NG	AP-42: Stationary Sources
Steels 1	2	351529.46	2507869.60	2.6	3.7	15.3	0.3	NG	AP-42: Stationary Sources
Steels 2	1	352706.46	2507918.13	10.5	15	99.9	0.4	NG	AP-42: Stationary Sources
Steels 3	2	352922.90	2506646.89	2.6	3.7	15.3	0.3	NG	AP-42: Stationary Sources
Steels 4	1	353634.20	2505678.72	10.5	15.0	99.9	0.4	NG	AP-42: Stationary Sources
Cement 1	1	354266.47	2505204.52	15.08	20.1	65.38	3.47	NG	AP-42: Stationary Sources
Cement 2	1	354681.40	2504651.28	15.08	20.1	65.38	3.47	NG	AP-42: Stationary Sources
Fertilizer 1	1	355195.12	2503781.91	1.04	1.6	16.0	2.22	NG	AP-42: Stationary Sources

Industry	Stack No.	UTM Coordinate		Emission Rate (g/s)				Fuel Type	Source
		East	North	$PM_{2.5}$	PM_{10}	NO_2	SO_2		
Fertilizer 2	1	355847.15	2502734.71	1.04	1.6	16.0	2.22	NG	AP-42: Stationary Sources
Chemical 1	1	356104.01	2502280.27	0.04	0.05	4.28	2.78	NG	AP-42: Stationary Sources
Chemical 2	1	356481.62	2501849.52	0.04	0.05	4.28	2.78	NG	AP-42: Stationary Sources
Chemical 3	1	356878.53	2501364.41	0.04	0.05	4.28	2.78	NG	AP-42: Stationary Sources
Chemical 4	1	357569.45	2499953.16	0.04	0.05	4.28	2.78	NG	AP-42: Stationary Sources
Chemical 5	1	357995.77	2500291.28	0.04	0.05	4.28	2.78	NG	AP-42: Stationary Sources
Chemical 6	1	357907.57	2499409.25	0.04	0.05	4.28	2.78	NG	AP-42: Stationary Sources
Paint 1 Boiler	2	357216.64	2500688.19	0.00105	0.0014	0.0061	0.039	NG	AP-42: Stationary Sources
Paint 1 Generator	2	357510.65	2500776.39	0.000225	0.0003	0.011	0.039	NG	AP-42: Stationary Sources
Paint 2 Boiler	2	358098.67	2499820.86	0.00105	0.0014	0.0061	0.039	NG	AP-42: Stationary Sources
Paint 2 Generator	2	358377.98	2499423.95	0.000225	0.0003	0.011	0.039	NG	AP-42: Stationary Sources
Petroleum Refinery 1	1	358613.19	2498674.22	1.56	2.0	10.0	6.94	RFG	AP-42: Stationary Sources

Note: HFO- Heavy Fuel Oil, NG- Natural Gas, RFG- Refinery Fuel Gas

Figure 2: Point Sources in the Study Area

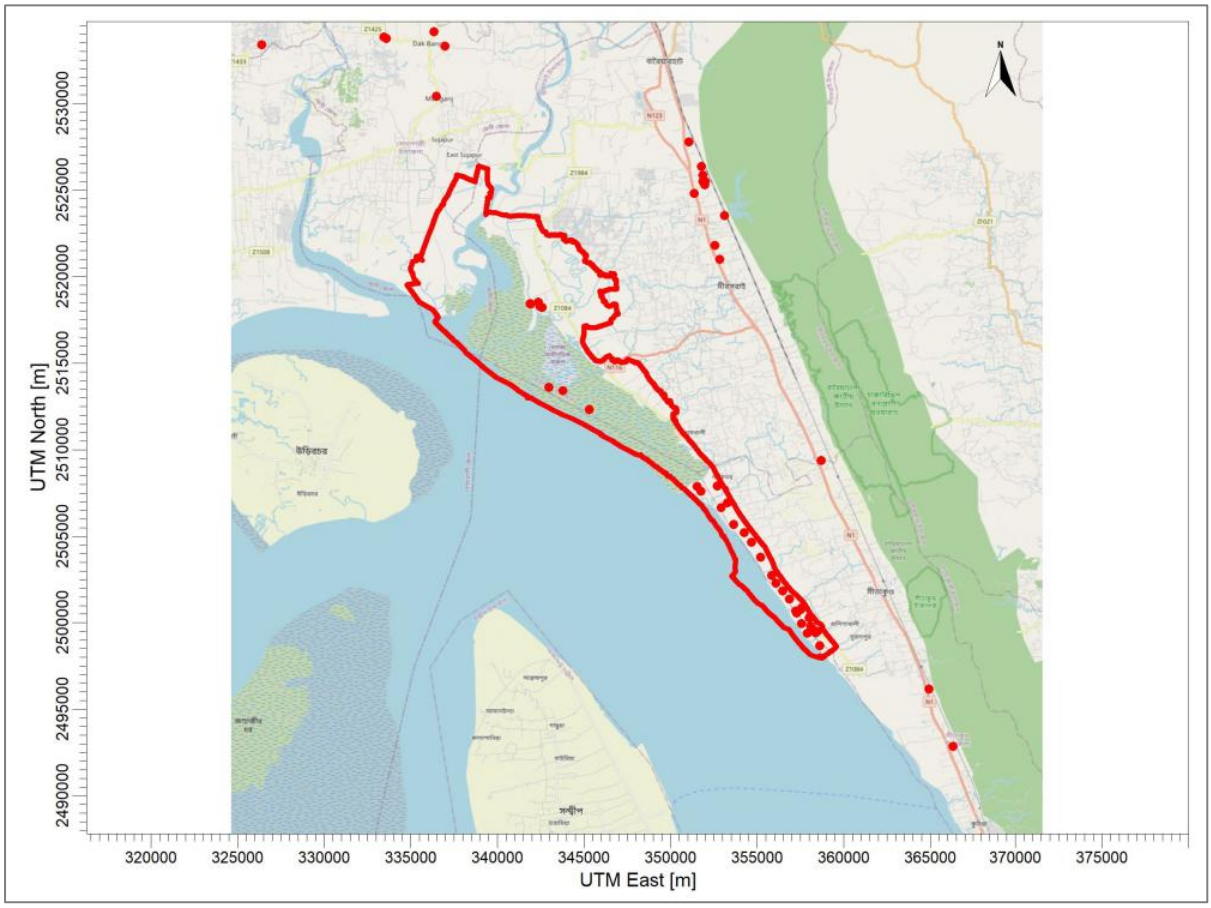
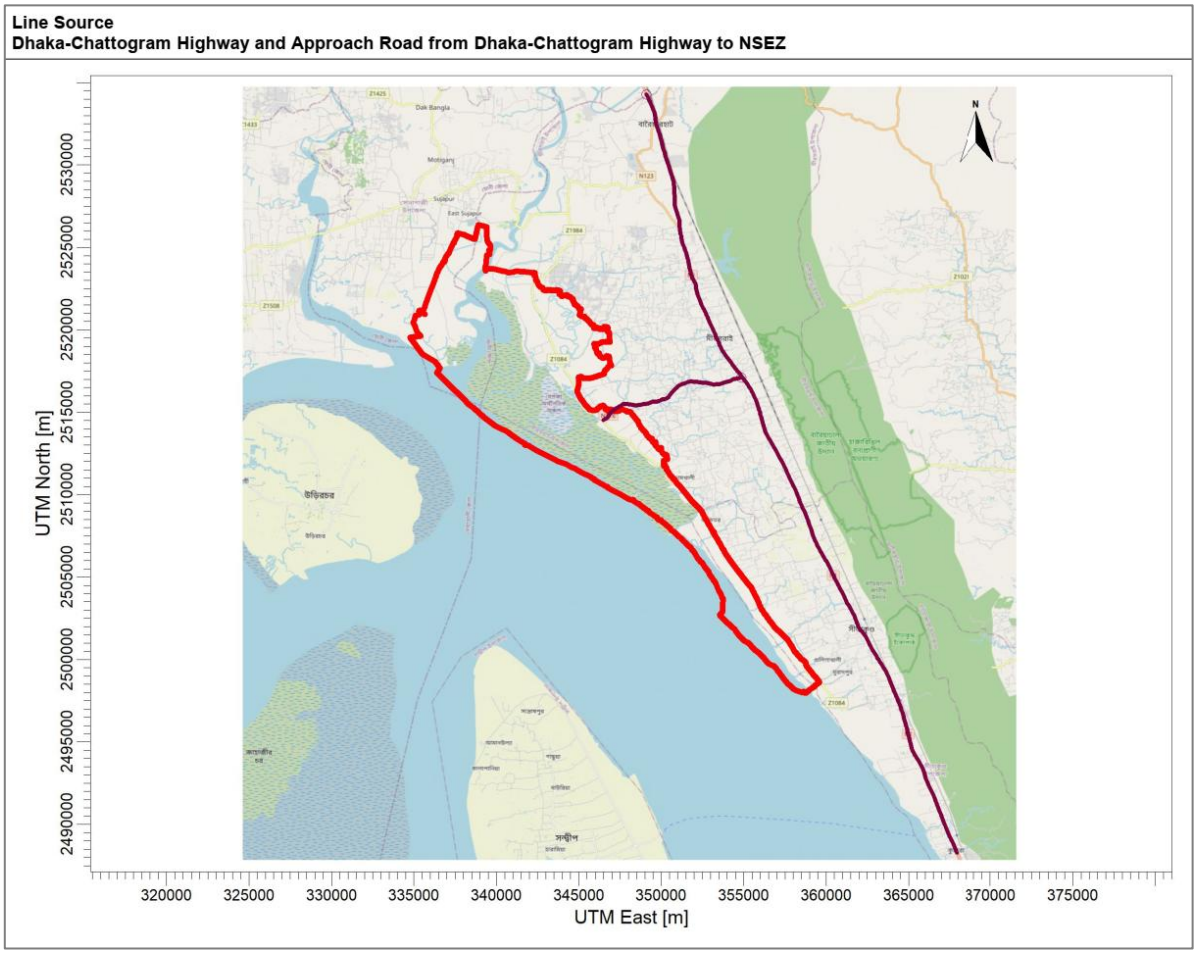


Table 3: Emission of Criteria Pollutants from Major Line Sources

Roads	Width (m)	Emission Rate (g/s-m)			
		$PM_{2.5}$	PM_{10}	NO_2	SO_2
Dhaka-Chattogram Highway	15.4	0.0000704983	0.000368	0.0000694	0.0000012
Dhaka-Chattogram Highway to NSEZ	10	0.00000023952	0.000108	0.0000212	0.000000116

Note: Derived from the https://www.rhd.gov.bd/OnlineRoadNetwork/Default.asp and Traffic survey on the approach road, Updated Emission Factors of Air Pollutants from Vehicle Operations in GREET TM Using MOVES, 2013, Argonne National Laboratory, USA for roads.

Figure 3: Major Line Sources in the Study Area

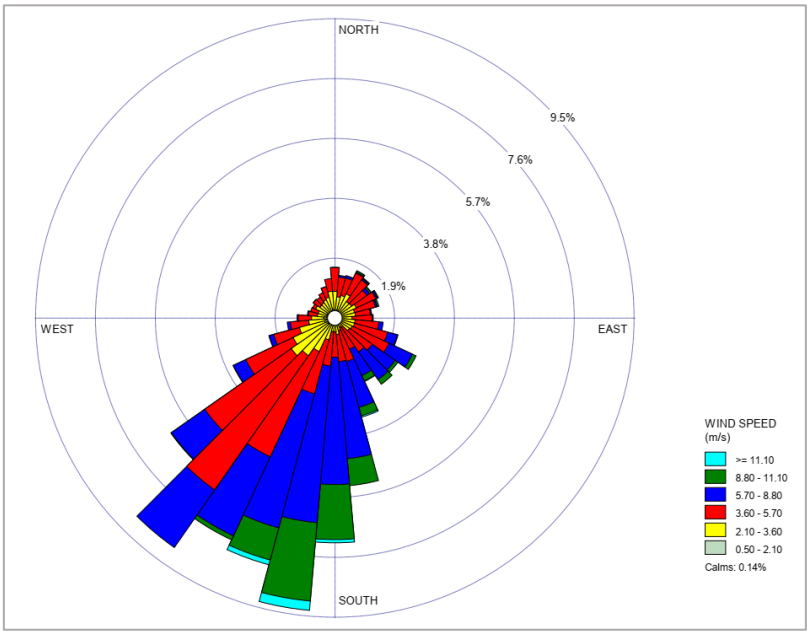


1.2.4 Meteorology

Air quality is dependent on the rate of pollutant emissions into the atmosphere and the ability of the atmosphere to disperse the pollutant emissions. The dispersion of air pollutants is affected by local meteorological patterns. The wind direction controls the path that air pollutants follow from the point of emission to the receptors. In addition, wind speeds affect the time taken for pollutants to travel from source to receptor and the distance over which air pollutants travel. As a result, wind speeds also impact the dispersion of air pollutants. Therefore, it is important to assess local meteorological patterns to assess potential air quality effects.

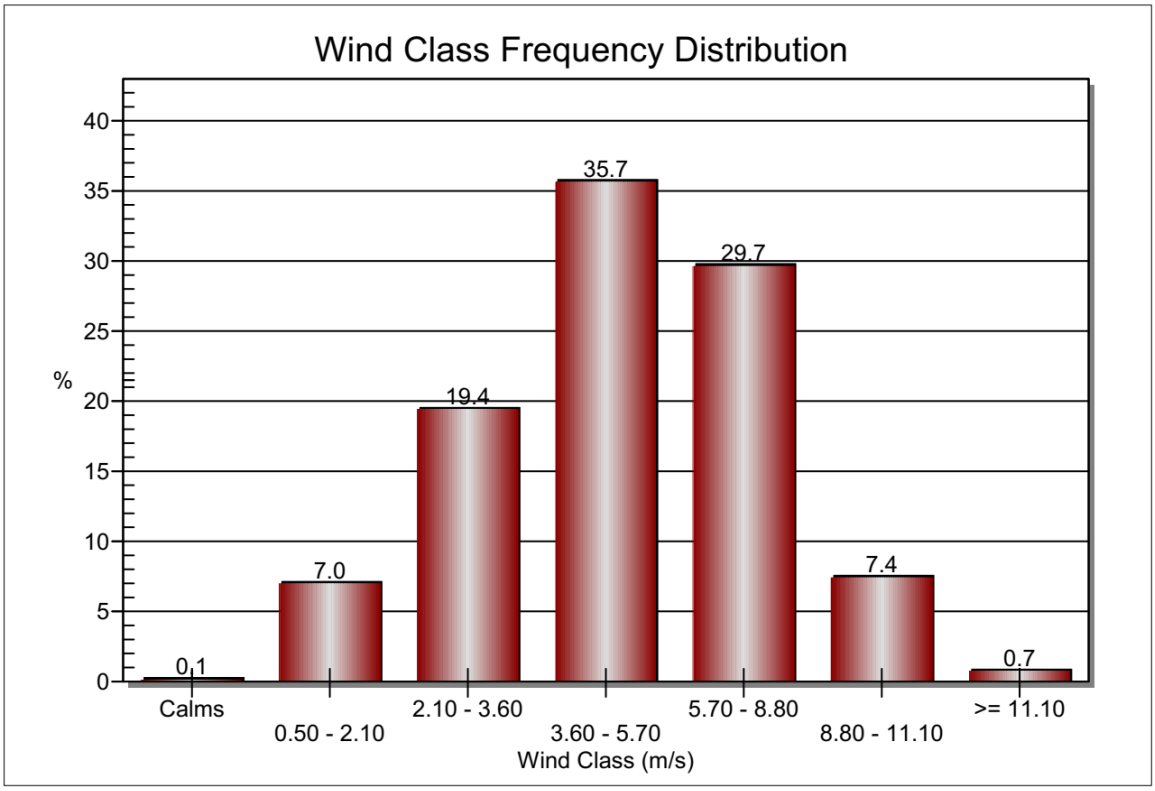
AERMET (Version#13.0.0), AERMOD's meteorological pre-processor requires hourly surface observations along with concurrent twice-daily upper air observations. As such, the dispersion modelling used three years (2021-2023) of meteorological data from lakes environment WRF data. Figure 4 shows a 1-year (2023) wind rose for meteorological data over the study area. The prevailing wind direction throughout the year is from South-east to North-east. Figure 5 shows a frequency distribution of the wind over 6 wind speed class ranges. The highest wind speed varies between 3.60-5.70 m/s at 35.7% followed by 5.70-8.80 m/s (29.7%), 2.10-3.60 m/s (19.4%), 8.80-11.10 m/s (7.4%) and 0.50-2.10 (7.0%) whereas 0.1% calm wind. The average wind speed over the study region is 5.21 m/s. Predominant wind directions are south by west to north by east, SSW to NNE. It has been concluded that the receptors present in the northeast direction are more susceptible to pollution generated from NSEZ.

Figure 4: Annual Wind Rose of the Study Region



Source: Data acquired from Lakes Environmental

Figure 5: Wind Class Frequency Distribution of Meteorological Data (Jan. 1, 2021 – Dec. 31, 2023)



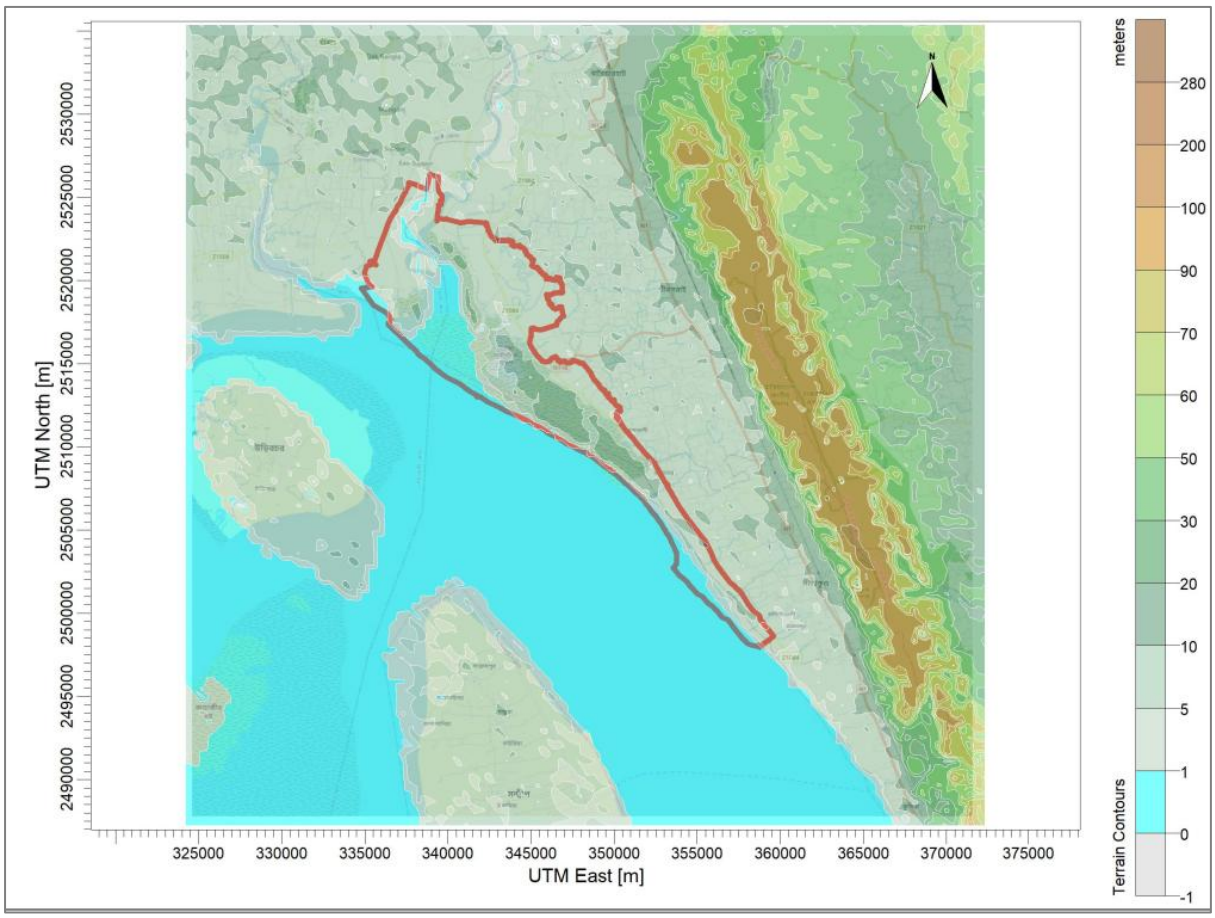
Source: Data acquired from Lakes Environmental

1.2.5 Terrain

A terrain height for each of the receptors on the grid was input into the model in order to accurately represent the changing elevations of the surrounding landscape. Terrain data for the AERMAP model were taken from the 30 m SRTM database. The elevation of the 7.5 km area varies between -1.0 to 280

m. The terrain of the study region is flat including rivers. The land elevation of the study region is presented in Figure 6.

Figure 6: Land Elevation of the Study Region



Source: Shuttle Radar Topography Mission (SRTM)

1.2.6 Sensitive Receptors

It is important to identify the sensitive receptors in and around the EZ surroundings for the air quality impact assessment. A total of ten air quality samples were collected from different sensitive receptors. Besides air quality monitoring locations, a total of 271 discrete sensitive receptors have been identified based on field visit and Google imagery analysis. The air quality monitoring location is presented in Table 4. Figure 7 shows the sensitive receptor locations within the model domain.

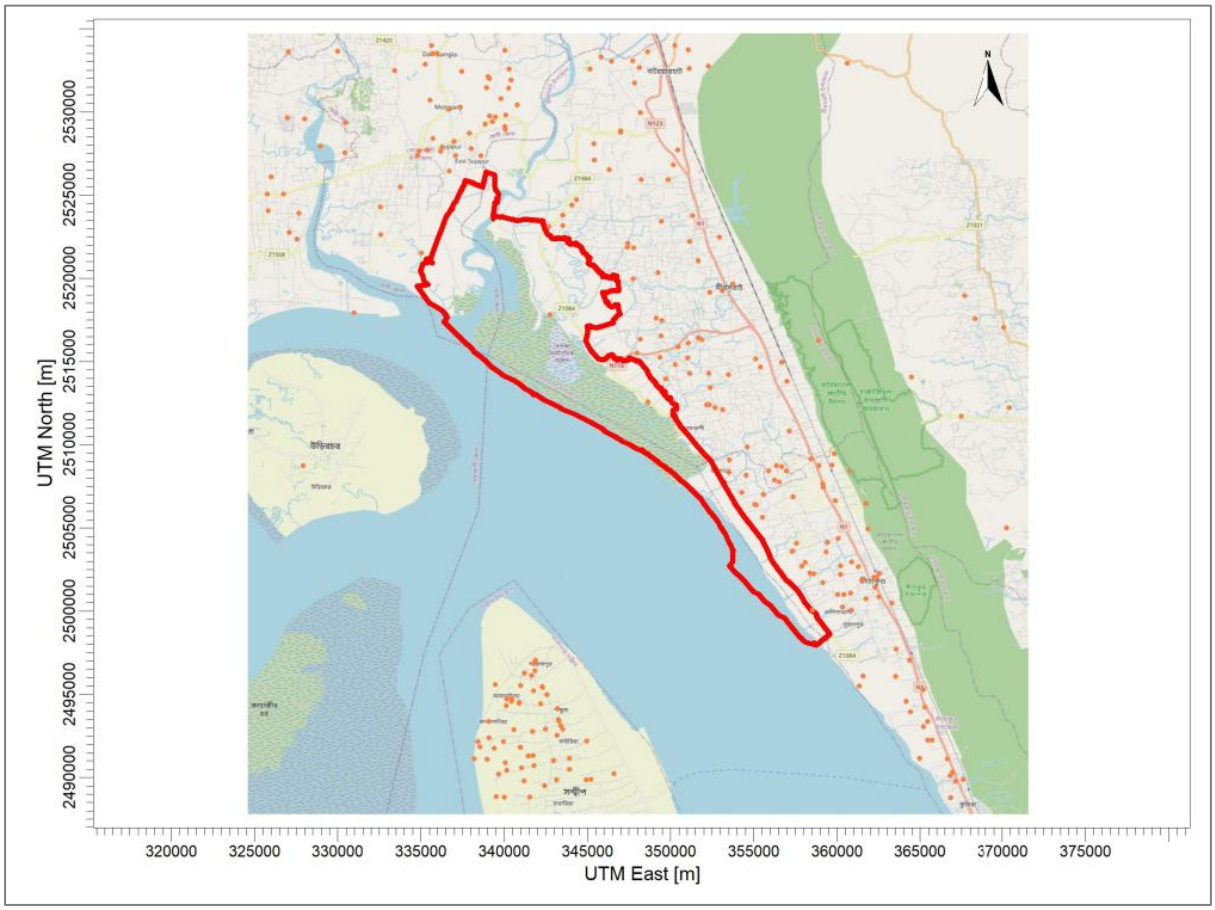
Table 4: Air Quality Monitoring Location

ID	Receptor's Location Name	Coordinate*	
		X	Y
AAQ-1	Near BADC sluice gate, Char Chandia, Sonagazi, Feni	22°47'36.148"N	91°23'34.199"E
AAQ-2	Near 7 no. Sonagazi Union parishad, Sonagazi, Feni	22°51'2.332"N	91°24'14.888"E
AAQ-3	East side of the road, Bishumiyarhat, Zorarjong, Mirsharai	22°51'35.38"N	91°30'31.534"E
AAQ-4	Near BEZA Administrative Building, NSEZ	22°45'37.566"N	91°28'5.761"E
AAQ-5	South Mogadia, Mirsharai	22°42'49.566"N	91°31'34.458"E

ID	Receptor's Location Name	Coordinate*	
		X	Y
AAQ-6	Beribadh Road, Infront of Unigas Plant, Barabkunda, Sitakunda	22°33'57.532"N	91°39'12.96"E
AAQ-7	Goll Chattor of Komor Ali Bazar, Mirsharai	22°41'11.543"N	91°38'8.382"E
AAQ-8	Middle Abu Turab Bazar, Mirsharai, Chattogram	22°44'52.103"N	91°33'26.088"E
AAQ-9	In front of the Government Technical School & College, Sitakunda	22°37'39.974"N	91°38'46.504"E
AAQ-10	In front of the Kazi company market, CNG station, Bamansundor, Darogarhat, Mirsharai	22°47'51.09"N	91°30'47.515"E

**UTM-46*
Source: Field Visit

Figure 7: Location of Sensitive Receptors



**UTM-46*
Source: Field Visit and Google Earth Imagery

1.2.7 Cumulative Air Quality Impact Assessment

The key air-polluting industries situated in the NSEZ are power plants, chemical industry, cement, fertilizer, and paint. Other air pollution in the study region are vehicle emissions, brick kiln, refinery, and steel industries. The cumulative impact on air quality due to the present and future operational industries and road vehicles and key air-polluting industries was assessed by modelling projected emission rates using the USEPA-approved AERMOD 13.0.0 view dispersion model. Information of stack details for the power plant and industries has been collected from the available primary and secondary sources.

However, due to the unavailability of all requisite information, certain assumptions considering the type of industries & their configuration were made during the modelling study. In the NSEZ and surrounding area, almost all industries run on natural gas except brick kilns which use coal as fuel. Hence, the air dispersion model runs for only $PM_{2.5}$, PM_{10}, NO_2, and SO_2. The standard values of the modelled parameter are presented in Table 5.

Table 5: Bangladesh Standard Values and WHO Guideline Value

Pollutant	Averaging Period	Unit	WHO Guideline Value		Bangladesh Standard
			Guideline Value	Interim Target-1	
$PM_{2.5}$	24-hr	$\mu g/m^3$	15	75	65
	Annual	$\mu g/m^3$	5	35	35
PM_{10}	24-hr	$\mu g/m^3$	45	150	150
	Annual	$\mu g/m^3$	15	70	50
NO_2	24-hr	$\mu g/m^3$	25	120	80
	Annual	$\mu g/m^3$	10	40	40
SO_2	24-hr	$\mu g/m^3$	40	125	80
	Annual	$\mu g/m^3$	-	-	-

1.2.7.1 Concentration of Particulate Matter ($PM_{2.5}$ and PM_{10})

The major contributors of the particulate matter in the NSEZ are power plants, paint industries, chemicals, steel, cement, fertilizer, refinery, road traffic, and construction activities. The particulates produced by natural gas combustion are usually less than 1 micrometer (micron) in diameter and are composed of low molecular weight hydrocarbons that are not fully combusted.

Other than industrial activity, development stressors like road traffic and construction material handling and storage activities are also contributing to the PM in the air-shed. In the study domain, there are the Dhaka-Chattogram Highway and the approach road from the Dhaka-Chattogram Highway to the NSEZ area. The existing traffic load on the highways is quite high. The burning of fossil fuel (oil/gas) in the vehicles plying on these roads has been generating PM through tailpipe emissions. Vehicular emissions are likely to be dispersed locally along the transport corridors. Future industrial growth and urbanization will lead to an increase in the traffic load and the increased traffic volume will result in more PM emissions. There are 27 active brick kilns within the study region which mainly operate during dry season.

The contribution of PM from key industrial sources (power plants, other industries like cement, steel, fertilizer, chemical, paint, and refinery) on the ambient air quality in the model domain was understood through predictions from the EPA Regulatory Model (AERMOD), as described above. The predictions were made at the locations selected for primary air quality monitoring during the study to enable appropriate comparison and analysis of the predicted results.

1.2.7.1.1

Predicted Concentration of $PM_{2.5}$

The air quality modeling results for 24 hourly maximum ground level concentrations (GLCs) of $PM_{2.5}$ are presented in Table 6. The isopleths generated for different scenarios, representing both 24-hourly maximum GLCs are presented in Figure 8 to Figure 13.

Table 6: Predicted 24-Hourly Maximum Ground Level Concentration of $PM_{2.5}$

Monitoring Locations	Monitored Conc. of PM (µg/m³)	Predicted 24 Hourly Max Concentration of $PM_{2.5}$ (µg/m³)					
		Power Plant	Industry		Brick Kiln	Road	All Sources
			Inside NSEZ	Outside NSEZ			
AQ1	46.38	2.94	1.97	0.020	3.86	0.45	4.21
AQ2	33.41	2.14	1.63	0.012	4.13	0.40	5.24
AQ3	20.15	4.05	1.86	0.014	5.61	2.00	7.93
AQ4	35.80	6.48	2.02	0.019	4.24	1.22	7.83
AQ5	33.19	3.93	2.63	0.022	6.05	1.91	7.92
AQ6	10.84	1.47	2.65	0.028	2.72	8.39	8.67
AQ7	17.29	1.41	3.47	0.021	4.02	23.84	23.88
AQ8	34.89	3.00	2.61	0.023	6.29	7.00	8.09
AQ9	15.97	1.55	3.88	0.028	3.48	17.65	18.90
AQ10	40.05	4.75	2.16	0.020	6.08	2.41	7.77

The air quality modeling study shows that the predicted contribution of $PM_{2.5}$ from the existing power plant varied from 1.47 µg/m³ (minimum) i.e. only 8.16% of the monitored $PM_{2.5}$ concentration at AQ7 (Goll Chattor of Komor Ali Bazar, Mirsharai) to 6.48 µg/m³ (maximum) i.e. 18.10% of monitored $PM_{2.5}$ concentration at AQ4 (Near BEZA Administrative Building, NSEZ).

The predicted contribution of $PM_{2.5}$ from industries inside the NSEZ varied from 1.63 µg/m³ (minimum) i.e. only 6.41% of the monitored $PM_{2.5}$ concentration at AQ2 (Near 7 no. Sonagazi Union parishad, Sonagazi, Feni) to 3.88 µg/m³ (maximum) i.e. 9.71% of monitored $PM_{2.5}$ concentration at AQ9 (In front of the Government Technical School & College, Sitakunda).

The predicted contribution of $PM_{2.5}$ from industries outside the NSEZ varied from 0.012 µg/m³ (minimum) i.e. only 0.04% of the monitored $PM_{2.5}$ concentration at AQ2 (Near 7 no. Sonagazi Union parishad, Sonagazi, Feni) to 0.028 µg/m³ (maximum) i.e. 0.26% of monitored $PM_{2.5}$ concentration at AQ6 (Beribadh Road, Infront of Unigas Plant, Barabkunda, Sitakunda).

The contribution of $PM_{2.5}$ from the brick kiln varied from 2.72 µg/m³ (minimum) i.e. 25.09% of the monitored $PM_{2.5}$ concentration at AQ6 (Beribadh Road, in front of Unigas Plant, Barabkunda, Sitakunda) to 6.29 µg/m³ (maximum) i.e. 18.03% of monitored $PM_{2.5}$ concentration at AQ8 (Middle Abu Turab Bazar, Mirsharai, Chattogram).

The air quality modeling study shows that the predicted contribution of $PM_{2.5}$ from road varied from 0.4 µg/m³ (minimum) i.e. 1.20% of the monitored $PM_{2.5}$ concentration at AQ2 (Near 7 no. Sonagazi Union parishad, Sonagazi, Feni) to 23.84 µg/m³ (maximum) i.e. 137.88% of monitored $PM_{2.5}$ concentration at AQ7 (Goll Chattor of Komor Ali Bazar, Mirsharai).

The contribution of $PM_{2.5}$ from existing and future industries including power plants, chemicals, paint, steel, cement, fertilizers, petroleum refinery, glass, brick kilns, and glass has been predicted through modeling study. The modeling result reveals that brick kiln and road dust will cumulatively result in increased $PM_{2.5}$ concentrations in the study area. The model reveals that major $PM_{2.5}$ contributors in the study area are road dust and brick kilns. However, the brick kilns only contribute to air pollution during the dry period. The model shows that the contribution of $PM_{2.5}$ from the existing industries in the NSEZ on air quality monitoring locations is insignificant. Hence, the contribution of $PM_{2.5}$ from existing industries within the NSEZ towards $PM_{2.5}$ concentrations in the air shed is assessed to be low.

Figure 8: Isopleths of 24-Hourly Maximum $PM_{2.5}$ GLC- All Sources

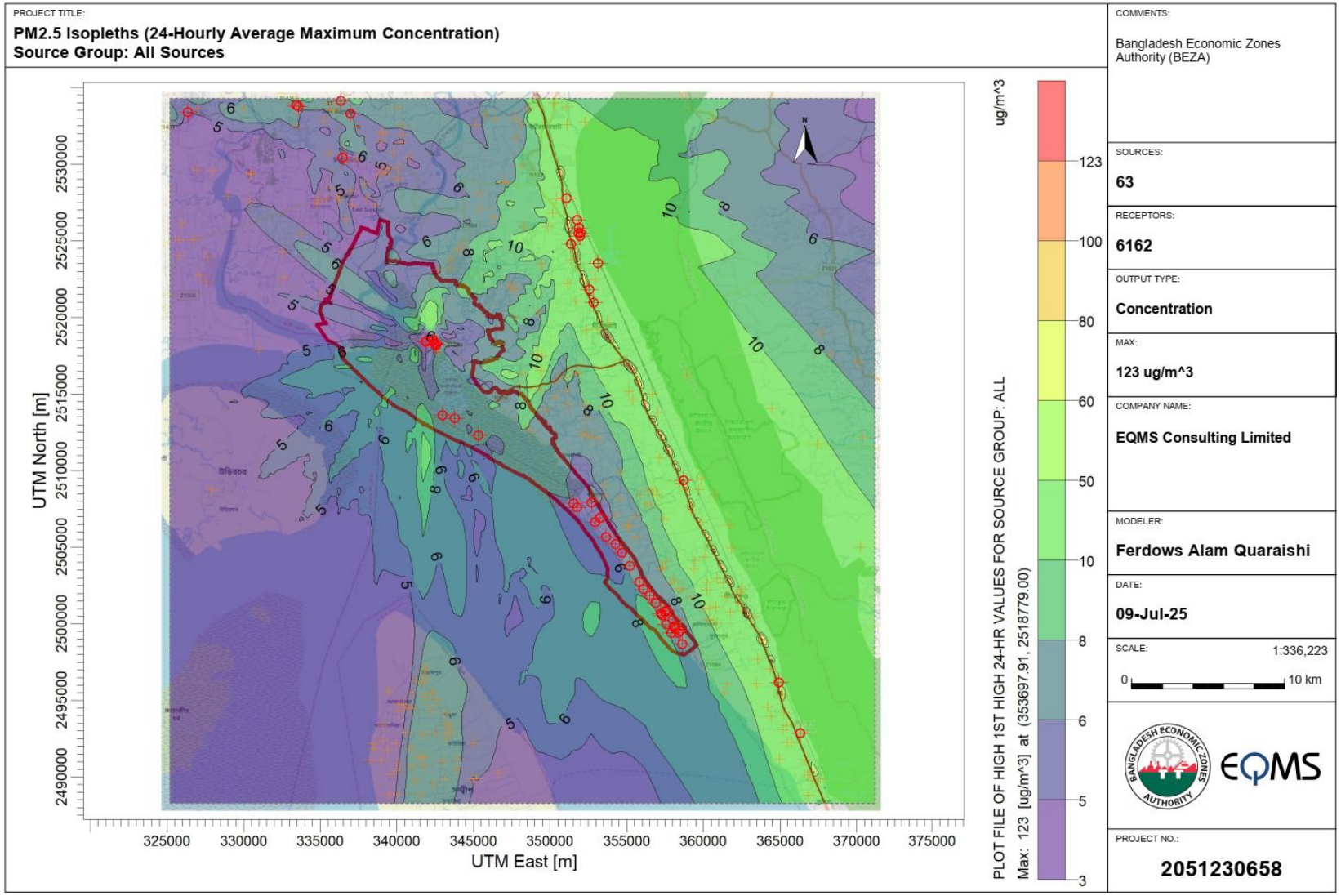


Figure 9: Isopleths of 24-Hourly Maximum $PM_{2.5}$ GLC- Existing Power Plant

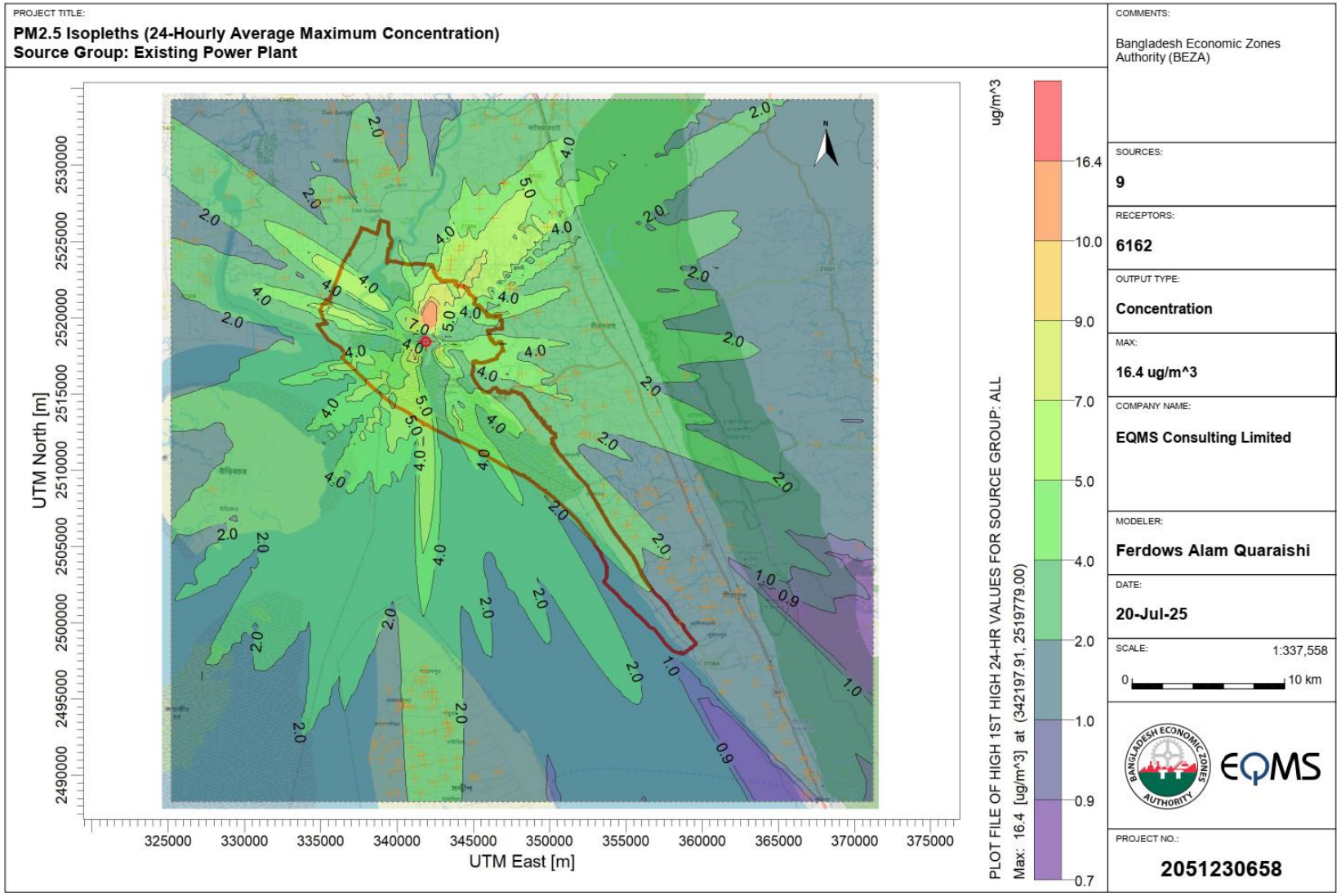


Figure 10: Isopleths of 24-Hourly Maximum $PM_{2.5}$ GLC- Industries Inside the NSEZ

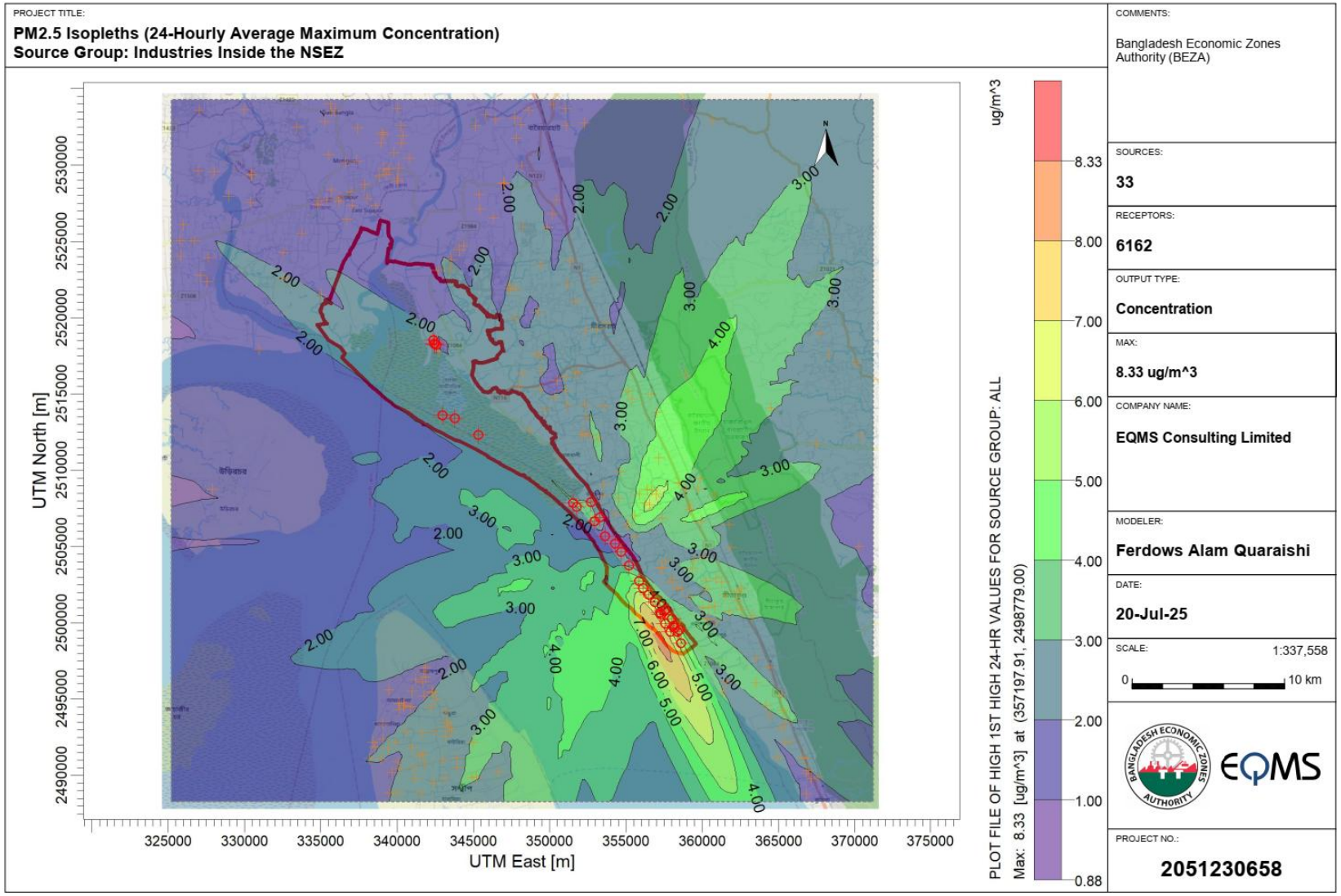


Figure 11: Isopleths of 24-Hourly Maximum $PM_{2.5}$ GLC- Industries Outside the NSEZ

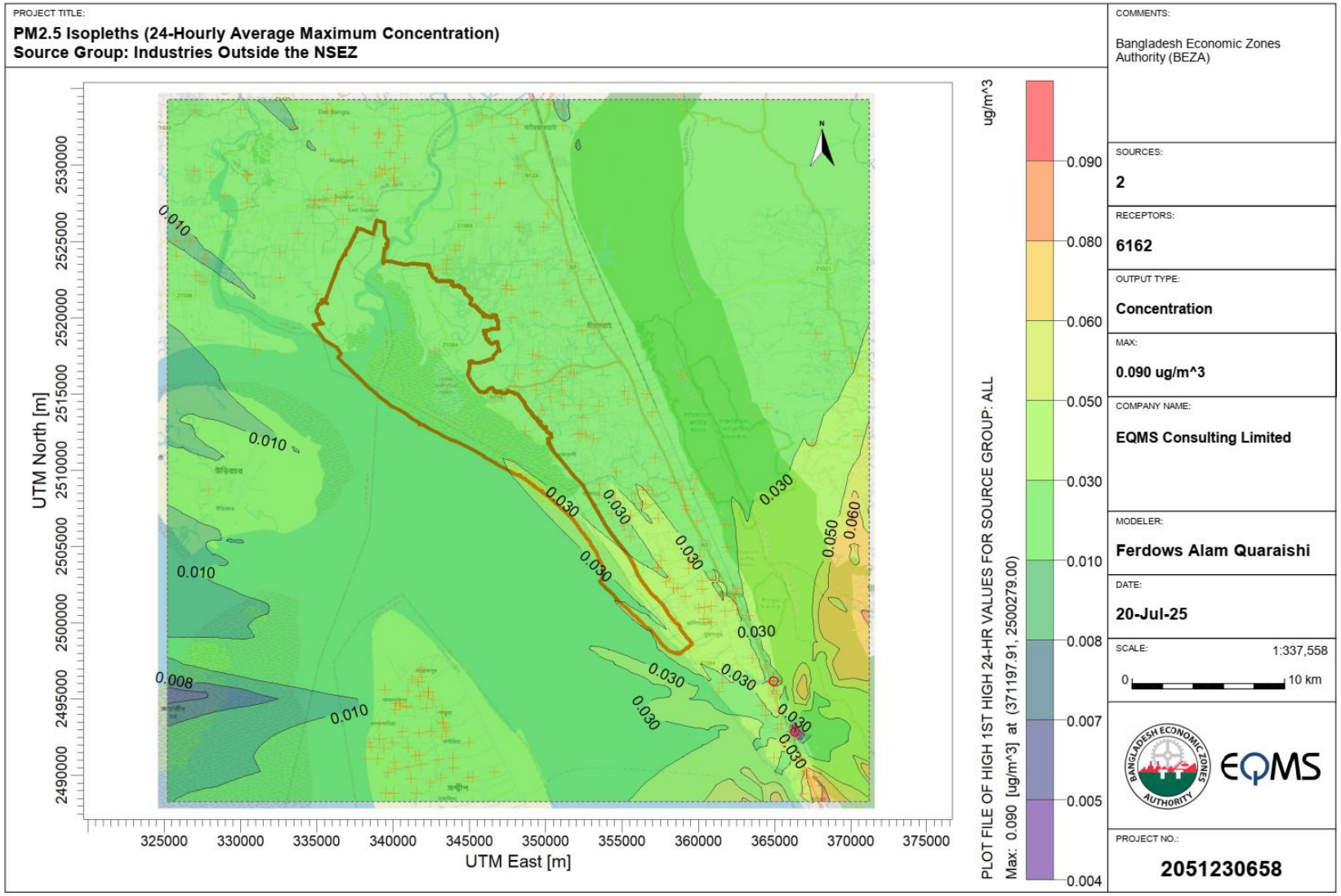


Figure 12: Isopleths of 24-Hourly Maximum $PM_{2.5}$ GLC- Brick Kiln

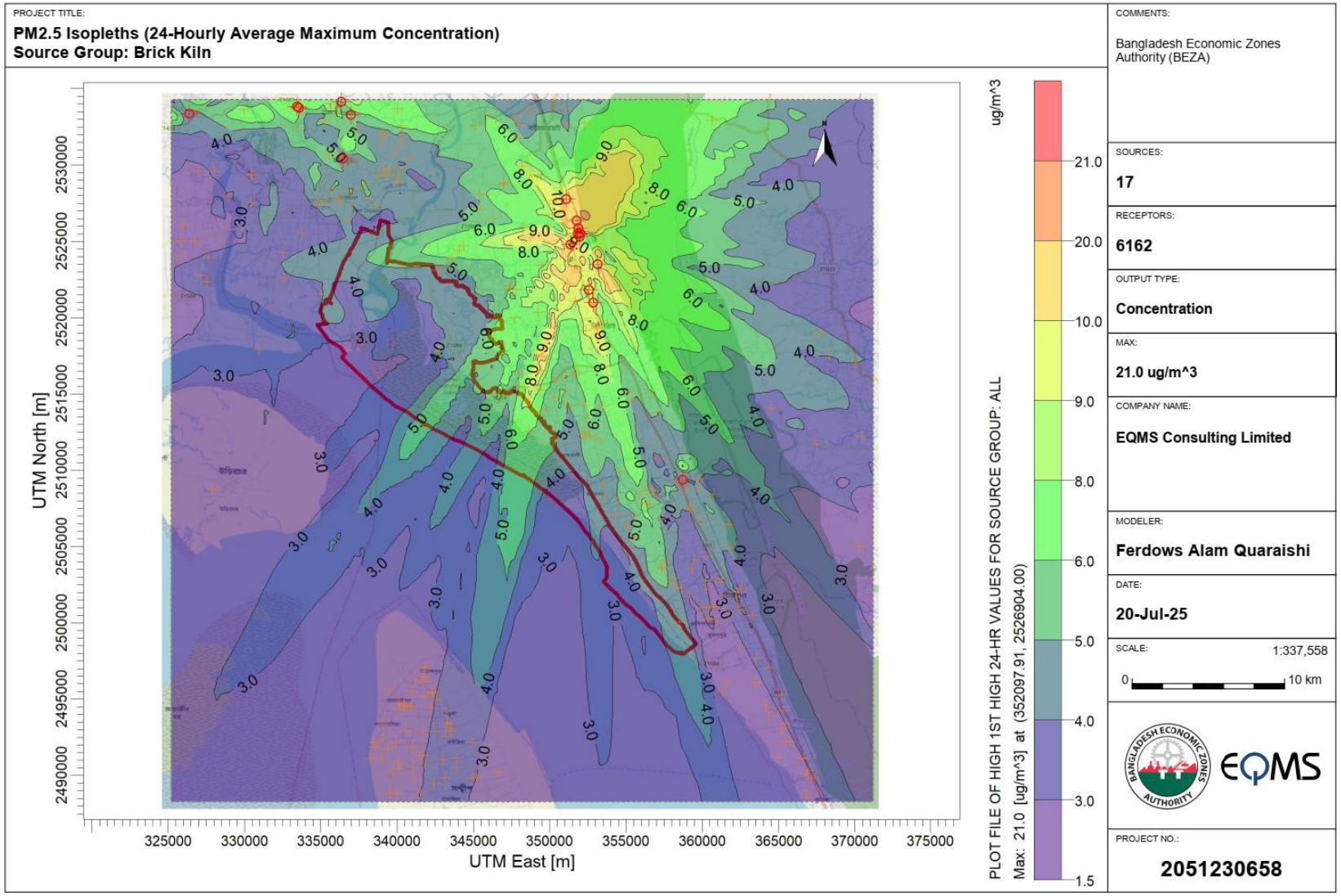
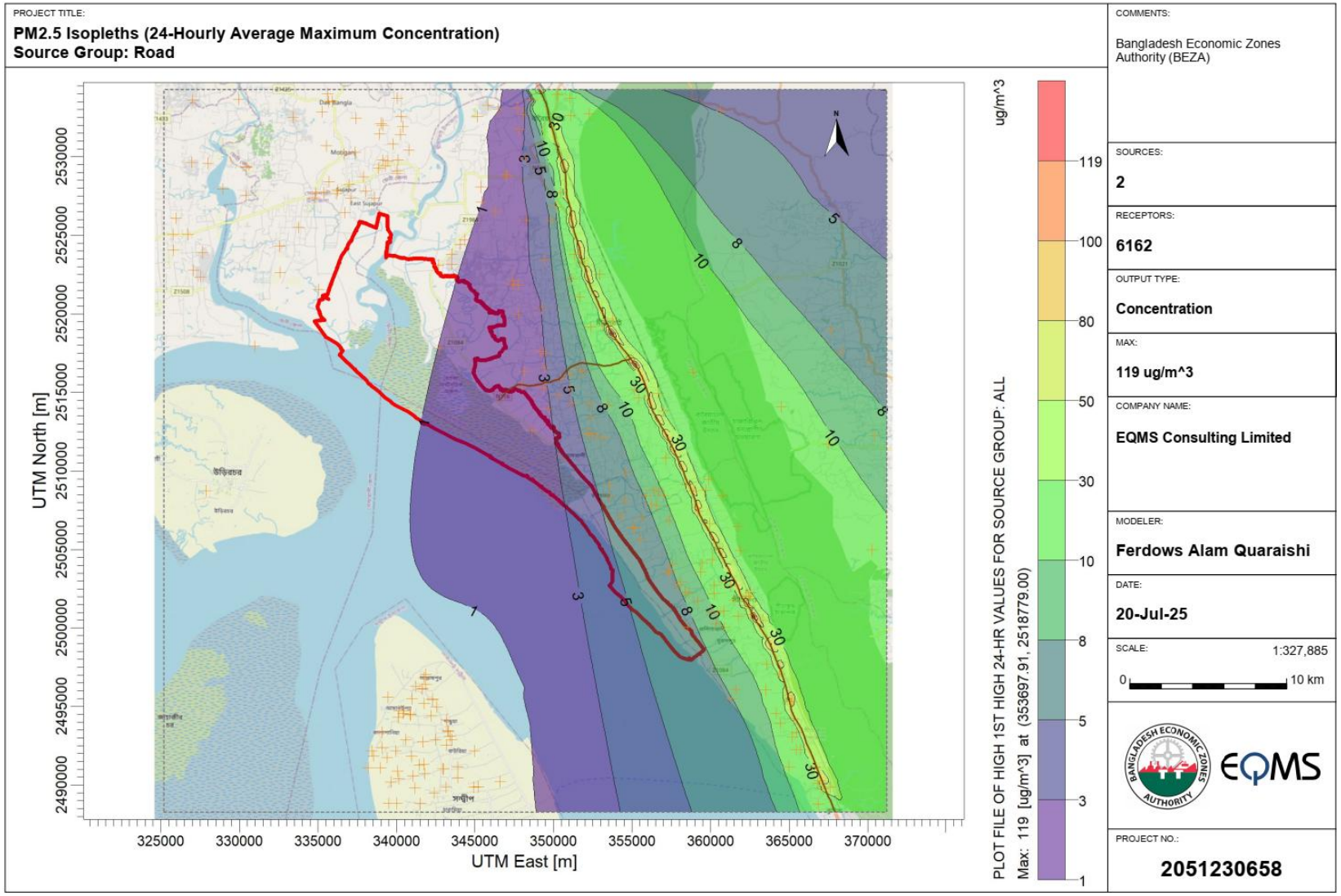


Figure 13: Isopleths of 24-Hourly Maximum $PM_{2.5}$ GLC- Road



1.2.7.1.2 Predicted Concentration of PM_{10}

The air quality modelling results for 24 hourly maximum ground level concentrations (GLCs) are presented in Table 7. The isopleths generated for different scenarios, representing both 24-hourly maximum GLCs are presented in Figure 14 to Figure 19.

Table 7: Predicted 24-Hourly Maximum Ground Level Concentration of PM_{10}

Monitoring Locations	Monitored Conc. of PM (µg/m³)	Predicted 24 Hourly Max Concentration of PM_{10} (µg/m³)					
		Power Plant	Industry		Brick Kiln	Road	All Sources
			Inside NSEZ	Outside NSEZ			
AAQ1	79.5	3.68	2.75	0.029	7.0	6.34	7.20
AAQ2	55.75	2.67	2.25	0.017	7.5	5.62	8.91
AAQ3	33.9	5.07	2.58	0.020	10.2	11.42	13.24
AAQ4	59.48	8.10	2.79	0.026	7.7	9.72	10.47
AAQ5	54.32	4.91	3.58	0.031	11.0	17.13	12.91
AAQ6	19.5	1.84	3.69	0.041	4.9	12.53	13.40
AAQ7	31.7	1.76	4.74	0.030	7.3	17.50	36.75
AAQ8	58.2	3.74	3.61	0.032	11.4	25.97	13.54
AAQ9	25.7	1.94	5.37	0.040	6.3	10.60	28.97
AAQ10	71.2	5.93	3.04	0.028	11.0	14.96	11.24

The air quality modelling study shows that the predicted contribution of PM_{10} from the existing power plant varied from 1.76 µg/m³ (minimum) i.e. only 5.6% of the monitored PM_{10} concentration at AAQ7 (Goll Chattor of Komor Ali Bazar, Mirsharai) to 8.10 µg/m³ (maximum) i.e. 13.6% of monitored PM_{10} concentration at AAQ4 (Near BEZA Administrative Building, NSEZ).

The predicted contribution of PM_{10} from industries inside the NSEZ varied from 2.25 µg/m³ (minimum) i.e. only 4.0% of the monitored PM concentration at AAQ2 (Near 7 no. Sonagazi Union parishad, Sonagazi, Feni) to 5.37 µg/m³ (maximum) i.e. 20.9% of monitored PM_{10} concentration at AAQ9 (In front of the Government Technical School & College, Sitakunda).

The predicted contribution of PM_{10} from industries outside the NSEZ varied from 0.017 µg/m³ (minimum) i.e. only 0.03% of the monitored PM_{10} concentration at AAQ2 (Near 7 no. Sonagazi Union parishad, Sonagazi, Feni) to 0.04 µg/m³ (maximum) i.e. 0.21% of monitored PM_{10} concentration at AAQ6 (Beribadh Road, Infront of Unigas Plant, Barabkunda, Sitakunda).

The contribution of PM_{10} from the brick kiln varied from 4.94 µg/m³ (minimum) i.e. 25.4 % of the monitored PM_{10} concentration at AAQ2 (Beribadh Road, in front of Unigas Plant, Barabkunda, Sitakunda) to 11.4 µg/m³ (maximum) i.e. 19.7% of monitored PM concentration at AAQ8 (Middle Abu Turab Bazar, Mirsharai, Chattogram).

The air quality modelling study shows that the predicted contribution of PM_{10} from road varied from 5.6 µg/m³ (minimum) i.e. 10.1% of the monitored PM_{10} concentration at AAQ2 (Near 7 no. Sonagazi Union parishad, Sonagazi, Feni) to 25.9 µg/m³ (maximum) i.e. 44.6% of monitored PM_{10} concentration at AAQ8 (Middle Abu Turab Bazar, Mirsharai, Chattogram).

The contribution of PM_{10} from existing and future industries including power plants, chemicals, paint, steel, cement, fertilizers, petroleum refinery, glass, brick, and glass has been predicted through modelling study. The modelling result reveals that brick kilns and road dust will cumulatively result in increased PM_{10} concentrations in the study area. The model reveals that major PM_{10} contributors in the study area are road dust and brick kilns. However, the brick kilns only contribute to air pollution during

the dry period. The model shows that the contribution of PM_{10} from the existing industries in the NSEZ on air quality monitoring locations is insignificant. Hence, the contribution of PM_{10} from existing industries within the NSEZ towards PM_{10} concentrations in the air shed is assessed to be low.

Figure 14: Isopleths of 24-Hourly Maximum PM_{10} GLC- All Sources

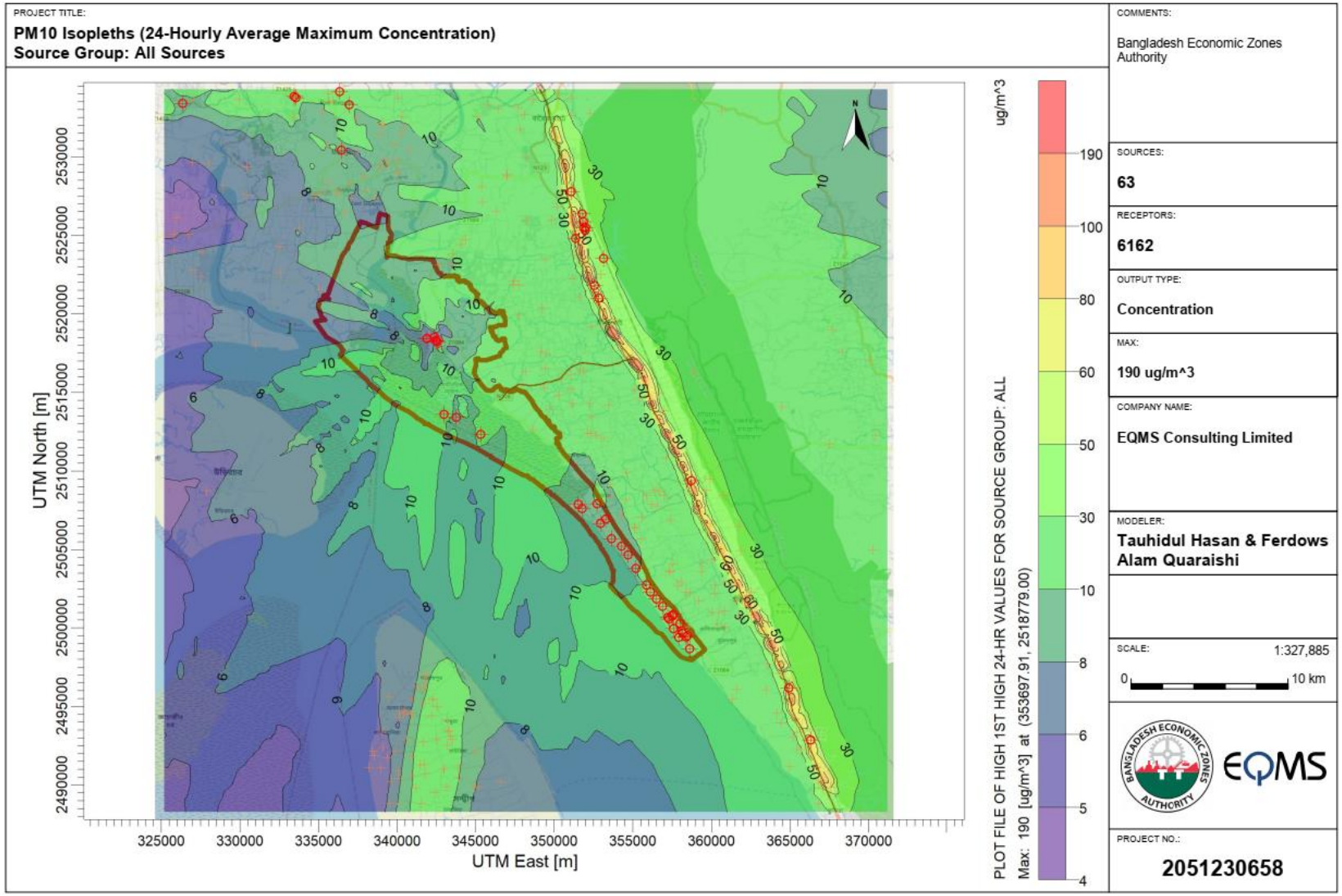


Figure 15: Isopleths of 24-Hourly Maximum PM_{10} GLC- Existing Power Plant

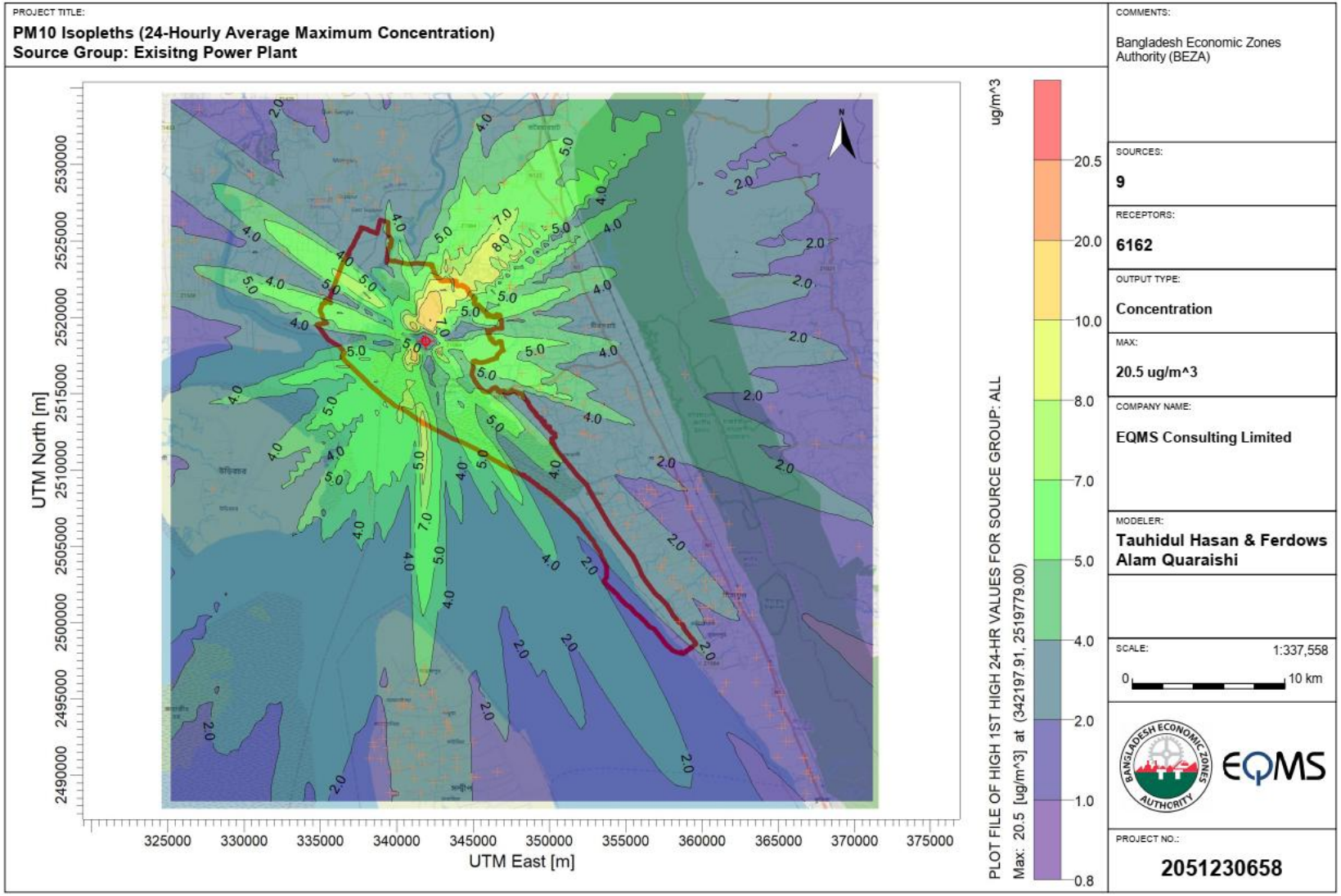


Figure 16: Isopleths of 24-Hourly Maximum PM_{10} GLC- Industries Inside the NSEZ

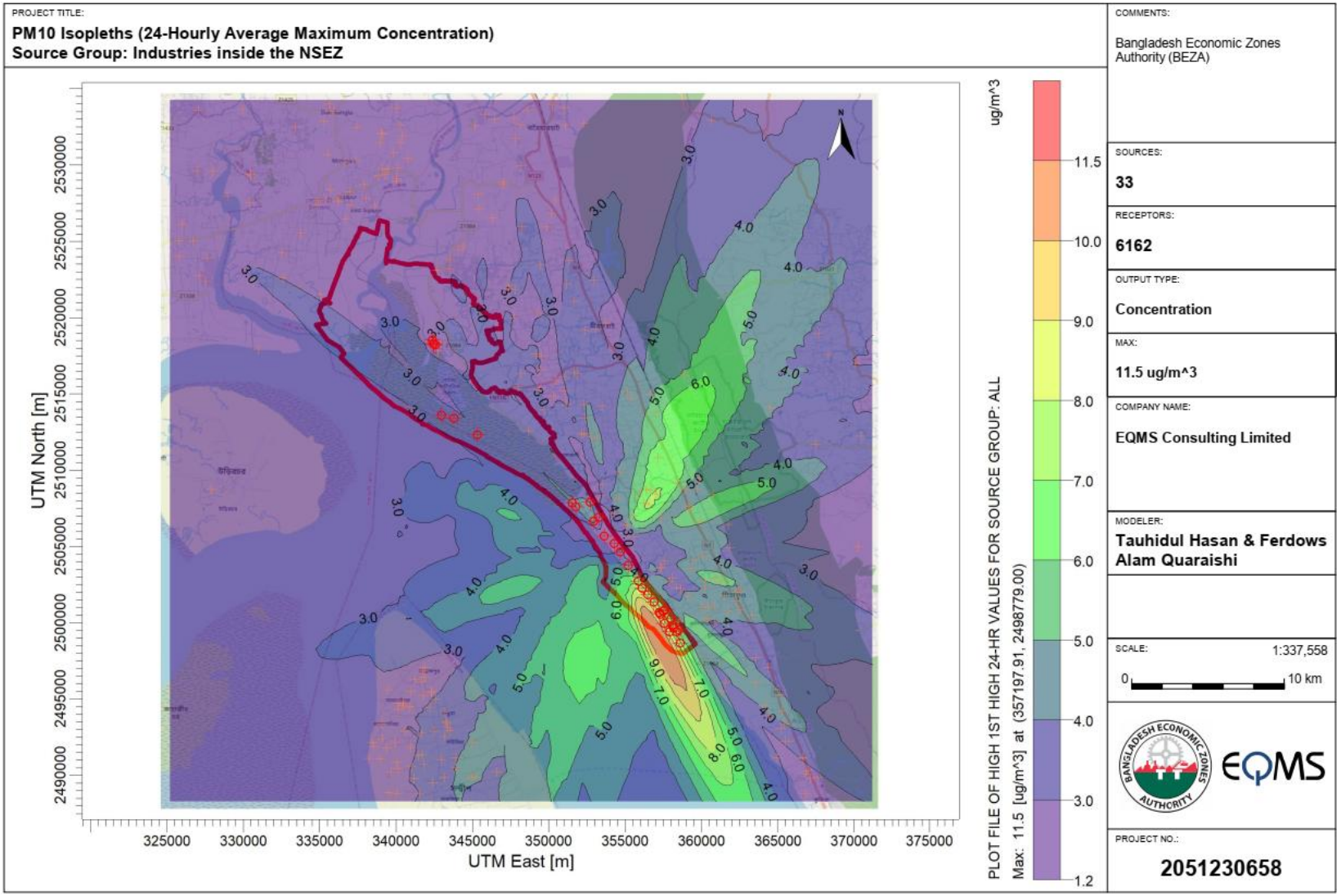


Figure 17: Isopleths of 24-Hourly Maximum PM_{10} GLC- Industries Outside the NSEZ

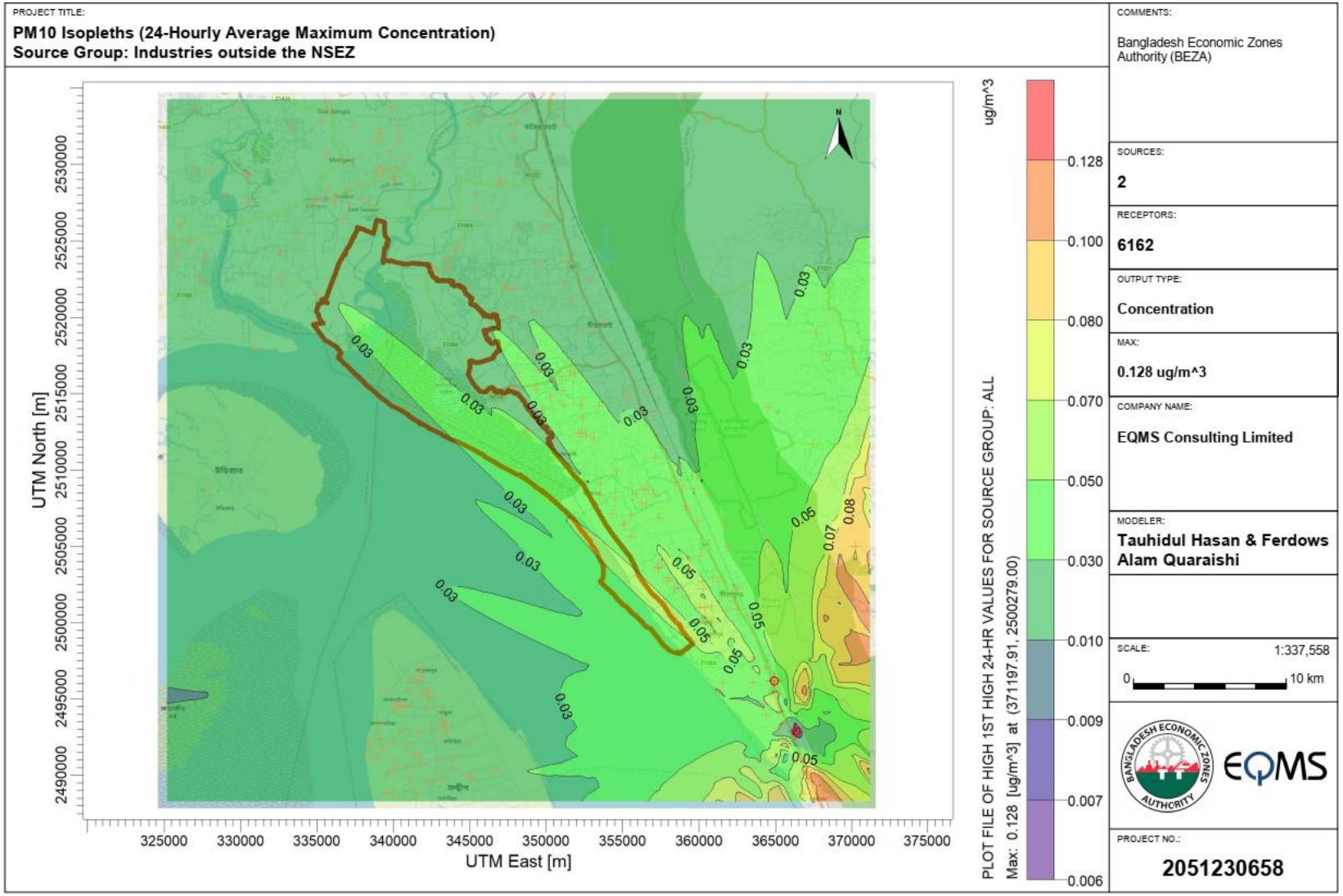


Figure 18: Isopleths of 24-Hourly Maximum PM_{10} GLC- Brick Kiln

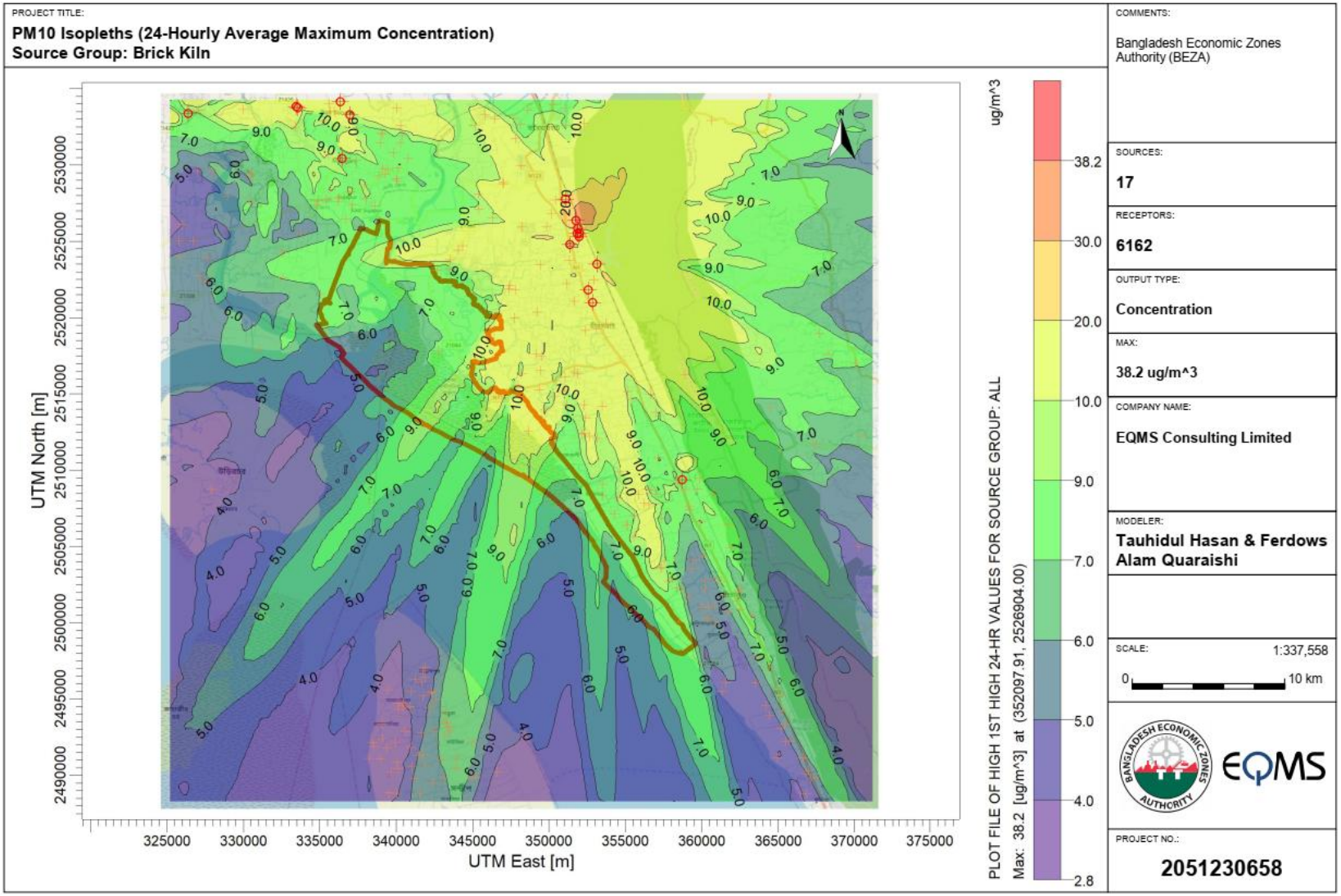
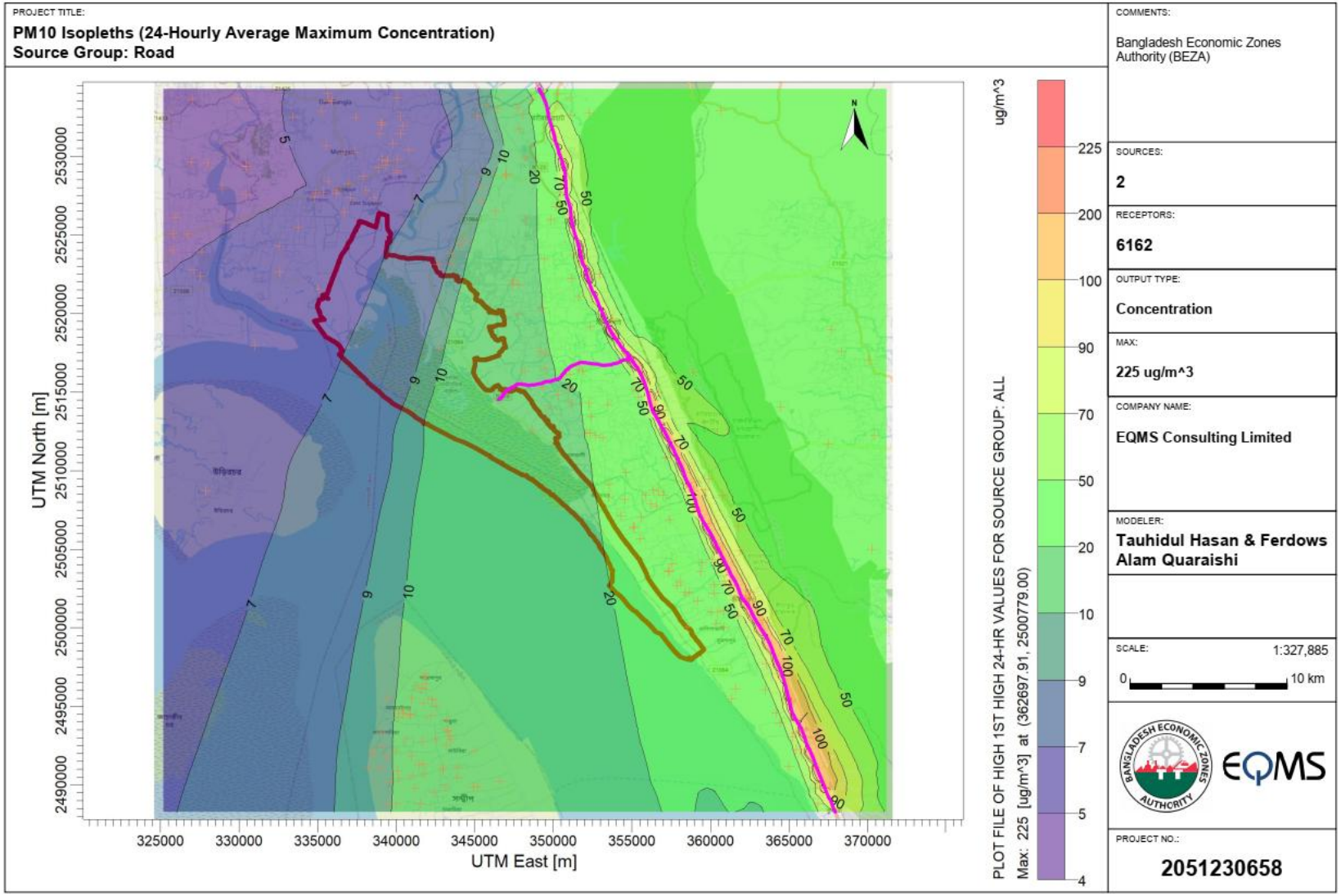


Figure 19: Isopleths of 24-Hourly Maximum PM_{10} GLC- Road



1.2.7.2 Concentration of NO_2

The air quality monitoring result shows that the NO_2 concentration is well within the national standard. The major contribution to the study area is road traffic. Daily huge numbers of vehicles plying on the Dhaka-Chattogram highway which is the key NO_2 emission source in the study region.

The industries located in the NSEZ and Sitakunda region are operating by gas. Hence, NO_2 emissions from these industries are comparatively lower than oil-based industries. In the NSEZ, there is only one HFO-based power plant which is the major contributor to generating NO_2 in the air shed. Combustion of fossil fuel (gas and oil) at high temperatures results in the generation of NO_2. The emission of NO_2 from oil-based power plants is almost three times higher than gas-based power plants.

As stated above, the one major highway and approach road from Dhaka-Chattogram highway to NSEZ act as a stressor on the air environment. NO_2 emissions from the traffic are due to the burning of fossil fuel and resultant tailpipe emissions. Future industrial growth and urbanization are expected to increase the corresponding traffic load. The increased traffic volume will also result in an increase in NO_2 emissions.

The contribution of NO_2 from existing industrial sources (power plants and other industries) in the air shed in the NSEZ and surrounding area was understood through predictions from the EPA Regulatory Model (AERMOD), as described above. The air quality modelling results for 24 hourly maximum ground level concentrations (GLCs) are presented in Table 8 while the isopleths generated for different scenarios, representing both 24 hourly maximum GLCs, are presented in Figure 20 to Figure 25.

Table 8: Predicted 24-Hourly Maximum Ground Level Concentration of NO_2

Monitoring Locations	Monitored Conc. of NO_2 ($\mu g/m^3$)	Predicted 24 Hourly Max Concentration of NO_2 ($\mu g/m^3$)					
		Power Plant	Industry		Brick Kiln	Road	All Sources
			Inside NSEZ	Outside NSEZ			
AAQ1	21.18	3.82	15.43	0.43	0.23	0.15	17.38
AAQ2	29.24	2.77	11.92	0.28	0.25	0.09	13.27
AAQ3	31.06	5.26	14.30	0.31	0.34	0.34	16.08
AAQ4	27.14	8.41	13.85	0.40	0.26	0.35	14.27
AAQ5	17.91	5.10	16.73	0.49	0.37	0.49	16.95
AAQ6	19.47	1.91	21.96	0.55	0.17	1.49	23.22
AAQ7	15.98	1.83	23.55	0.46	0.24	2.00	23.81
AAQ8	18.59	3.89	18.02	0.51	0.38	2.06	18.03
AAQ9	33.06	2.01	28.43	0.64	0.21	2.43	29.10
AAQ10	21.18	3.82	18.55	0.43	0.23	0.15	18.76

The air quality modelling study shows that the predicted contribution of NO_2 from the existing power plant varied from 1.8 $\mu g/m^3$ (minimum) i.e., only 11.4% of the monitored NO_2 concentration at AAQ7 (Goll Chattor of Komor Ali Bazar, Mirsharai) to 8.41 $\mu g/m^3$ (maximum) i.e., 31.0% of monitored NO_2 concentration at AAQ4 (Near BEZA Administrative Building, NSEZ).

The predicted contribution of NO_2 from industries inside the NSEZ varied from 11.92 $\mu g/m^3$ (minimum) i.e., 40.8% of the monitored NO_2 concentration at AAQ2 (Near 7 no. Sonagazi Union parishad, Sonagazi, Feni) to 28.43 $\mu g/m^3$ (maximum) i.e., 86.0% of monitored NO_2 concentration at AAQ9 (In front of the Government Technical School & College, Sitakunda).

The predicted contribution of NO_2 from industries outside the NSEZ varied from 0.28 $\mu g/m^3$ (minimum) i.e., only 0.96% of the monitored NO_2 concentration at AAQ2 (Near 7 no. Sonagazi Union parishad,

Sonagazi, Feni) to 0.64 µg/m^3 (maximum) i.e., 1.95% of monitored NO_2 concentration at AAQ9 (In front of the Government Technical School & College, Sitakunda).

The contribution of NO_2 from the brick kilns varied from 0.17 µg/m^3 (minimum) i.e., 0.85% of the monitored NO_2 concentration at AAQ6 (Beribadh Road, In front of Unigas Plant, Barabkunda, Sitakunda) to 0.38 µg/m^3 (maximum) i.e., 2.06% of monitored NO_2 concentration at AAQ8 (Middle Abu Turab Bazar, Mirsharai, Chattogram).

The air quality modelling study shows that the predicted contribution of NO_2 from road varied from 0.09 µg/m^3 (minimum) i.e., 0.30% of the monitored NO_2 concentration at AAQ2 (Near 7 no. Sonagazi Union parishad, Sonagazi, Feni) to 2.43 µg/m^3 (maximum) i.e., 7.36% of monitored NO_2 concentration at AAQ9 (In front of the Government Technical School & College, Sitakunda).

The contribution of NO_2 from existing and future industries including power plants, chemicals, paint, steel, cement, fertilizers, petroleum refinery, glass, brick kilns, and road vehicles has been predicted through modelling study. The modelling result reveals that industrial, brick kiln and road sectors will cumulatively result in increased NO_2 concentrations varying from 13.27 µg/m^3 (minimum) i.e., 45.4% of the monitored NO_2 concentration at AAQ2 (Near 7 no. Sonagazi Union parishad, Sonagazi,Feni) to 29.10 µg/m^3 (maximum) i.e., 88.0% of the monitored NO_2 at AAQ9 ((In front of the Government Technical School & College, Sitakunda).

The past, present, and future industrial activity will cumulatively impact on the condition of the NSEZ, and the surrounding area air shed. The model shows that the contribution of NO_2 from the other industries inside the NSEZ contributes maximum followed by power plant in the NSEZ, road traffic, brick kiln, and industries outside the NSEZ. It can state that industry in the NSEZ will contribute NO_2 significantly to the airshed.

Figure 20: Isopleths of 24-Hourly Maximum NO_2 GLC- All Sources

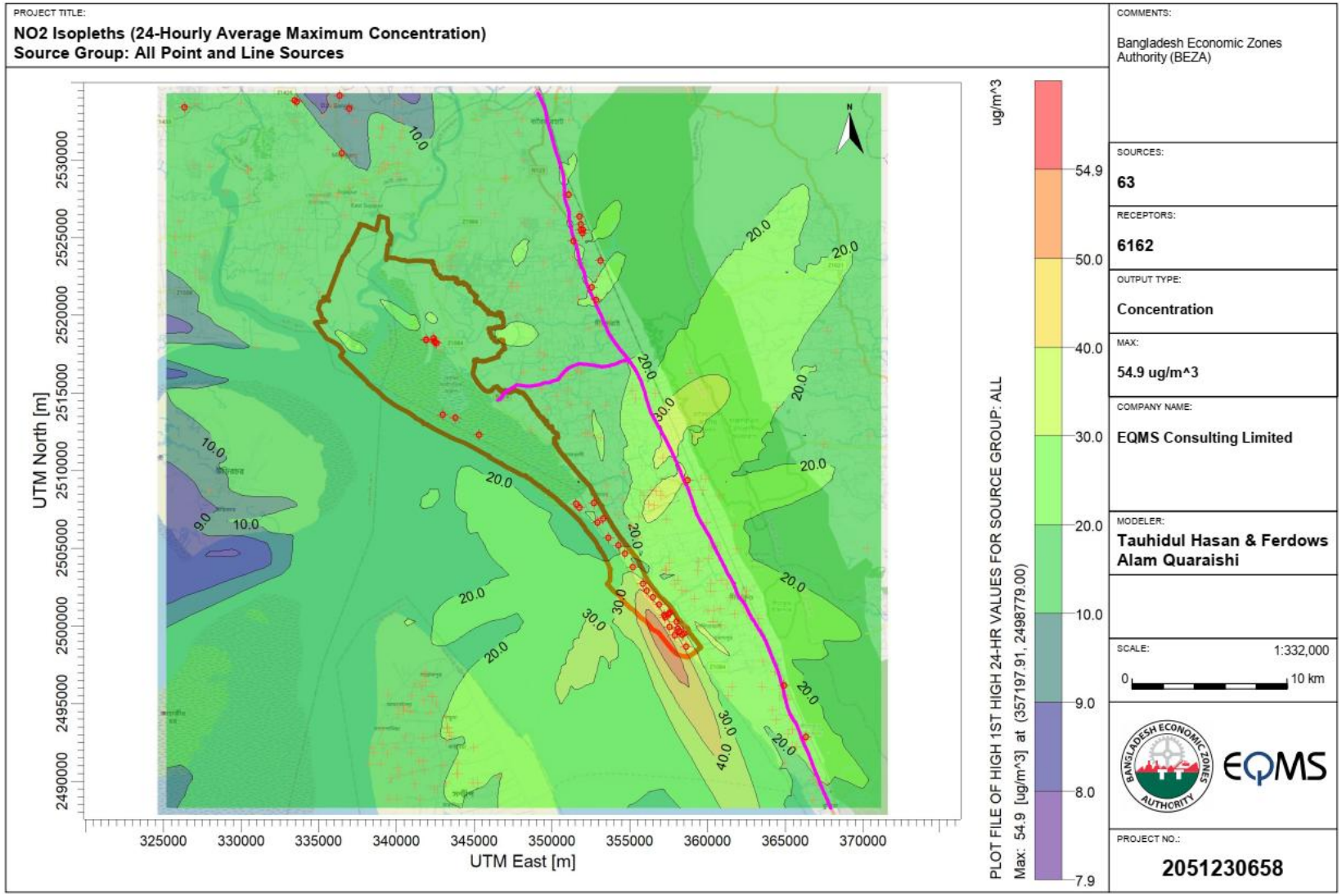


Figure 21: Isopleths of 24-Hourly Maximum NO_2 GLC- Power Plant

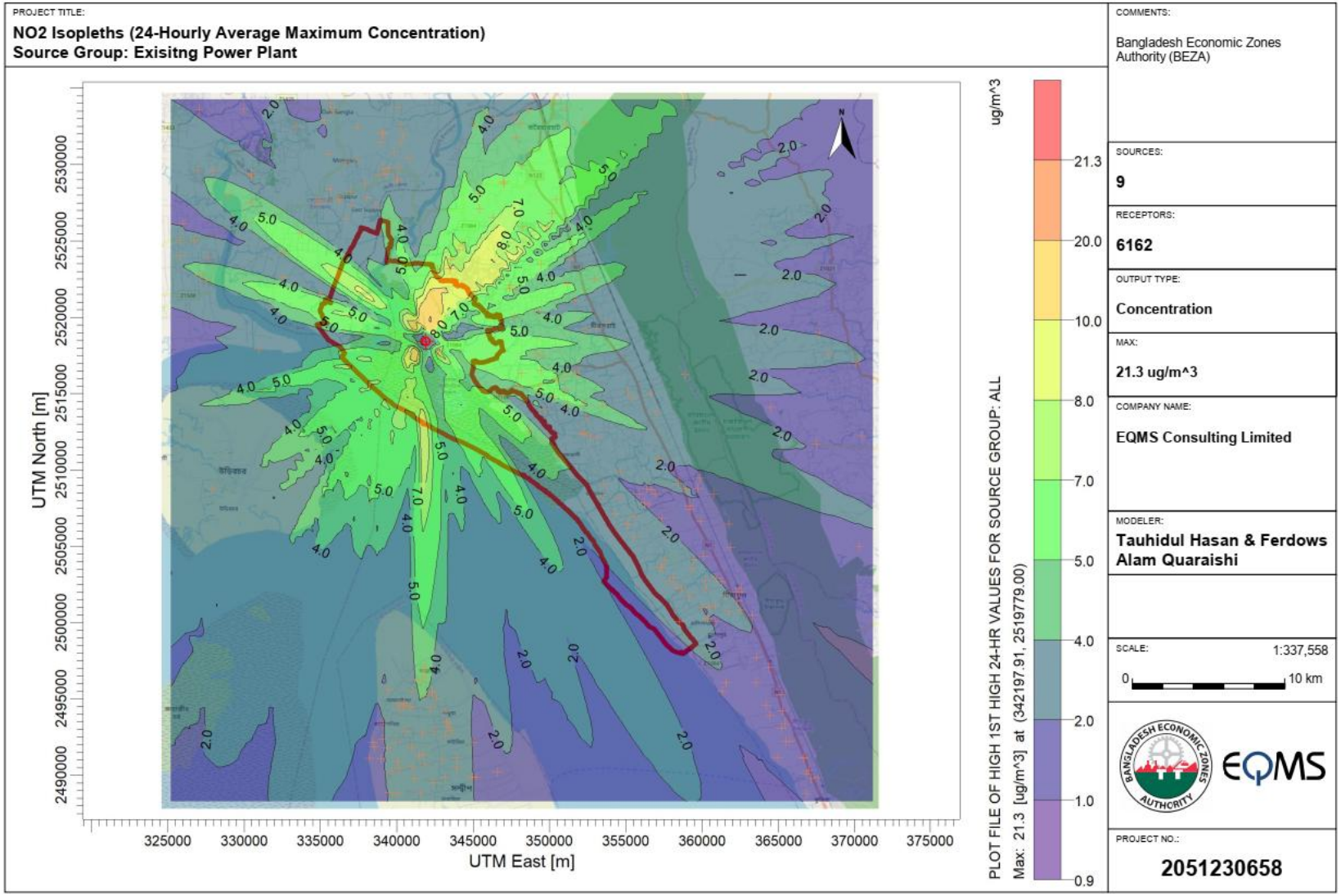


Figure 22: Isopleths of 24-Hourly Maximum NO_2 GLC- Industries Inside the NSEZ

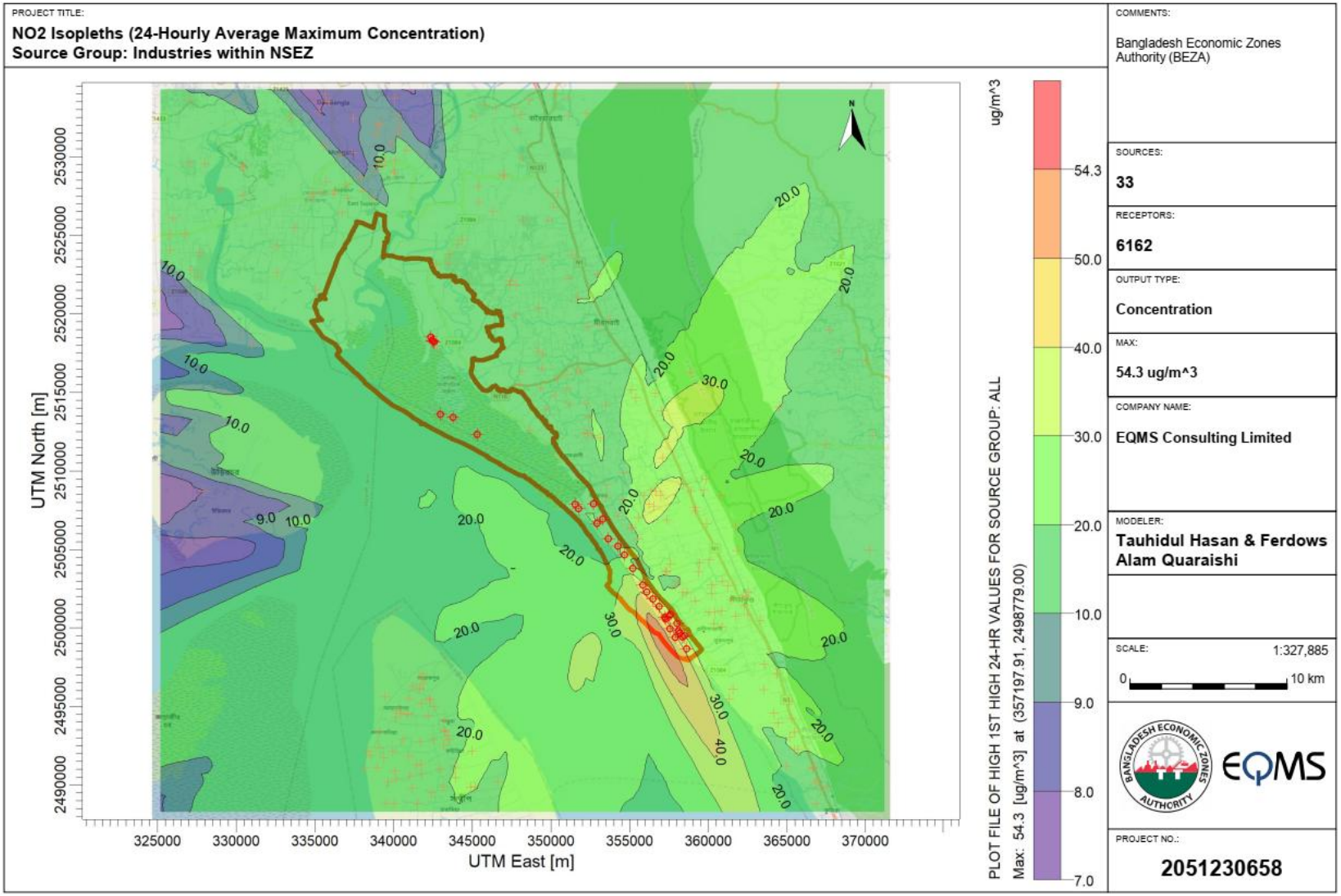


Figure 23: Isopleths of 24-Hourly Maximum NO_2 GLC- Industries Outside the NSEZ

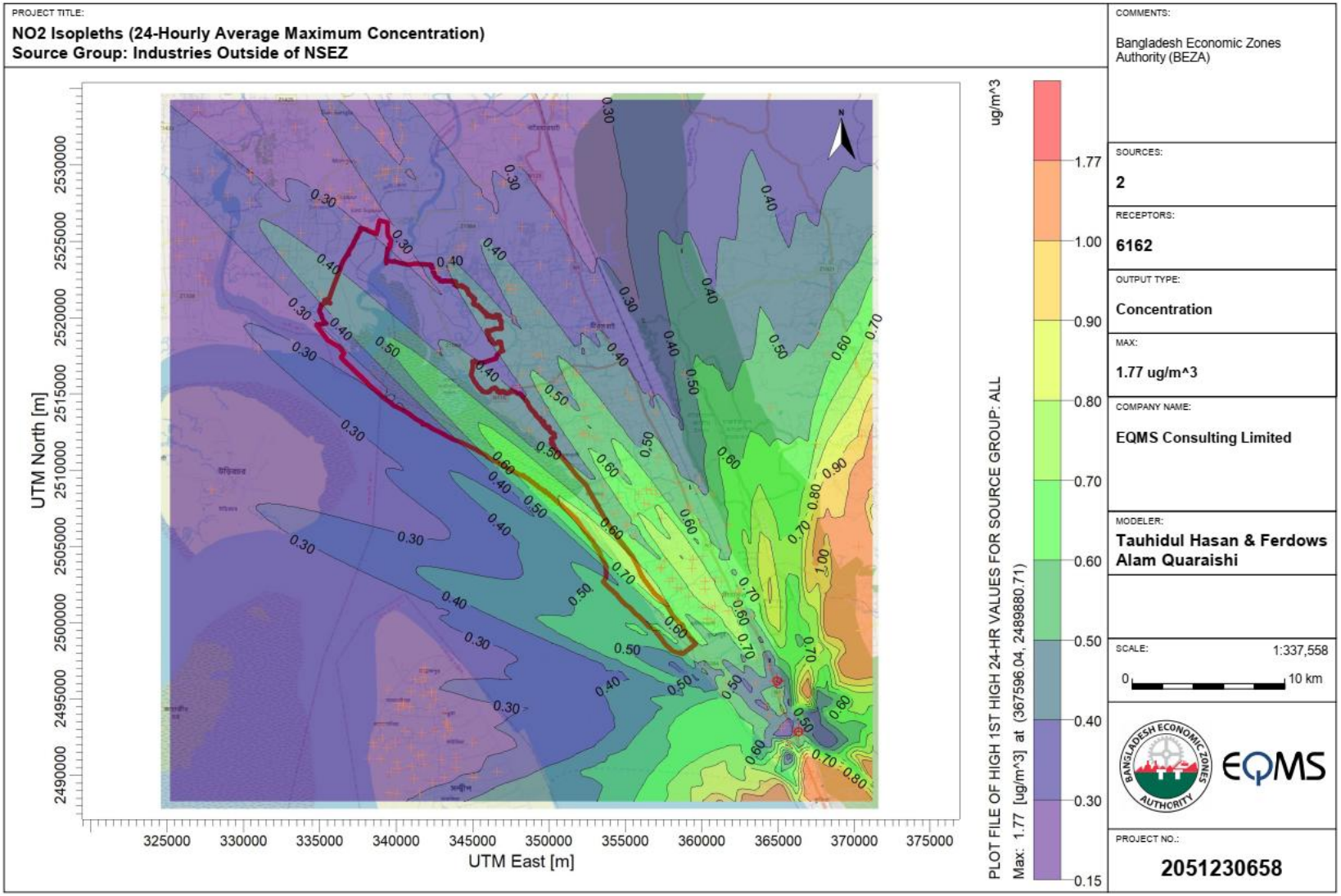


Figure 24: Isopleths of 24-Hourly Maximum NO_2 GLC- Brick Kiln

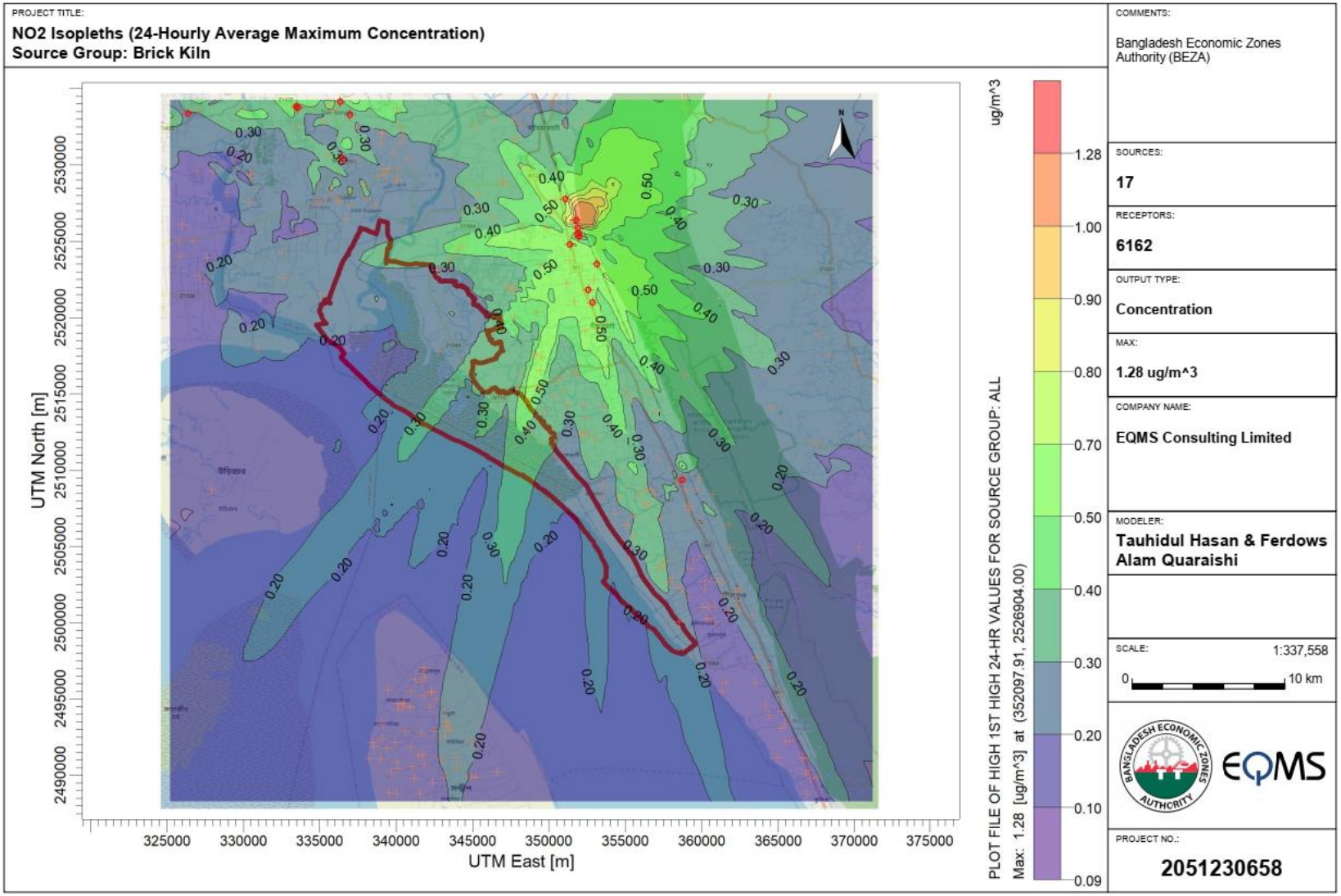
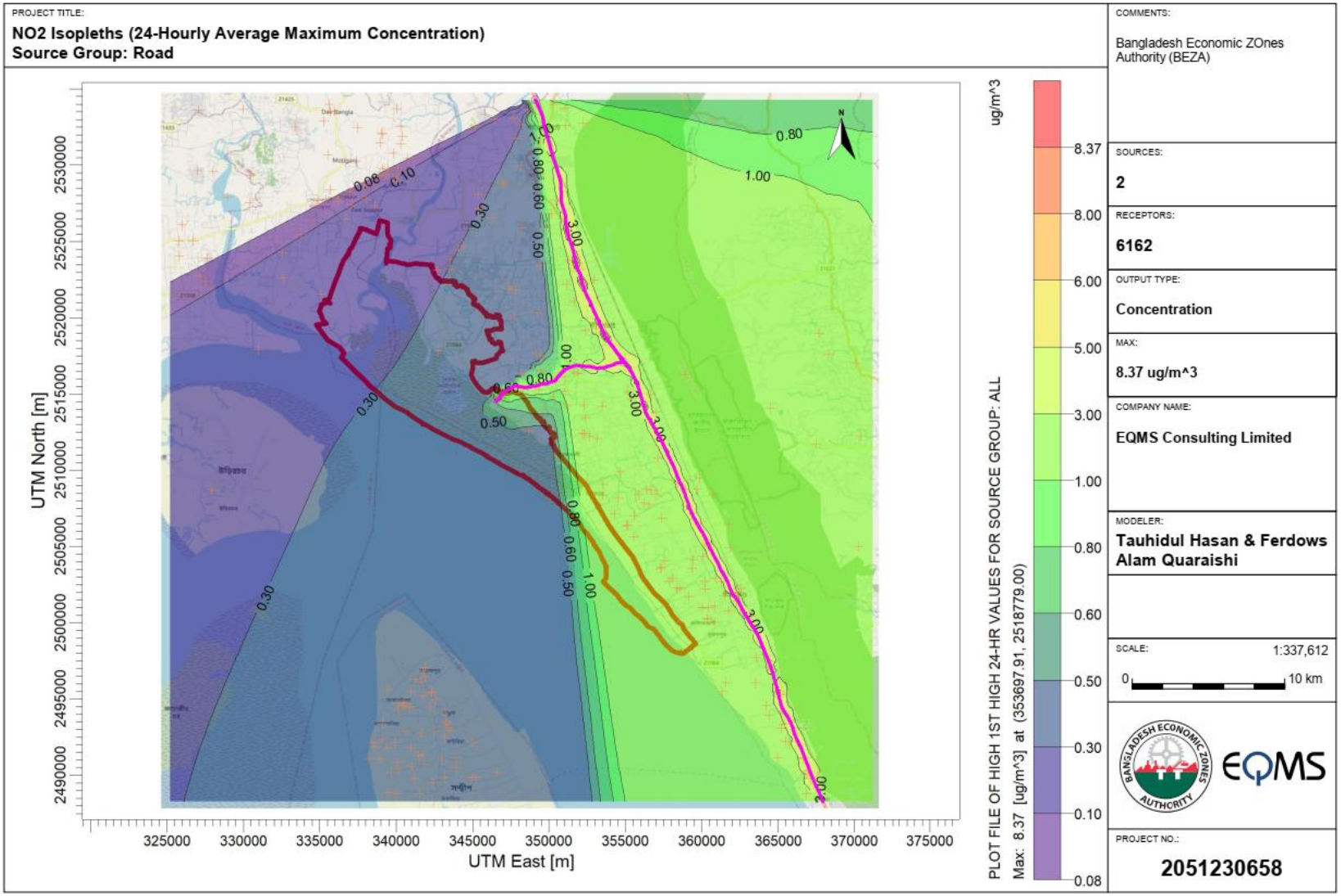


Figure 25: Isopleths of 24-Hourly Maximum NO_2 GLC- Road



1.2.7.3 Concentration of SO_2

The air quality monitoring result shows that the SO_2 concentration is well within the national standard. The industries located in the NSEZ and Sitakunda region are operating by gas. Hence, SO_2 emissions from these industries are comparatively lower than oil-based industries. In the NSEZ, there is only one HFO-based power plant which is the major contributor to generating SO_2 in the air shed. Combustion of fossil fuel (gas and oil) at high temperatures results in the generation of SO_2. The emission of SO_2 from oil-based power plants is almost three times higher than gas-based power plants.

Brick kilns are significant contributors to ambient SO_2 concentrations in and around the NSEZ. This highlights the widespread influence of brick kiln operations within the airshed, likely due to their high sulfur content fuels and low-stack heights, which lead to poor dispersion.

The contribution of SO_2 from existing industrial sources (power plants and other industries) in the air shed in the NSEZ and surrounding area was understood through predictions from the EPA Regulatory Model (AERMOD), as described above. The air quality modeling results for 24 hourly maximum ground level concentrations (GLCs) are presented in Table 9 while the isopleths generated for different scenarios, representing both 24 hourly maximum GLCs, are presented in Figure 26 to Figure 31.

Table 9: Predicted 24-Hourly Maximum Ground Level Concentration of SO_2

Monitoring Locations	Monitored Conc. of SO_2 ($\mu g/m^3$)	Predicted 24 Hourly Max Concentration of SO_2 ($\mu g/m^3$)					
		Power Plant	Industry		Brick Kiln	Road	All Sources
			Inside NSEZ	Outside NSEZ			
AQ1	11.63	10.86	1.23	0.23	7.32	0.008	11.54
AQ2	25.45	7.89	1.16	0.18	7.83	0.007	11.74
AQ3	24.38	14.98	1.04	0.17	10.63	0.034	20.23
AQ4	21.55	23.94	3.59	0.29	8.04	0.021	26.37
AQ5	15.40	14.50	2.02	0.31	11.46	0.038	21.68
AQ6	26.44	5.44	3.99	0.38	5.15	0.143	8.43
AQ7	31.52	5.21	2.94	0.29	7.61	0.410	10.95
AQ8	22.21	11.06	1.60	0.31	11.92	0.138	17.88
AQ9	39.90	5.73	2.95	0.42	6.59	0.303	11.23
AQ10	18.62	17.54	1.68	0.25	11.51	0.041	22.47

The air quality modeling study shows that the predicted contribution of SO_2 from the existing power plant varied from 5.21 $\mu g/m^3$ (minimum) i.e., only 16.5% of the monitored SO_2 concentration at AQ7 (Goll Chattor of Komor Ali Bazar, Mirsharai) to 23.94 $\mu g/m^3$ (maximum) i.e., 111.1% of monitored SO_2 concentration at AQ4 (Near BEZA Administrative Building, NSEZ).

The predicted contribution of SO_2 from industries inside the NSEZ varied from 1.04 $\mu g/m^3$ (minimum) i.e., 4.3% of the monitored SO_2 concentration at AQ3 (East side of the road, Bishumiyarhat, Zorarjong, Mirsharai) to 3.99 $\mu g/m^3$ (maximum) i.e., 15.1% of monitored SO_2 concentration at AQ6 (Beribadh Road, In front of Unigas Plant, Barabkunda, Sitakunda).

The predicted contribution of SO_2 from industries outside the NSEZ varied from 0.17 $\mu g/m^3$ (minimum) i.e., only 0.7% of the monitored SO_2 concentration at AQ3 (East side of the road, Bishumiyarhat, Zorarjong, Mirsharai) to 0.42 $\mu g/m^3$ (maximum) i.e., 1.1% of monitored SO_2 concentration at AQ9 (In front of the Government Technical School & College, Sitakunda).

The contribution of SO_2 from the brick kilns varied from 5.15 $\mu g/m^3$ (minimum) i.e., 19.5% of the monitored SO_2 concentration at AQ6 (Beribadh Road, In front of Unigas Plant, Barabkunda, Sitakunda)

to 11.92 µg/m^3 (maximum) i.e., 53.7% of monitored SO_2 concentration at AQ8 (Middle Abu Turab Bazar, Mirsharai, Chattogram).

The air quality modeling study shows that the predicted contribution of SO_2 from road varied from 0.007 µg/m^3 (minimum) i.e., 0.03% of the monitored SO_2 concentration at AQ2 (Near 7 no. Sonagazi Union parishad, Sonagazi, Feni) to 0.410 µg/m^3 (maximum) i.e., 1.3% of monitored SO_2 concentration at AQ7 (Goll Chattor of Komor Ali Bazar, Mirsharai).

The contribution of SO_2 from existing and future industries including power plants, chemicals, paint, steel, cement, fertilizers, petroleum refinery, glass, brick kilns, and road vehicles has been predicted through modeling study. The modeling result reveals that industrial, brick kiln and road sectors will cumulatively result in increased SO_2 concentrations varying from 8.43 µg/m^3 (minimum) i.e., 31.9% of the monitored SO_2 concentration at AQ6 (Beribadh Road, In front of Unigas Plant, Barabkunda, Sitakunda) to 26.37 µg/m^3 (maximum) i.e., 122.4% of monitored SO_2 concentration at AQ4 (Near BEZA Administrative Building, NSEZ).

The past, present, and future industrial activity will cumulatively impact on the condition of the NSEZ and the surrounding area air shed. The model shows that the contribution of SO_2 from the power plant in the NSEZ contributes maximum followed by brick kiln, other industries inside the NSEZ, industries outside the NSEZ, and road traffic.

Figure 26: Isopleths of 24-Hourly Maximum SO_2 GLC- All Sources

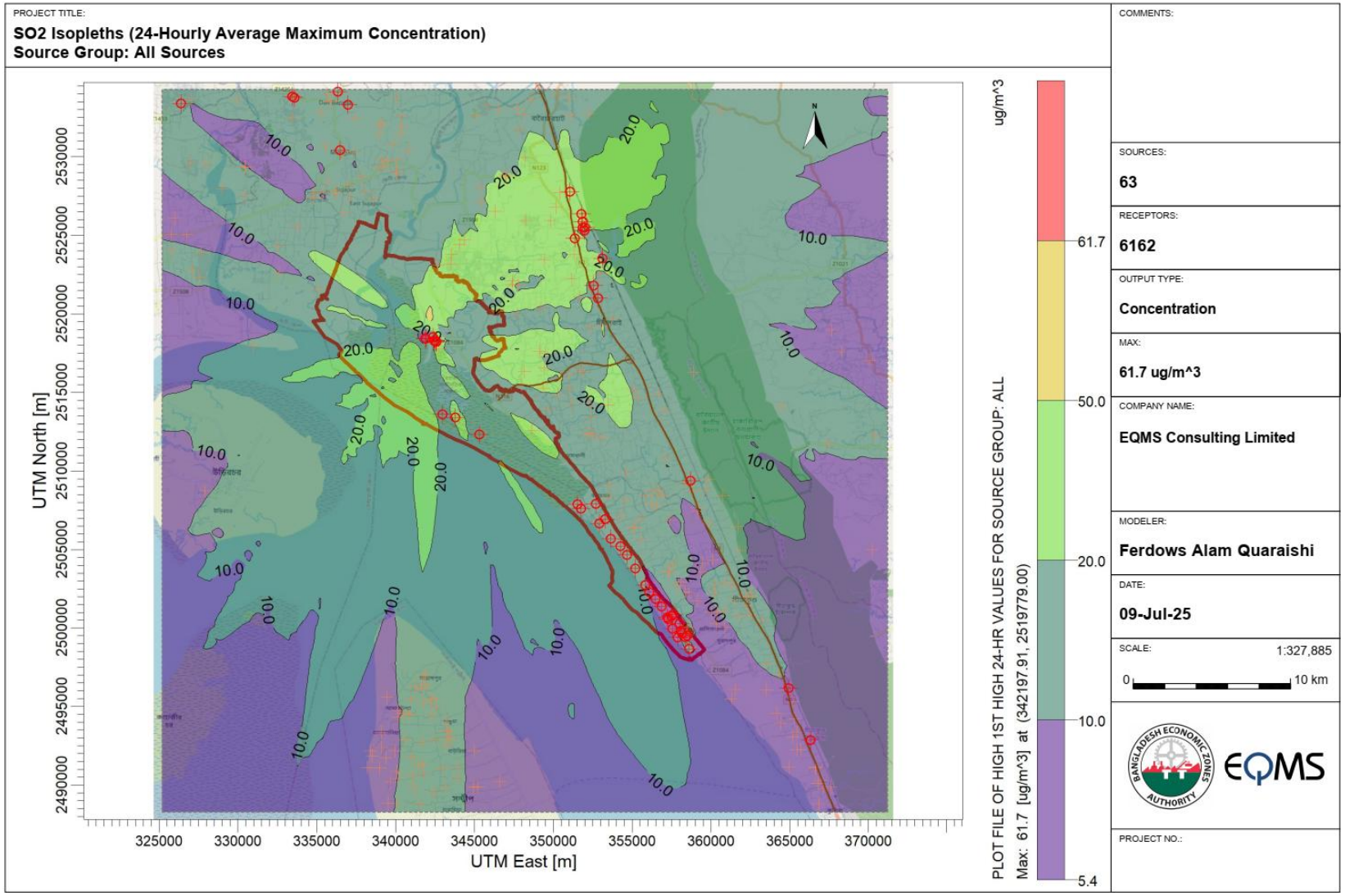


Figure 27: Isopleths of 24-Hourly Maximum SO_2 GLC- Power Plant

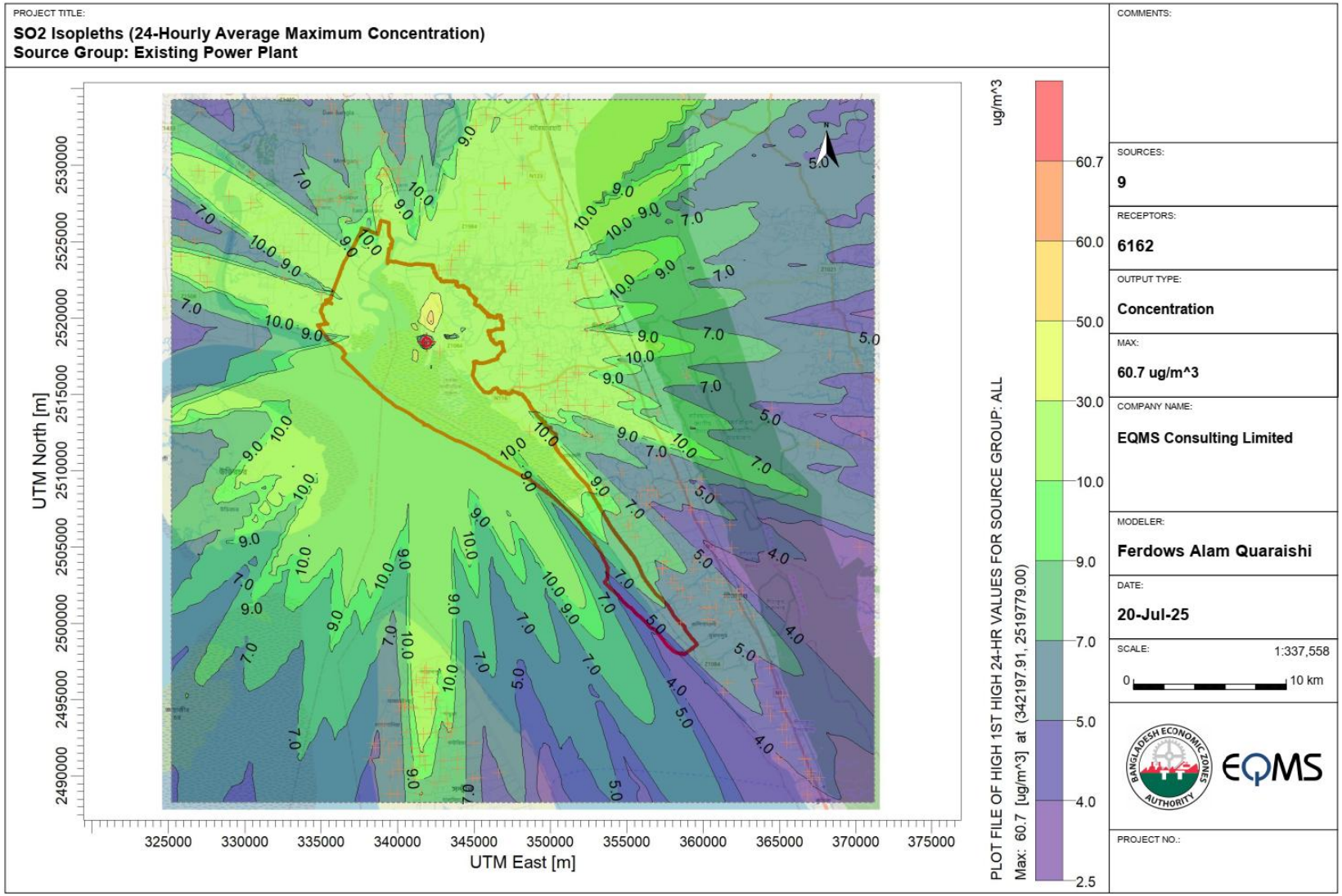


Figure 28: Isopleths of 24-Hourly Maximum SO_2 GLC- Industries Inside the NSEZ

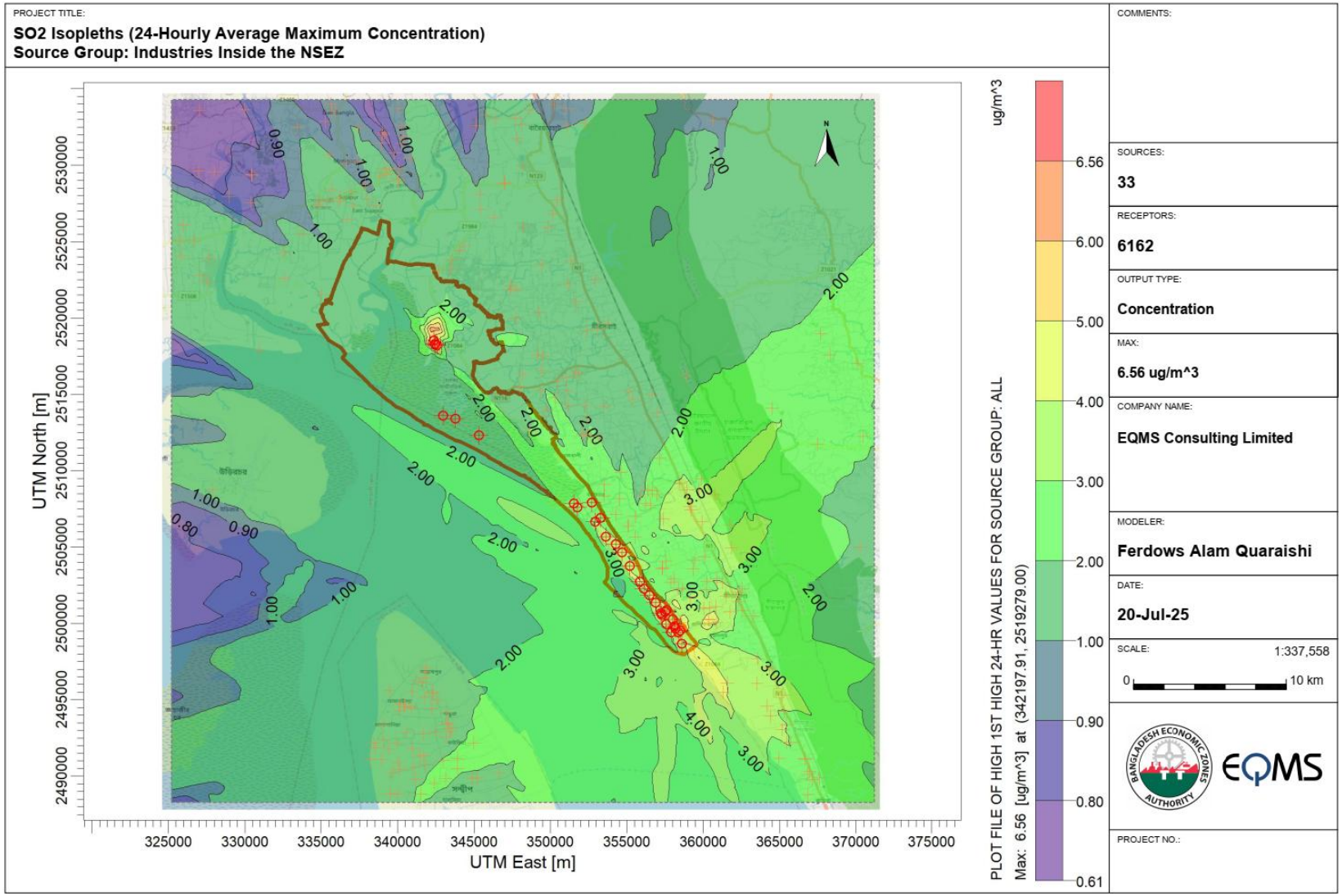


Figure 29: Isopleths of 24-Hourly Maximum SO_2 GLC- Industries Outside the NSEZ

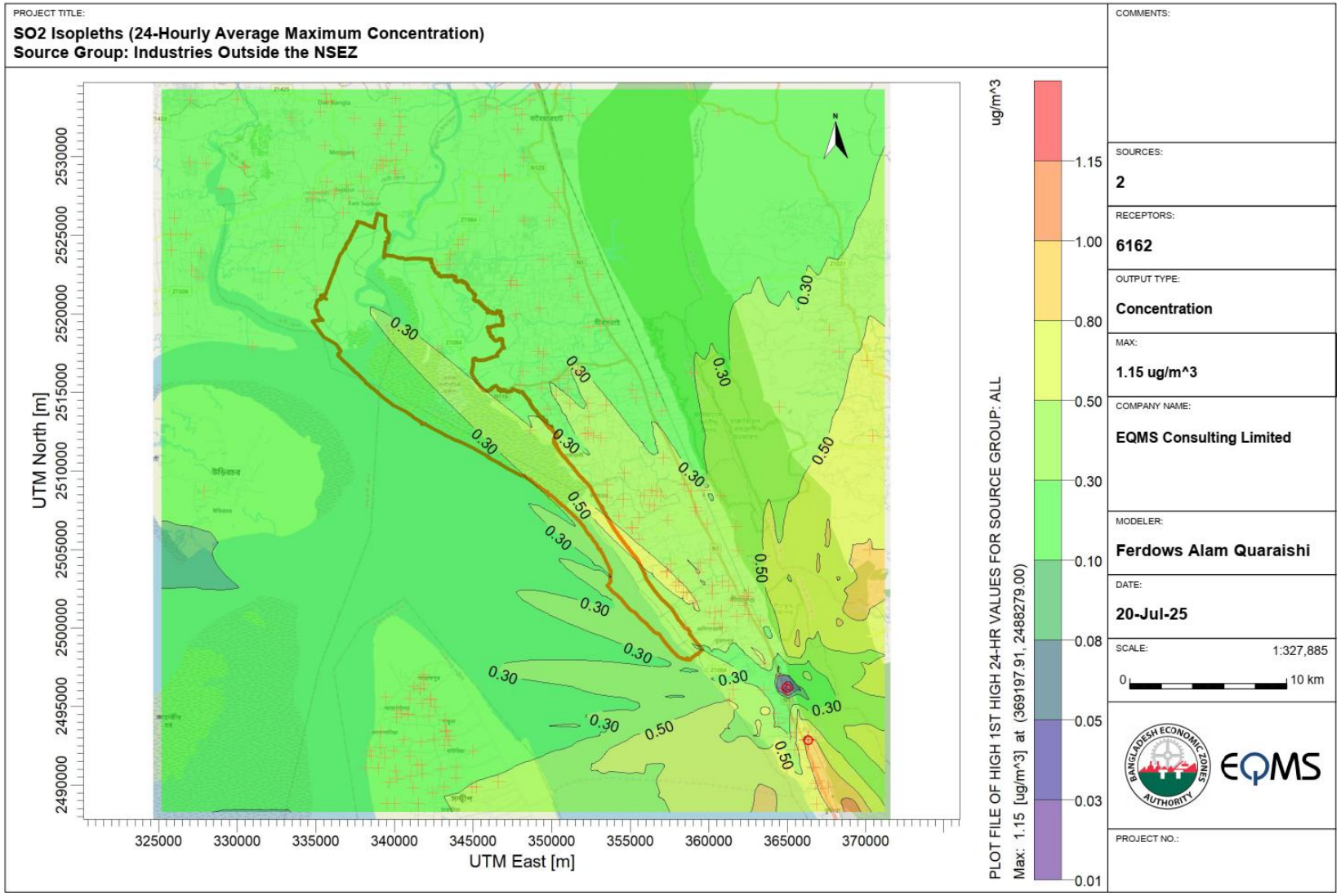


Figure 30: Isopleths of 24-Hourly Maximum SO_2 GLC- Brick Kiln

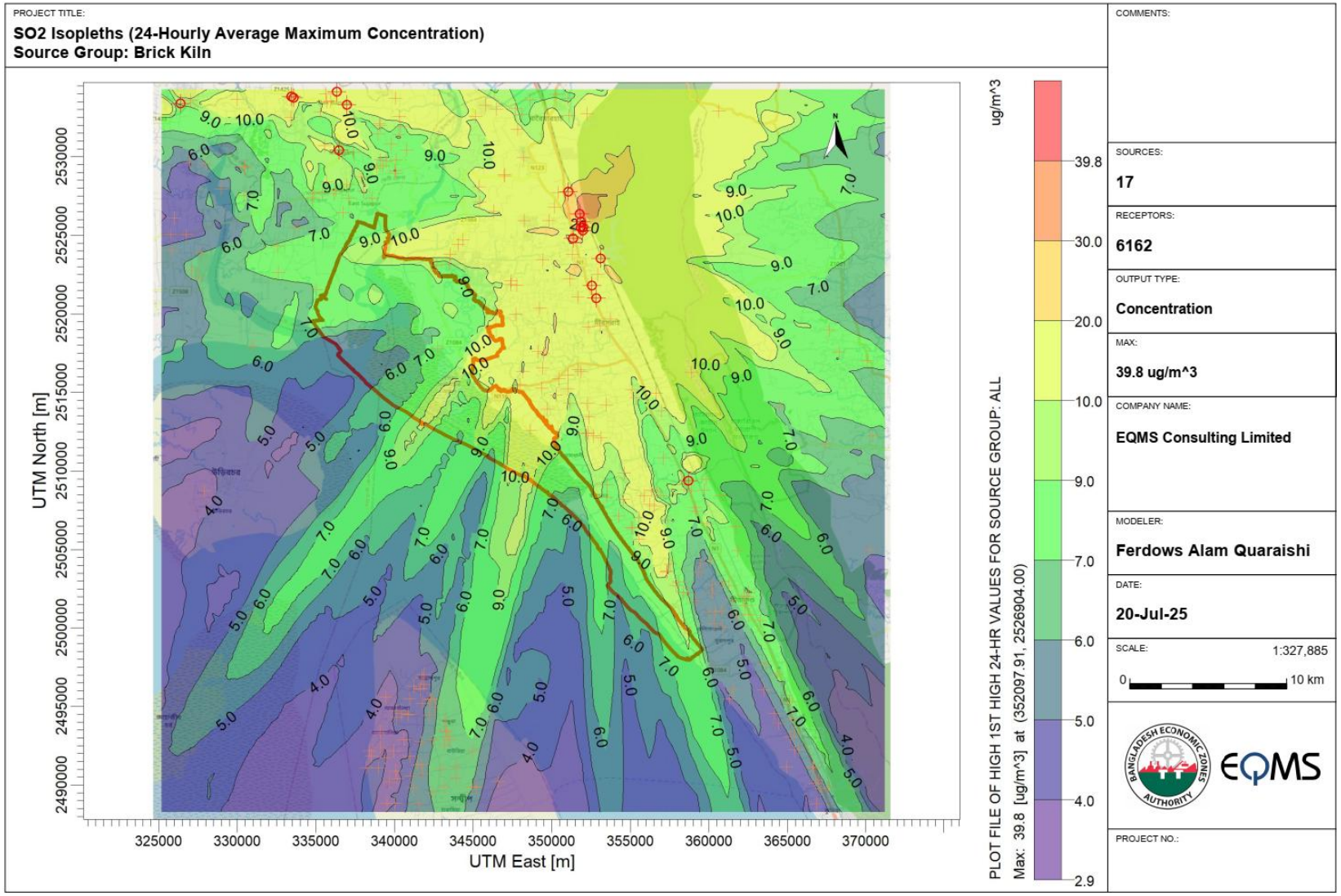
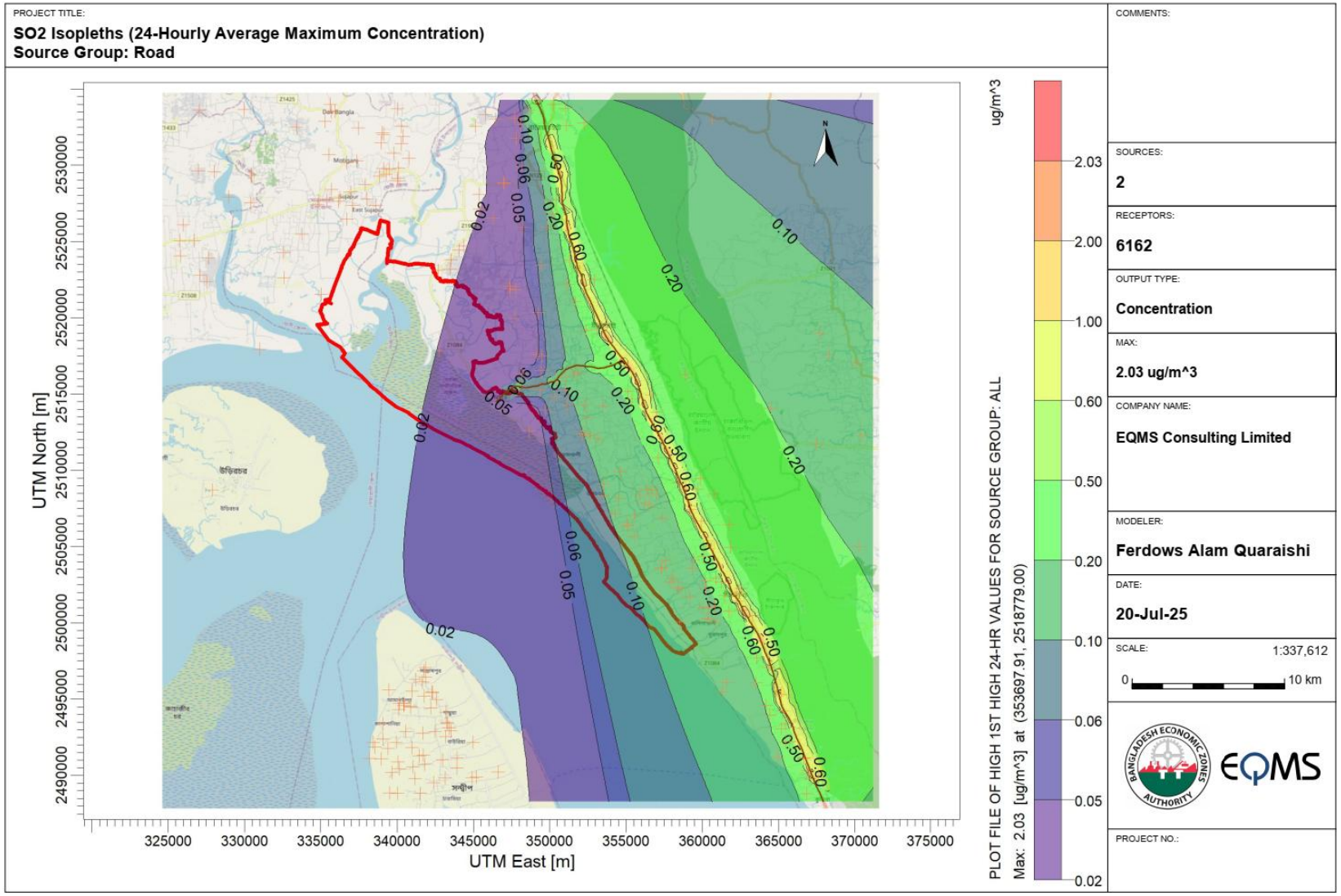


Figure 31: Isopleths of 24-Hourly Maximum SO_2 GLC- Road



APPENDIX H

Appendix H: Noise Modelling Report

Source of Noise

Major sources of noise in the NSEZ region are as follows:

- Operation of industries
- Vehicular movement

Noise Level Guidelines

Ministry of Environment, Forest, and Climate Change (MOEFCC) Bangladesh has set standards for noise levels for different areas of use. Ambient noise standard as per Noise Pollution (Control) Rules 2006 is presented in Table-1.

Table-1: Ambient Noise Standard for Bangladesh

SL#	Category of Area/Zone	Decibel dB(A) Leq	
		Day Time	Nighttime
1	Silent zone	50	40
2	Residential Area	55	45
3	Mixed zone	60	50
4	Commercial Area	70	60
5	Industrial Area	75	70

Note: Daytime is defined as the period 6.00 am-9.00 pm and night-time is defined as the period 9.00 pm-6.00 am.

International Finance Corporation (IFC) has also set Environmental, Health, and Safety (EHS) guidelines for ambient noise levels. Environmental, Health, and Safety noise guidelines of IFC are given in Table 2.

Table-2: IFC Noise Level Guidelines

Receptor	One Hour LAeq (dBA)	
	Day time 07:00 - 22:00	Nighttime 22:00 - 07:00
Residential, Institutional, Educational	55	45
Industrial, Commercial	70	70

Modeling Methodology

The environmental noise prediction model Sound PLAN 8.2 has been used for modeling noise emissions from the construction and operation of industries in the NSEZ and noise from other sources in the surrounding area. The existing noise sources in the region are shown in Table-3.

Table-3: Noise Generated from Existing Industries at NSEZ

SL #	Industry Name	Major Source of Noise	Noise Level dB(A)	Assumed noise escape after mitigation
1.	B-R Powergen Ltd.	Engine	110	70
		Charge air intake	150	85
		Exhaust gas outlet	140	85
		Radiator fans	75	75

SL #	Industry Name	Major Source of Noise	Noise Level dB(A)	Assumed noise escape after mitigation
		Pumps	85	85
		Compressors	85	85
2.	Asian Paint Bangladesh Ltd.	Process units	85	70
		Pumps	85	85
		Compressors	85	85
		Power plant	110	70
		Boiler room	85	70
		Utility room	85	70
3.	McDonald Steel Industries Ltd.	Factory Shed	85	70
4.	Basundhara Ready Mix	Mixer	85	85
		Vehicle washing plant	85	80
5.	Basundhara Chemical Industries Limited	Process unit	85	70
6.	Samuda Construction Ltd.	Process unit	85	70
7.	Marico Bangladesh Ltd.	Processing unit	85	70
8.	Nippon and McDonal Steel Industries Ltd.	Processing Unit	85	70

Traffic Data

- Traffic data has been taken from the traffic survey data conducted during the regional baseline study.

Modeling Output

Based on the noise propagation from the existing projects at NSEZ, a noise contour map has been prepared using the modeling tool. The existing scenario map for noise modeling is shown in Figure-1. The noise contour map of the NSEZ region is shown in Figure-2. The predicted noise levels at different receptor points are shown in Table-4.

Table-4: Predicted Noise Levels at Receptors for the Existing Condition

Receptor	Category of Area/ Receptor	Baseline Sound Pressure Levels at Receptors, Leq (dBA)[3]		Predicted Sound Pressure Levels at Receptors, Leq (dBA)		Total Sound Pressure Level (Baseline + Predicted), Leq (dBA)		Applicable National Standard[4], dB(A) as per Land use		IFC Guidelines	
		Leqd	Leqn	Leqd	Leqn	Leqd	Leqn	Leqd	Leqn	Leqd	Leqn
ANL-1	Industrial	48.0	44.0	47.5	47.5	50.8	49.1	75	70	70	70
ANL-2	Mixed	62.2	53.5	57.5	57.5	63.5	59.0	60	50	55	45
ANL-3	Silent	60.6	48.4	<20.0	<20.0	60.6	48.4	50	40	55	45
ANL-4	Commercial	69.6	58.4	<20.0	<20.0	69.6	58.4	70	60	70	70
ANL-5	Commercial	60.2	39.4	27.5	27.5	60.2	39.7	70	60	70	70

[3] Ambient noise levels as monitored during the regional baseline survey
[4] Noise Pollution (Control) Rules, 2006

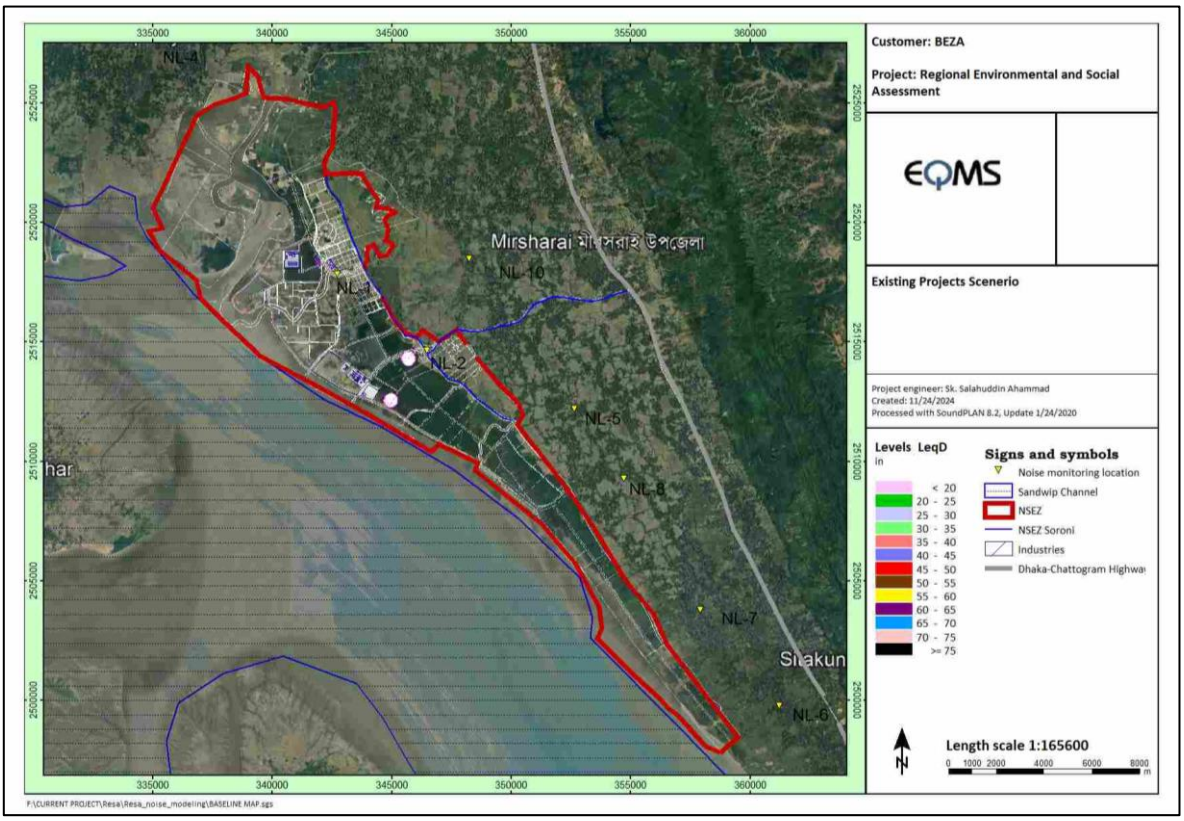
Receptor	Category of Area/ Receptor	Baseline Sound Pressure Levels at Receptors, Leq (dBA)[3]		Predicted Sound Pressure Levels at Receptors, Leq (dBA)		Total Sound Pressure Level (Baseline + Predicted), Leq (dBA)		Applicable National Standard[4], dB(A) as per Land use		IFC Guidelines	
		Leqd	Leqn	Leqd	Leqn	Leqd	Leqn	Leqd	Leqn	Leqd	Leqn
ANL-6	Commercial	65.0	51.6	<20.0	<20.0	65.0	51.6	70	60	70	70
ANL-7	Commercial	61.0	51.9	<20.0	<20.0	61.0	51.9	70	60	70	70
ANL-8	Commercial	61.1	57.9	<20.0	<20.0	61.1	57.9	70	60	70	70
ANL-9	Industrial	60.7	46.4	<20.0	<20.0	60.7	46.4	75	70	70	70
ANL-10	Commercial	56.5	47.0	32.5	32.5	56.5	47.2	70	60	70	70

Source: EQMS, June 2024

Discussion

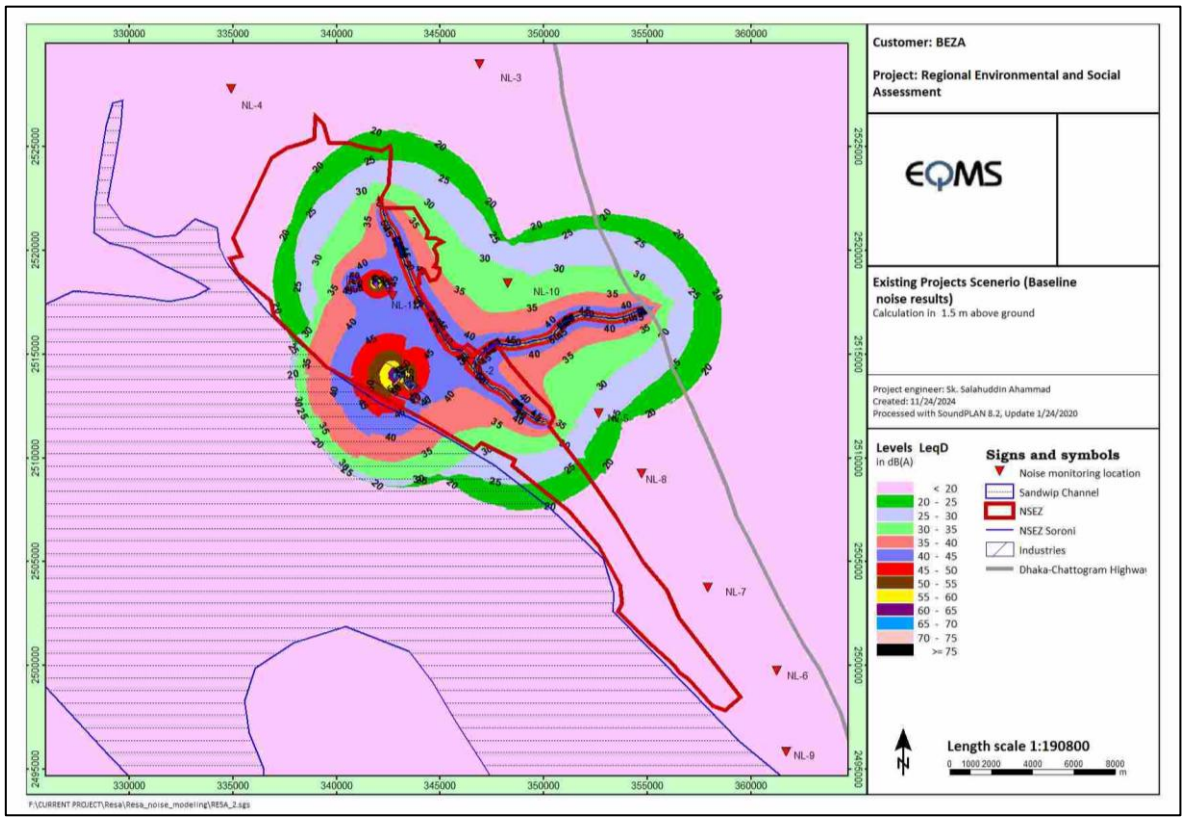
It has been observed that the predicted noise level in all the receptors is within the permissible limit set in the Noise Pollution (Control) Rules 2006, except the ANL-2 which already exceeds the standard due to industrial activities and vehicular movement around the receptors. However, the incremental noise level at ANL-2 is very low.

Figure-1: Noise Modeling set up for the NSEZ



Source: EQMS, June 2024

Figure-2: Noise Contour Map for Operation of Existing Industries and Vehicle Movement at NSEZ Region



Source: EQMS, June 2024

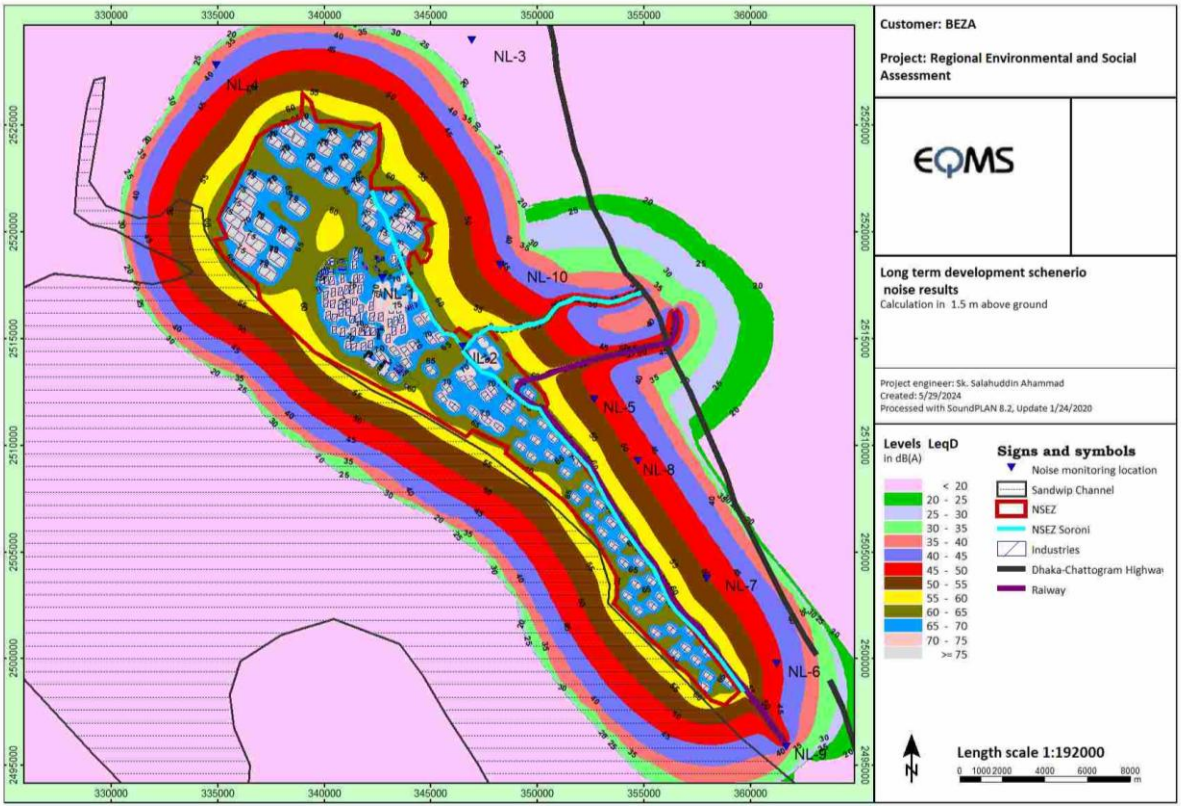
Based on the noise propagation from all the projects at the economic zone, a noise contour map has been prepared using the modeling tool. The predicted noise level at different receptor points is shown in Table-5 and the noise contour map is shown in Figure-3.

Table-5: Predicted Noise Levels at Receptors for the full phase development of NSEZ

Receptor	Category of Area/Receptor	Baseline Sound Pressure Levels at Receptors, Leq (dBA)[1]		Predicted Sound Pressure Levels at Receptors, Leq (dBA)		Total Sound Pressure Level (Baseline + Predicted), Leq (dBA)		Applicable Standard, dB(A) [2] as per Land use		IFC Guidelines	
		Leqd	Leqn	Leqd	Leqn	Leqd	Leqn	Leqd	Leqn	Leqd	Leqn
ANL-1	Industrial	48.0	44.0	65.2	65.2	65.3	65.2	75	70	70	70
ANL-2	Mixed	62.2	53.5	63.4	63.4	65.9	63.8	60	50	55	45
ANL-3	Silent	60.6	48.4	<20	<20	60.6	48.4	50	40	55	45
ANL-4	Commercial	69.6	58.4	38.9	38.9	69.6	58.4	70	60	70	70
ANL-5	Commercial	60.2	39.4	49.7	49.7	60.6	50.1	70	60	70	70
ANL-6	Commercial	65.0	51.6	46.2	46.2	65.1	52.7	70	60	70	70
ANL-7	Commercial	61.0	51.9	50.3	50.3	61.4	54.2	70	60	70	70
ANL-8	Commercial	61.1	57.9	48.9	48.9	61.4	58.4	70	60	70	70
ANL-9	Industrial	60.7	46.4	38.7	38.7	60.7	47.1	75	70	70	70
ANL-10	Commercial	56.5	47.0	45.6	45.6	56.8	49.4	70	60	70	70

Source: EQMS, January 2025

Figure-3: Noise Contour map for full phase development of NSEZ



Source: EQMS, January 2025

It has been observed that the predicted noise level in all the receptors is within the permissible limit set in the Noise Pollution (Control) Rules 2006, except the ANL-2 and ANL-3 which already exceeds the standard due to industrial activities and vehicular movement around the receptors. In addition, few locations are very close to the national noise level standards.

APPENDIX I

Appendix I: List of Roads

Appendix I-1: Road in Mirsharai Upazila, Chattogram District

SL#	Type of Road	Proposed Road ID	Name of the Road	Length (km)	Remarks
1.	VR-A		Bamonsundur Darogarhut Road (Zone-11 Jahangir Bolli Shop to Boshor Membar Bridge)	4.05	Earthen
2.	VR-A		Nondobashi Road (Eone-12, Babul Soudagor Shop to Four Road Crossing Charsarat Banglabazar)	0.4	Earthen
3.	VR-A		Obaydul Hoq Master House Road (Zone-12 to Old Dyke Road)	0.41	Earthen
4.	VR-A		Daborkhali Road (Zone-13, Noyon Soudagor Shop to Charsorot Old Dyke Road)	0.45	Earthen
5.	VR-A		Chaina Babul Road (Zone-13 Shohider Shop to Charsorot Banglabazar Road)	0.43	Earthen
6.	VR-A		Malomazir Road (Zone-13 to Charsorot Banglabazar Road)	0.42	Earthen
7.	VR-A		Abu Bakar Road (Zone-13 Abu Bakar Masque to Charsorot Banglabazar Road)	0.42	Earthen
8.	VR-A		Charsorot Master Road (Choesor Nondobashi Road to Front Side of Charsorot Mondir)	2.65	Earthen
9.	VR-A		Choani Road (Beside the Zone-18 to Bortakia Road)	0.76	Earthen
10.	VR-A		Hoania Road (Zone-20 Hoani to Amtola Road)	1.55	Earthen
11.	VR-A		Hazi Ali Akbor Road (Zone-22, Bechur Shop to Khayer Hat Road)	1.3	Earthen
12.	VR-A		Ismail Road (Zone-22, Alamin House to Khayer Hat Road via Ismail Road)	0.78	Earthen
13.	VR-A		Hasan Mistry Road (Hazi Ali Akbor Road to Ismail Road)	1	Earthen
14.	VR-A		Nozir Ahmed Road	1	Earthen
15.	VR-A		Beside the Sayed Choudhory Firm Road (Zone-23 Baribad to South Side via Mostofa Chairme House to Domkhali Road)	1.43	Earthen

SL#	Type of Road	Proposed Road ID	Name of the Road	Length (km)	Remarks
16.	VR-A		Middle Domkhali Gopat (Zone-23 Baribad to Domkhali Road)	1.3	Earthen
17.	VR-A		South Domkhali Gopat (Zone-23 Baribad to South Domkhali Mosque Road)	0.6	Earthen
18.	VR-A		Mother of Acia Gopat Road (Zone-7 Baribad to Ashak Driver Road)	1.8	Earthen
19.	VR-A		Chairmen Road (Zone-6 Baribad to Near Haidar Ali Mazi Bari)	3.1	Earthen
20.	VR-A		Old Varibad Road (Vabir More to Zone-7 Taker Hat Road)	2.8	Earthen
Total Length = 26.23 km					

Appendix I-2: Road in Sonagazi Upazila, Feni District

SL#	Type of Road	Proposed Road ID	Name of the Road	Length (km)	Remarks
1.	VR-A		Jinnat Ali Road (Char Khondokar road to Abuler char)	1.5	Earthen
2.	VR-A		South char chandia gov. school road (Jinnat Ali road to River Broken Point)	1.8	Earthen
3.	VR-A		Wapda Dyke Road (Mohori project to Chourasta fish zone)	4.3	Earthen
4.	VR-A		Charchandia road (Rice Research Institute Road to Charchandia River Broken point)	2.1	Earthen
5.	VR-A		Freedom Fighter Road (Rice Research Institute Road to Charchandia Road)	0.65	Earthen
6.	VR-A		Kella Road (Safiullah Sareng Panja Kana Masjid to Charchandia south side)	1.0	Earthen
7.	VR-A		Mochapur Road (Kella Road to Mochapur Closer)	3.4	Earthen
Total Length 14.75 km					

APPENDIX J

Appendix J: Disaster Risk Assessment and Disaster Risk Management Plan

1.1 General

BEZA has decided to establish the NSEZ on approximately 33,805 acres of land at Feni and Chattogram District of Bangladesh. NSEZ is planned by the GOB and is going to be the third largest megacity in Bangladesh which includes several types of construction viz. road, seaport, rail connectivity, industrial areas, marine drive, residential area, hospital, school, university, etc. The EZ is located on the coastline along the Sandwip Channel in the Bay of Bengal and is vulnerable to different natural disasters. It is therefore, important to formulate a disaster risk assessment and disaster risk management plan for the NSEZ in order to be in a state of preparedness to respond in a structured and systematic manner to disasters when they occur, so that loss of human life is minimized, and recovery is possible within a short time after any major disaster in NSEZ region.

1.2 Legislations relating to Disaster Management in Bangladesh

The legal framework for disaster management in Bangladesh is given below:

- Disaster Management Act 2012
- Disaster Management Policy 2015
- Standing Orders on Disaster 2010
- National Plan for Disaster Management 2010-2015
- Earthquake Contingency Planning
- National Strategy on the Management of Disaster and Climate-induced Internal Displacement 2015

1.3 Identification of Natural Disasters in the Study Region

1.3.1 Cyclone and Tidal Surges

Bangladesh's coast is one of the most cyclone-prone areas of the world due to its geographical location and funnel-shaped coast of the Bay of Bengal. The cyclone season in the Bay of Bengal mainly occurs in the pre-monsoon and post-monsoon seasons, between April-May and October-November. The high winds and rainfall associated with cyclones cause flooding, landslides, damage to infrastructure, destruction of crops, and disruption to services, as well as injuries and fatalities.

Most of the damage occurs in the coastal districts such as Khulna, Barguna, Patuakhali, Barisal, Noakhali, and Chattogram, and the offshore islands of Bhola, Hatiya, Sandwip, Manpura, Kutubdia, Maheshkhali, Nijhum Dwip, Urir Char, and many other newly formed islands. Devastating cyclones hit the coastal zones almost every year and are usually accompanied by high-speed winds, sometimes reaching 230 km/hr. or more and with 2 feet to 33 feet-high waves, causing extensive damage to life, property, and livestock. The NSEZ area is located in the high-risk zone for cyclones and its associated disasters like storm surges. A list of major cyclonic storms and associated tidal surge height in the Chattogram coast is given in Table-1. A map of the cyclone storm track on the Bangladesh coast is shown in Figure-1.

Table-1: Major Cyclonic Storms and Tidal Surges Height in Chattogram Coast

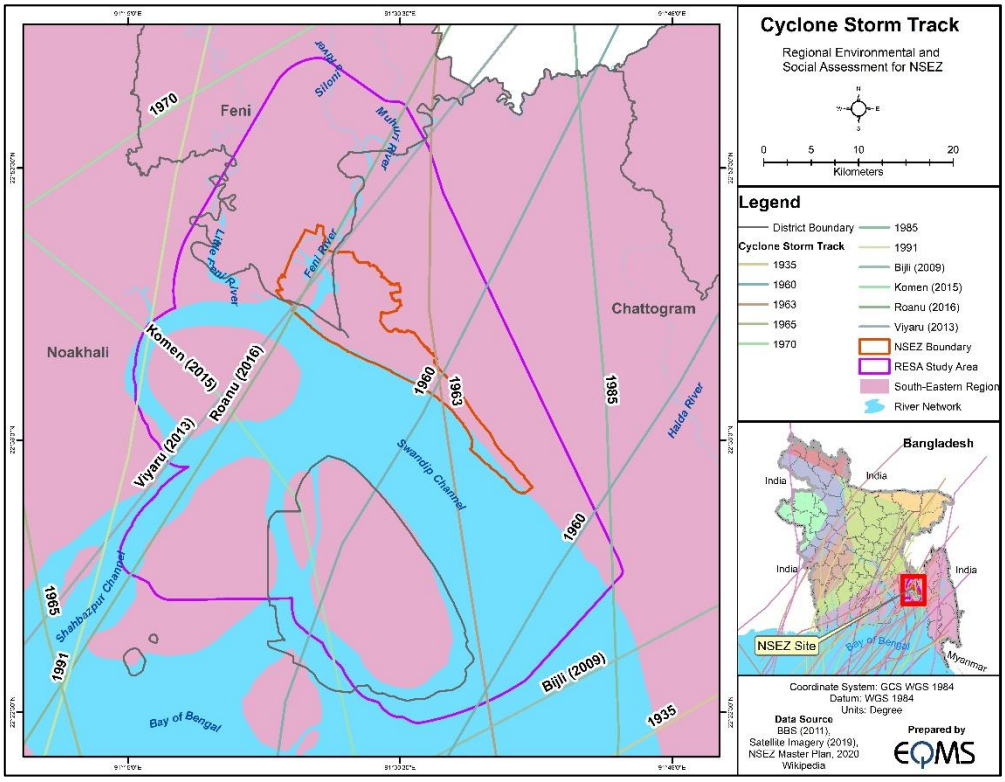
Date of Occurrence	Landfall Area	Max. Wind Speed (km/hr.)	Tidal Surge Height (feet)
11/10/1960	Chattogram	160	15
31/10/1960	Chattogram	193	20
09/05/1961	Chattogram	160	8-10
30/05/1961	Chattogram (near Feni)	160	6-15

Date of Occurrence	Landfall Area	Max. Wind Speed (km/hr.)	Tidal Surge Height (feet)
28/05/1963	Chattogram-Cox's Bazar	209	8-12
11/05/1965	Chattogram-Barisal Coast	160	12
15/10/1965	Chattogram	160	8-12
01/11/1966	Chattogram	120	20-22
12/11/1970	Chattogram	224	10-33
15/10/1983	Chattogram	93	-
24/05/1985	Chattogram	154	15
29/04/1991	Chattogram	225	12-22
19/05/1997	Sitakundu, Chattogram	232	15
27/09/1997	Sitakundu, Chattogram	150	10-15
16-20/05/1998	Sitakundu, Chattogram	150	1.83-2.44
19/05/2004	Cox's Bazar and Akyab	65-90	0.6-1.2
14-15/05/2007	Chattogram - Cox's Bazar	120	-
15/11/2007	Southern Bangladesh	260	-
26/11/2008	Bangladesh coast	85	-
17/04/2009	Chattogram - Cox's Bazar coast near Chattogram	90	-
27-29/05/2009	15 districts of the south-western part of Bangladesh	120	-
16-17/05/2013	Noakhali-Chattogram	100	1-1.5
29/07/2015	Chattogram-Cox's Bazar	95	5-7
21/05/2016	Barisal-Chattogram coast near Patenga	128	4-5
30/05/2017	Chattogram-Cox's Bazar Coast near Kutubdia	146	1.2-1.5
9/11/2019	Khulna, Barisal, and Chattogram	139	-
04/10/2021	Chattogram	111	-
24/10/2022	Chattogram, Barisal, Dhaka	83	-
14/05/2023	Chattogram	256	-
25/10/2023	Chattogram	148	-
17/11/2023	Khulna, Barisal, and Chattogram	72	-

Source: Bangladesh Meteorological Department, December 2023 and Worlddata.info[5]

[5] https://www.worlddata.info/asia/bangladesh/cyclones.php

Figure-1: Cyclone Storm Track in Bangladesh Coast



Source: Banglapedia and EQMS Database, Bangladesh

1.3.2 Earthquake

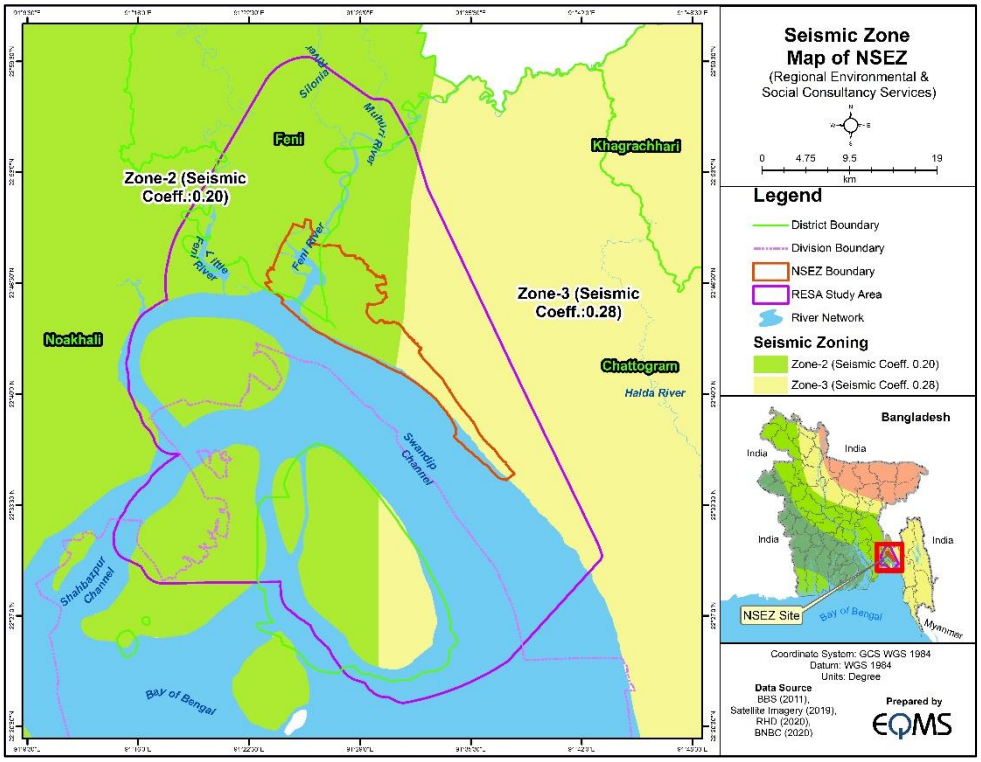
Bangladesh can be affected by moderate to strong earthquake events due to its proximity to the collision boundary of the northeast-moving Indian Plate and Eurasian Plate. Strong historical earthquakes with a magnitude greater than 7.0 have affected parts of Bangladesh in the last 150 years, some of them had their epicenters within the country. According to the Bangladesh National Building Code 2020, the country has been divided into four seismic zones with different levels of ground motion. Each zone has a seismic zone coefficient (Z) which represents the maximum considered peak ground acceleration on very stiff soil/rock in units of g (acceleration due to gravity). The NSEZ site and study region fall in both severe seismic intensity zone (zone 3) with coefficients of 0.28 and moderate seismic intensity zone (zone 2) with coefficients of 0.20. Table-2 includes a description of the four seismic zones and a map of the seismic zone is shown in Figure-2.

Table-2: Description of Seismic Zones

Seismic Zone	Location	Seismic Intensity	Seismic Zone Coefficient, Z
1	Southwestern part including Barisal, Khulna, Jessore, Rajshahi	Low	0.12
2	Lower Central and Northwestern parts including Noakhali, Dhaka, Pabna, and Dinajpur, as well as Southwestern corner including Sundarbans	Moderate	0.20
3	Upper Central and Northwestern parts including Brahmanbaria, Sirajganj, Rangpur	Severe	0.28
4	Northeastern part including Sylhet, Mymensingh, Kurigram	Very Severe	0.36

Source: Bangladesh National Building Code (BNBC), 2020

Figure-2: Seismic Zone Map of Bangladesh



Source: Bangladesh National Building Code (BNBC)

Historically Bangladesh has been affected by five earthquakes of large magnitude (≥7.0) from 1869 to 1930. One of the strongest earthquakes of the world, the Great Indian earthquake in Shillong, Assam on 12 June 1897, had an epicentral distance of about 230 km from Dhaka, its magnitude has recently been re-estimated to be 8.1. Two of these earthquakes had their epicenters within the country. The 14 July 1885 Bengal earthquake, measured as 7.0, originated near Bogra in Bangladesh. The Srimangal earthquake occurred in the Sylhet region of Bangladesh on 8 July 1918 and its magnitude was determined as 7.6. In addition, some historical reporting points out the occurrence of a major earthquake (>7) near Chattogram in 1762. Table-3 gives brief information about these major earthquakes.

Table-3: List of Major Regional Earthquakes

Date	Epicenter	Magnitude	Effects
02/04/1762	Near Chattogram	>7.0	Some changes in landforms in the coastal area and liquefaction
10/01/1869	Cachar, Assam	7.5	Some damage occurred in Sylhet
12/06/1897	Shillong, Assam	8.1	Greatest damage in Rangpur including a railway line and buildings; intense ground fissures and vents in Mymensingh, Jamalpur, Sylhet; damages to masonry buildings covering a major portion of Bangladesh including Dhaka
08/07/1918	Srimangal, Sylhet	7.6	Collapse/severe damage of buildings in Srimangal, damage to buildings in Habiganj, Moulvibazar
1950	Assam, India	8.4	The tremor was felt throughout Bangladesh, but no damage was reported
1997	Chattogram	6.0	Minor damage around Chattogram town

Date	Epicenter	Magnitude	Effects
1999	Maheshkhali Island	5.2	Severely felt around Maheshkhali island and the adjoining sea. Houses cracked and, in some cases, collapsed
2006	Narail	4.2	The tremor was widely felt in Dhaka as well as other places in the country
2008	Mymensingh city	5.1	Caused panic, tremors from this earthquake were felt in many parts of the Dhaka metropolitan area
2008	Kachua of Chandpur	4.5	Caused tremendous panic among the city dwellers
12/01/2008	Rangamati	5.0	No casualties
07/11/2007	Chattogram, Bandarban, Rangamati	5.1	No casualties
2009	Andaman Islands and Myanmar	7.5	No significant damage was reported throughout Bangladesh, but the tremor was felt strongly in Dhaka
10/09/2010	Narayanganj	4.8	No casualties
18/03/2012	Dhaka	4.5	14 km ENE of Dohar, Bangladesh
04/01/2016	Sylhet	6.7	180 kilometers east of Sylhet
26/11/2021	Chattogram	6.2	5 injuries
23/01/2023	Sylhet	5.1	122 km E from Sylhet
16/06/2023	Sylhet	5.0	24km SE from Sylhet
14/08/2023	Sylhet	5.3	39 km ENE from Sylhet
11/09/2023	Sylhet	5.0	307 km E from Sylhet
02/12/2023	Cumilla	5.5	46 km SW from Cumilla

Source: BNBC 2020, Banglapedia, Asiatic Society of Bangladesh.

In recent years, the occurrence and damage caused by several earthquakes (magnitude between 4 and 6) inside the country or near the country's border, has raised an alarm. The 21 November 1997, a magnitude 6.0 earthquake at the Bangladesh-Myanmar border triggered the collapse of an under-construction reinforced concrete frame building that killed several people in the port city of Chattogram. The 22 July 1999 magnitude 5.1 earthquake with its epicenter very near the island of Moheshkhali, near Cox's Bazar, caused extensive damage and collapse of rural mud-walled houses, as well as damaging column of cyclone shelter. The December 2001 magnitude 4.0+ earthquake with its epicenter very near Dhaka city caused panic and injuries to prison inmates at the Dhaka Central Jail. In the 27 July 2003 magnitude 5.6 Rangamati earthquake, in the village of Kolabunia, brick masonry buildings as well as mud-walled houses were severely damaged.

1.3.3 Tsunami

Tsunamis are a series of waves produced by the displacement of a large volume of water generally generated by earthquakes or volcanic eruptions. The coastal belt of Bangladesh is located in an area of a potential tsunami. Though the Indian subcontinent is in a seismically active region, tsunamis along the coastline of India and Bangladesh have been rare, but not unprecedented. The historical records of the tsunami in the Bay of Bengal are given in Table-4.

Table-4: Historical Tsunami in the Bay of Bengal

Date	Place of Occurrence	Height of Water	Damage
11 & 12/10/1737	Mouth of the River Ganges	40 ft	Not Available
02/04/1762	Arakan Coast	22 ft	200 people with all their cattle lost; permanent submergence of 60 sq. miles near Chattogram
11/11/1842	Near the northern end of the Bay of Bengal	NA	Not Available
May 1874	Bhola District	-	Killing several hundred thousand people
31/12/1881	Car Nicobar Island (7.9 magnitudes)	0.8m - 1.0m	Not Available
1884	Western part of the Bay of Bengal	-	Not Available
June 1941	Andaman Sea (8.1 magnitude)	0.75m - 1.25m	Damage masonry structures and property in places like Chennai
December 2004	Sumatra-Andaman earthquake	Few meters	Some buildings in Chattogram got cracked and two deaths were caused in the coast

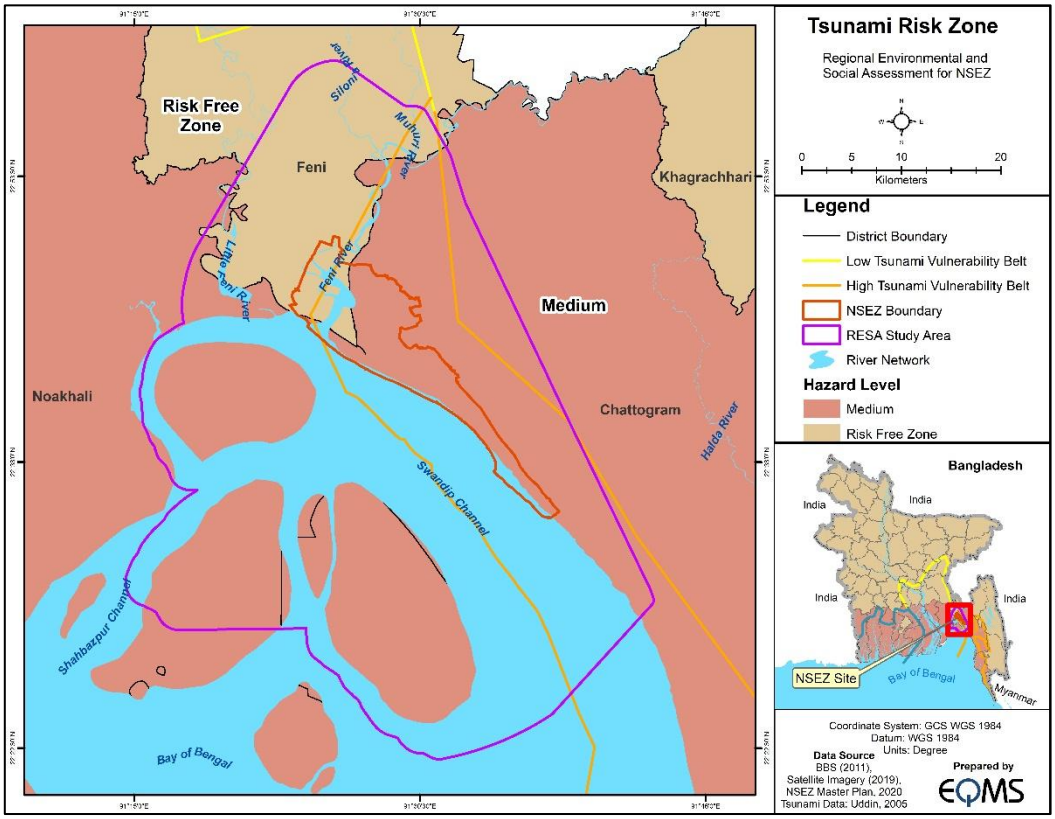
Source: Khan 2007; Mathur 1998; Rastogi et. al. 2006; Berninghausen, 1966; Murty et. al. 1999; Rizvi, S.N.H. 1975; http://www.freejournal.net

Considering the state of tsunami vulnerability and potential seismic sources, the coastal belt is classified into three tsunamigenic zones (Uddin, 2005) as shown in Figure-3. In this map, the coastal belt of Bangladesh is divided into three Tsunami Vulnerability Belts.

- Tsunami Vulnerability Coastal Belt-I of the Chittagong-Teknaf coastline-most vulnerable. The intra-deltaic coastline is very close to the tectonic interface of the Indian and Burmese plates. The active Andaman-Nicobar fault system is often capable of generating tsunami waves.
- Tsunami Vulnerability Coastal Belt-II of the Sundarbans-Barishal coastline-moderately vulnerable. This old deltaic belt is extremely vulnerable to local tsunamis due to the presence of Swatch of No Ground nearby.
- Tsunami Vulnerability Coastal Belt-III of the Barishal-Sandwip estuarine coastline-low vulnerability. The estuarine coastal belt is considered to be less vulnerable due to the presence of numerous islands and shallow mudflats in the upper regime of the continental shelf.

According to this classification, the NSEZ area falls within Zone-I, which is reportedly the most vulnerable belt.

Figure-3: Tsunami Vulnerability Map of Bangladesh



Source: Uddin, 2005

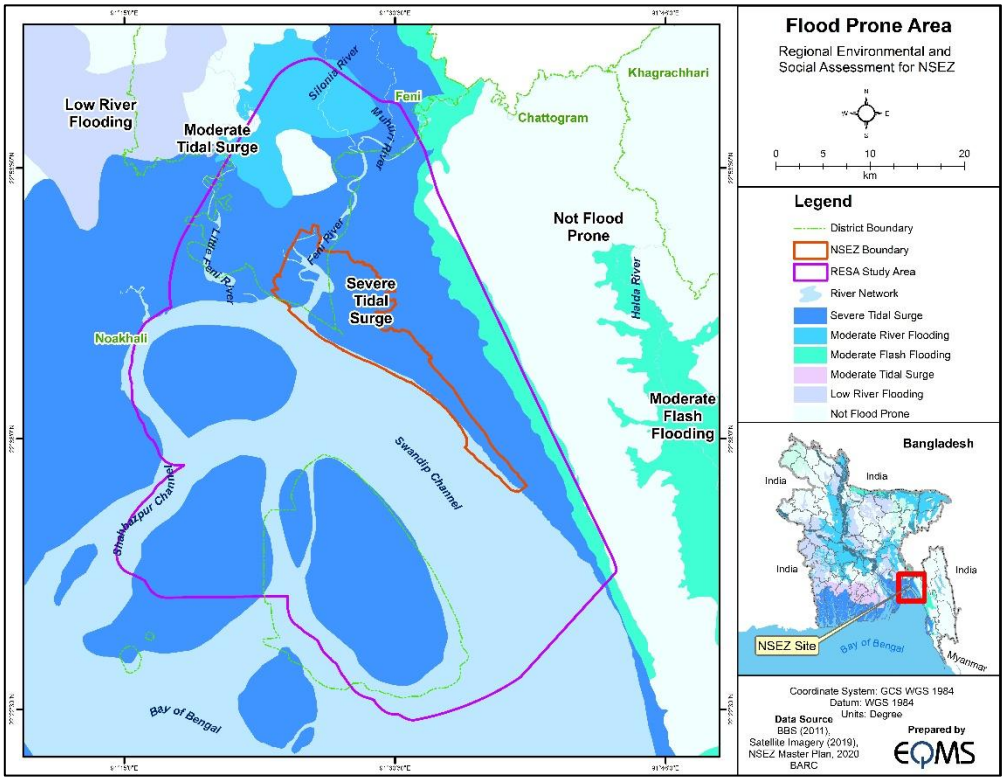
1.3.4 Flood

The NSEZ site is located on the shoreline of the Bay of Bengal and is highly vulnerable to coastal floods caused by tidal/storm surges. As a result, a super dyke has been constructed along the EZ boundary to protect the EZ from tidal surges/storm surges.

According to the Mirsharai Upazila Disaster Management Plan, Mirsharai is an extremely flood-prone area (UDMP, 2014a). Flood prevails here from June to October. Consequently, agriculture, fisheries, infrastructure, households, education, communication, and other sectors are heavily affected by floods. Though it happens each year the floods in 1986, 1987, 1988, 1990, 1992, 1995, 1998, 2002, 2003, and 2007 were the most terrific ones.

According to the Sitakundu Upazila Disaster Management Plan, Sitakundu Upazila is affected by floods every year. All unions are affected by the flood. Now intensity of floods is increasing during rainy monsoons due to siltation/sedimentation of rivers/khall and Sandwip channel (UDMP, 2014b). A map of the flood-prone zone of Bangladesh is shown in Figure-4.

Figure-4: Flood Prone Area Map of Bangladesh



Source: BARC

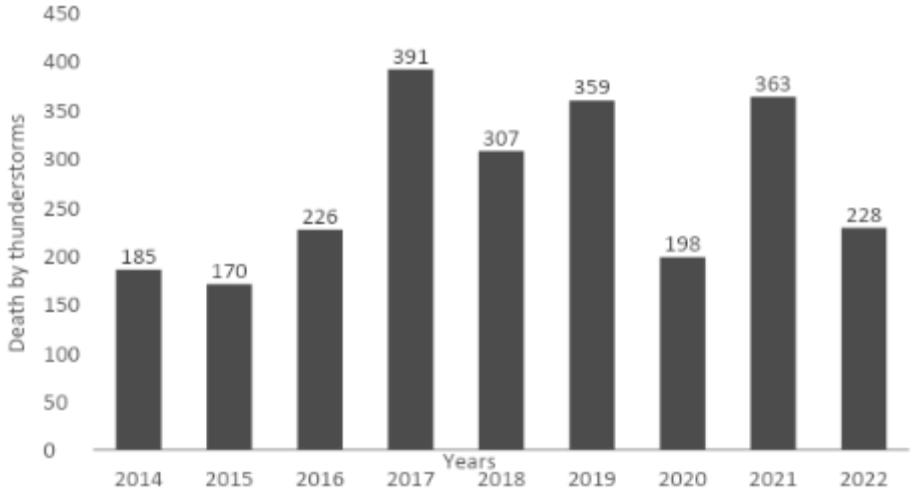
1.3.5 Lightning

Nowadays, one of the most discussed issues in the country is the increased number of deaths from lightning and thunderstorms. Every year more than 200 people die in Bangladesh from lightning. During pre-monsoon (March-May) and Monsoon (June-September), lightning and thunderstorms occurred in Bangladesh. Considering the massive death toll, the Government of Bangladesh announced on 17 May 2016 as a natural disaster.

In Bangladesh, only a few studies have been conducted on lightning. These reveal that the number of lightning incidents in the country is quite high (Karim, 1995; Gomes et. al., 2006). Another study shows that in Bangladesh, the incidence of lightning fatalities is 0.9 per 1,000,000 population per year, which is higher than in high-income countries (Holle, 2010). This is a fairly high rate while the global range of mortality rate is between 0.2 to 1.7 deaths in 1,000,000 population. A total of 1,476 people died from lightning in Bangladesh during 2010-2016[6]. In 2016 alone, 226 deaths were caused by thunderstorms in the country. According to DDM, the number of deaths further increased in the following years, reaching 391, 359, and 363 in 2017, 2019, and 2021, respectively (Figure-5).

[6] VOA News. Bangladesh Declares Lightning Strikes a Disaster as Deaths Surge. 22 June 2016. https://www.voanews.com/east-asia/bangladesh-declares-lightning-strikes-disaster-deaths-surge

Figure-5: Number of Deaths by Thunderstorms in the Last Nine Years



Source: Department of Disaster Management

From the secondary data analysis, two lightning events have been found near the proposed EZ area. The recorded lightning events and their causalities are given in Table-5.

Table-5: Lightning in the Study Region

Date	Location	Fatalities
01/06//2017	Muhuri project area, Osmanpur Union, Feni	2 people died and 7 injured
13/06/2017	Purba Bardhali and Alaiapur village under Sonagazi Upazila, Feni	2 people died

Source: Dhaka Tribune[7], Banglanews24[8]

1.3.6 Tornadoes

Tornados are mainly occurring in two transitional periods (pre-monsoon and post-monsoon). They are suddenly formed of brief duration and are extremely localized in nature. Therefore, it is very difficult to locate Tornados or forecast their occurrence with the available techniques available at present. However, high-resolution satellite images, suitable radar, and a network of densely spaced meteorological observatories could be useful for the prediction or for issuing warnings of tornados. They may also cause a lot of havoc and destruction (SDC, 2010). Since independence in 1971, Bangladesh has experienced at least eight major tornados, killing an average of more than 100 people in each event, and causing severe damage in their narrow paths (SDC, 2010).

Wind speeds in nor'westers usually do not exceed 113-130 km/hr. (70-80 miles/hr.), though often their speeds exceed 162 km/hr. (100 miles/hr.). When the winds become whirling with funnel-shaped clouds having a speed of several hundred kilometers or miles per hour, they are called tornados. From the field data collection and secondary literature, the occurrence of tornadoes has been found in the study region. A list of major regional tornado events has been provided in Table-6.

[7] https://www.dhakatribune.com/bangladesh/nation/21661/siblings-among-10-killed-in-lightning-strikes

[8] https://www.banglanews24.com/english/national/news/bd/61650.details

Table-6: List of Major Regional Tornadoes

Date	Location	Fatalities
04/04/1927	Noakhali	27
19/04/1967	Sudharam, Noakhali	12
01/05/1967	Laksham in Comilla dist. and Munshiganj in Dhaka district	31
03/04/1968	Noakhali, Raipur, Lumxipur and Begumganj	42
14/04/1969	Homna P. S. under Comilla district	263
08/05/1976	Hatiya Island, Noakhali	2
12/04/1981	Parshuram, Fulgazi, Somarpur, and Sonagazi in Feni	200

Source: Pakistan Observer; Bikos et. al. 2015; and Goldar et. al. 2001

1.3.7 Landslides

A landslide is a sudden calamity that highly disrupts the functioning of a community or society and causes human, material, and economic or environmental losses that overstep the community's or society's ability to cope using its own resources. Landslide is a very common hazard in Bangladesh, especially in the hilly districts of Bangladesh like Chattogram, Khagrachari, Rangamati, Bandarban, and Cox's Bazar districts. Slope instability caused by indiscriminate hill-cutting activities and heavy rainfall during monsoon are triggering factors of landslides in the hilly areas of Bangladesh. The NSEZ site is located on the shoreline of the Bay of Bengal and the confluence of the Feni and Choto Feni Rivers. There is no hilly area inside of the EZ boundary and within the 10 km radius of the EZ boundary. Therefore, it can be concluded that there is no possibility of landslide occurrence in the NSEZ site and its surrounding area.

1.3.8 Drought

Droughts mainly occur in the western parts (Rajshahi and Rangpur Division) of Bangladesh and the Chittagong Hill Tracts area. During the period 1949 to 1991, the country faced droughts 24 times. However, the NSEZ site is located in the coastal area of Bangladesh, which does not fall in the drought-prone area. The humidity is comparatively high in the EZ area due to the adequate rainfall and proximity to the Bay of Bengal.

1.3.9 Climate Change

The tropical weather in Bangladesh features a hot and humid summer, humid monsoon, and mild winter season. The weather pattern in the coastal region varies slightly due to topographic features. From historical data (1948 to 2013) analysis, it was found that the temperature of the coastal region varies from 10°C to 37°C with a mean annual temperature of around 26°C. The temperature during 1948-2010 shows an increasing trend in different parts of the coastal region (CDMP II, 2013). There was an increasing rate of 0.01°C, 0.23°C, 0.15°C, and 0.27°C/decade for Khulna, Bhola, Chattogram, and Cox's Bazar regions respectively with a 95% level of confidence. An increasing trend of annual rainfall has also been observed for the coastal region and the rate is higher for the western part of the coastal region.

The rainfall and temperature patterns are likely to change in the future due to global climate change. Statistical downscaling using the delta method has been utilized for climate projection. The ensemble means of five GCMs (CCSM4, GFDL-ESM2M, HadGEM2-ES, MIROC5, and MPIESM-MR) have been used. It can be estimated that the temperature might rise in the country by around 1.6°C for RCP 4.5 and around 2°C for RCP8.5 by 2050. Further, a rise in temperature is expected in the latter half of the century. The rainfall pattern is going to be more variable and erratic in the future. There is an indication that pre-monsoon rainfall will decrease, and monsoon rainfall will increase due to climate change.

1.3.10 Sea Level Rise

At present, the coastal region of Bangladesh is under the threat of submergence due to the consequences of global warming. The Intergovernmental Panel on Climate Change (IPCC) in 2014 has predicted a rise in the sea of 0.2m to 1.0m by the year 2050. A recent study (CEGIS, 2015) found that the tidal water trend in the Ganges floodplain is 7-8 mm/year. On the other hand, the trend is 6-9 mm/year in the Meghna Estuarine floodplain and 11-20 mm/year in the Chittagong coastal plain areas. It is approximated that, Bangladesh could lose up to 15% of its land under the sea and about 30 million people living in the coastal area may become climate refugees because of this. Migration of people inland will raise population density there and cause socio-economic problems and other harmful impacts on their living. Sea level rise will bring more coastal areas under inundation. Approximately, 2,500, 8,000, and 14,000 sq. km. of land will be lost due to sea level rise of 0.1m, 0.3m, and 1.0m respectively. Coastal waters will become more saline and soil salinity will also increase. Scientific research indicates sea levels worldwide have been rising at a rate of 0.14 inches (3.5 millimeters) per year since the early 1990s. Most predictions say the warming of the planet will continue and likely will accelerate. Oceans will likely continue to rise as well, but predicting the amount is an inexact science. Table-7 shows the possible impact of sea level rise along Bangladesh's coastline and hinterland.

Table-7: Sea Level Rise in Bangladesh and Its Possible Impact

Year	2050	2100
Sea Level Rise	25cm	1.0m (high-end estimate)
Land Below SLR	4% of land (6,300 km^2)	17.5% of the land (25,000 km^2) in Patuakhali, Khulna, and Barisal regions will be most affected
Storm Surge	cyclones with a 10% increase in intensity, wind speed increases from 225 to 248 km/h; storm surge goes from 7.1m to 8.6m with 0.3m SLR.	Storm surge goes from 7.4m to 9.1m with 1m SLR.
Flooding	Increased flooding in the Meghna and Ganges floodplain. Monsoonal floods increase yield loss.	Both inundation area and flood intensity will increase tremendously.
Agriculture	0.3m SLR inundates 0.5 Mmt. of production; 2% of the current total.	Devastating floods may cause crop failure for any year.
Ecosystem	Inundates 40% of the Sundarbans.	The Sundarbans would be lost. Loss of the Sundarbans and other coastal wetlands would reduce breeding grounds for many estuarine fish, which would reduce their population.
Salinity	Increase	Increase

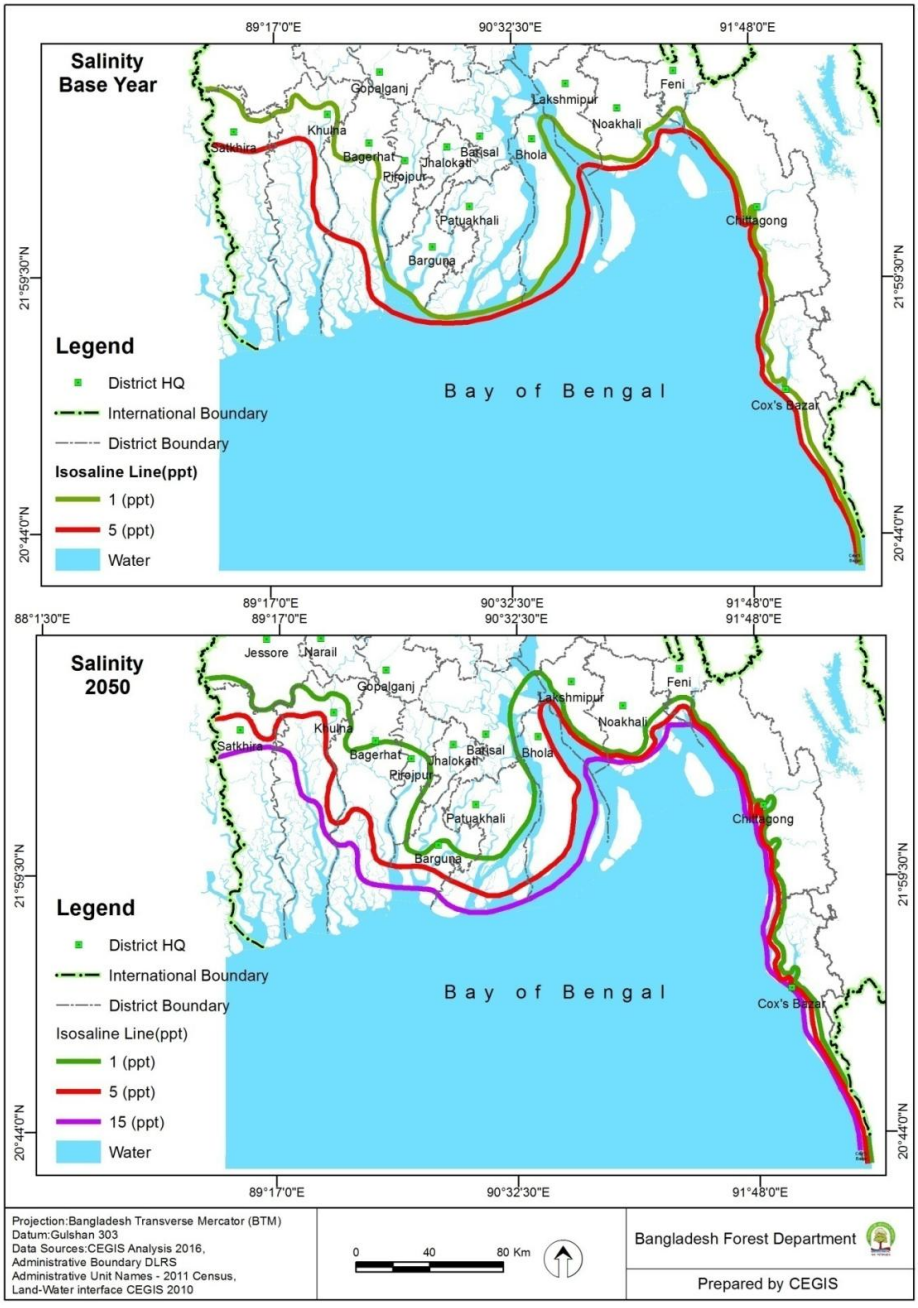
Source: World Bank, 2010

1.3.11 Salinity Intrusion

A direct consequence of sea level rise would be increased intrusion of salinity with tide through the rivers and estuaries which would be more acute in the dry season. In the dry season, when the flow of upstream water reduces drastically, the saline water goes up to 240 kilometers inside the country and reaches to Magura district (Rahman et al., 2014). The present interface between freshwater and saline water lies around 120 to 160 km inland in the southwest. This could well be pushed northward as far as the central Jessore region as well as Chattogram region in the event of a sea level rise. The iso-saline lines of 1, 5, and 15 ppt have been drawn for the base (2005) and 2050 conditions to show changes in salinity in the coastal area of Bangladesh (IWM and CEGIS, 2007) (Figure-6). It indicates that in the base (2005) condition about 10% area is under 1 ppt salinity and 16% under 5 ppt salinity and this area

will increase up to 17.5% (1 ppt) and 24% (5 ppt) by 2050 in extreme scenarios. So, there will be around 7% increases in areas under 5 ppt salinity levels.

Figure-6: Surface Water Salinity in the Coastal Region of Bangladesh



Source: IWM & CEGIS, 2007

A recent study shows that a 5 ppt saline front will penetrate about 40 km inland for SLR of 88 cm which is going to affect the only fresh-water pocket of the Tetulia River in Meghna Estuary. Not only that, even the groundwater aquifers will bear the brunt of salinity intrusion. Agriculture, forestry, and fisheries sectors will be severely affected by increased water and soil salinity. Due to the changing climate, the salinity situation will further deteriorate by increased sea level, decreasing freshwater flow from the upstream, upward sub-surface pressure of the saline and freshwater interface, increased frequency and intensity of tidal surges, etc.

1.4 Disaster Risk Summary

Considering the available hazard, exposure, and vulnerability information of the study region, an overall risk summary for the NSEZ is shown in Table-8.

Frequency represents the average recurrence interval of an event of the same intensity. The NSEZ classifies frequency as:

- Low (10 years or more between events).
- Medium (2 years up to 10 years between events),
- High (less than 2 years between events).

Severity is the extent to which a hazard event is expected to cause loss or damage. The NSEZ classifies three levels of severity as:

- Low
- Medium
- High

Combining frequency and severity, the NSEZ sets thresholds for low, medium, and high-risk levels, as shown in Table-9. For example, the NSEZ would classify high-severity low-frequency hazards (e.g., earthquakes) as high risk - the same risk level as medium-severity high-intensity hazards (e.g., floods).

The NSEZ approaches the threats from the risk levels as follows:

- **High Risk**: Stakeholders should be particularly aware of potentially severe damage from such hazards and prioritize actions to reduce and manage these risks. If no measures to mitigate the hazard and risk are taken, high levels of damage and loss from this threat can be expected to occur in NSEZ during our lifetime.
- **Medium Risk:** Stakeholders should prioritize measures to reduce and manage the hazard and risk, particularly where exposure and vulnerability may be highest.
- **Low Risk:** Stakeholders should consider measures to reduce and manage the hazard and risk at critical locations, where exposure and vulnerability may be highest.

Table-8: Risk Level Definition by Frequency and Severity

	Risk Level			
Frequency (Return period)	**High** (Less than 2 years between events)	**Medium** Risk	**High** Risk	**High** Risk
	Medium (2 to 10 years between events)	**Low** Risk	**Medium** Risk	**High** Risk
	Low (2 to 10 years between events)	**Low** Risk	**Medium** Risk	**High** Risk
		Low Severity	**Medium** Severity	**High** Severity
		Identified **Severity**		

Source: Adopted from DANM, 2018

Table-9: Risk Summary

Natural Disasters	Short Description	Frequency	Severity	Risk
Cyclone and Tidal Surges	NSEZ region is prone to severe cyclonic storms and associated tidal surges. The cyclone season in the EZ region is mainly the pre-monsoon and post-monsoon seasons, between April-May and October-November. In recent times the number of cyclones occurrence in the Bay of Bengal, specifically on the Chattogram Coast has increased. For example, from October 2021 to November 2023, 5 cyclones cross the EZ region.	High	High	High
Earthquake	According to the Bangladesh National Building Code 2020, the NSEZ region falls in both severe seismic intensity zone (zone 3) with coefficients of 0.28 and moderate seismic intensity zone (zone 2) with coefficients of 0.20. Earthquakes have not been very frequent in the NSEZ area. However, in recent years the occurrence and damage caused by several earthquakes inside the country or near the country's border, has raised an alarm. For example, five earthquakes have already taken place in 2023. The 21 November 1997, the magnitude 6.0 earthquake at the Bangladesh-Myanmar border triggered the collapse of an under-construction reinforced concrete frame building that killed several people in the port city of Chattogram.	High	High	High
Tsunami	NSEZ region falls within tsunami Zone-I, which is reportedly the most vulnerable belt. Though the Indian subcontinent is in a seismically active region, tsunamis along the coastline of India and Bangladesh have been rare, but not unprecedented.	Low	High	High
Floods/Flash Floods	According to the NSEZ master plan, flooding is considered the most critical natural hazard for the NSEZ site, given its proximity to bodies of water and its elevation. The coastal area proposed for development in NSEZ is subject to a variety of types of flood hazards including: i) coastal floods caused by high tides and storm surges, ii) fluvial or river floods caused by river overflow, and iii) pluvial or urban floods caused by poor drainage of heavy rain on the site. Although different causes trigger these hazards, their consequences (such as inundation) as related to infrastructure assets and services, are similar. NSEZ raised its land and built a super dike in order to protect the site against various flood risks. The super dikes are designed and constructed with crest elevations at MSL+9.0 m to protect the site against a 100-year return period coastal flood. River embankments are designed and constructed with crest elevations at MSL+8.0 m to protect the site against river overflow from a 25-year return period river flood. The land plots are being raised from initial ground levels from an average of MSL +4m to MSL +6.5m, in order to protect all development/investment from inundation from historical maximum water levels at the coastline and rivers.	High	High	High

Natural Disasters	Short Description	Frequency	Severity	Risk
Lightning	Lightning is one of the most widespread and deadly hazards in Bangladesh. Every year more than 200 people die in Bangladesh from lightning. During pre-monsoon (March-May) and Monsoon (June-September), lightning and thunderstorms occurred in Bangladesh. A total of 1,476 people died from lightning in Bangladesh during 2010-2016. From the secondary data analysis, two lightning events in the same year have been found in the study region.	High	Low	Medium
Tornadoes	Tornados are mainly occurring in two transitional periods (Pre-monsoon and post-monsoon). They are suddenly formed of brief duration and are extremely localized in nature. Therefore, it is very difficult to locate Tornados or forecast their occurrence with the available techniques available at present. They may also cause a lot of havoc and destruction. Since independence in 1971, Bangladesh has experienced at least eight major tornados, killing an average of more than 100 people in each event, and causing severe damage in their narrow paths. When the winds become whirling with funnel-shaped clouds having a speed of several hundred kilometers or miles per hour, they are called tornados. From the field data collection and secondary literature, the occurrence of tornadoes has been found in the study region.	Low	Medium	Medium
Landslides	NSEZ site is located on the shoreline of the Bay of Bengal. There is no hilly area inside of the EZ boundary and within the 10 km radius of the EZ boundary. Therefore, landslides are not expected in the NSEZ site and its surrounding area.	-	-	No
Droughts	NSEZ site is located in the coastal area of Bangladesh, which does not fall in the drought-prone area. The humidity is comparatively high in the EZ area due to the adequate rainfall and proximity to the Bay of Bengal.	-	-	No

1.5 Disaster Risk Management Plan

This section of the report presents an outline disaster management plan for the National Special Economic Zone (NSEZ). The purpose of the disaster management plan is to identify potential foreseeable accidents/disasters/emergencies and establish and maintain procedures to address or prevent such situations, as well as to test the effectiveness/review/revise such procedures periodically.

It is to be noted that this DMP provides only an overview of the applicable at the NSEZ level. Every establishment including industrial, commercial, residential, etc. that comes up in the NSEZ shall develop their individual emergency response plans or disaster management plans.

According to the Master plan of the EZ, BNBC 2015 has been recommended for infrastructural development in the NSEZ however this BNBC already updated in the meantime. Therefore, the updated one should be adopted for the infrastructure development in the EZ. To protect the EZ area from flood, salinity instruction, erosion caused by tidal surges and cyclone, a coastal embankment/super dyke has been designed and constructed along the shoreline considering the crest elevations at MSL+9.0 m to protect the site against a 100-year return period coastal flood. River embankments are designed and constructed with crest elevations at MSL+8.0 m to protect the site against river overflow from a 25-year return period river flood. The land plots are being raised from initial ground levels from an average of MSL +4m to MSL +6.5 m, to protect all development/investment from inundation from historical maximum water levels at the coastline and rivers (NSEZ Master Plan).

1.5.1 Objectives of Disaster Risk Management Plan

The objectives of the disaster risk management plan are to use the combined resources of the NSEZ and the outside services to achieve the following:

- Minimize damage to the environment and property.
- Safeguard workers and other people in the NSEZ.
- Secure the safe rehabilitation of affected areas.
- Effective identification, rescue, and medical treatment of causalities.
- Identify any dead body.
- Disseminate authoritative information to the news media.

1.6 Organization Structure

1.6.1 Disaster Management Committee

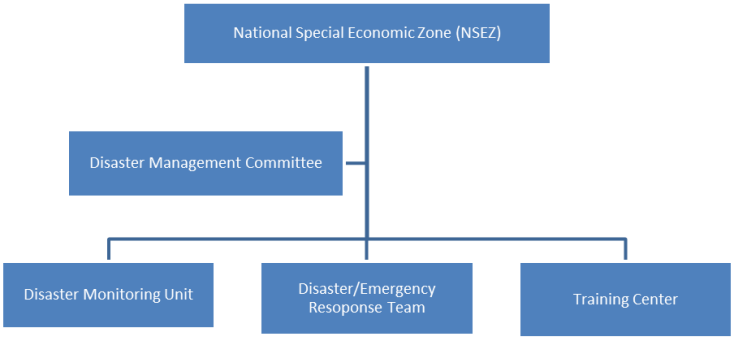
The NSEZ shall constitute a Disaster Management Committee (DMC). The DMC will be the apex planning body and will play a major role in the preparedness and mitigation of any disaster. The committee will have the following key functions:

- Preparation of a comprehensive Disaster Management Plan for NSEZ and update the plan when required.
- Setting up of Emergency Control Centre during emergencies.
- Coordination with the District Disaster Management Committee of Feni and Chattogram Districts and the Upazila Disaster Management Committee of Mirsharai, Sitakunda, and Sonagazi Upazila.
- To supervise emergency response measures in case of any emergency.
- Keep track of predictable natural hazard events such as floods, cyclones, earthquakes, tsunamis, tidal surges, etc.
- Organize training and capacity-building programmes on disaster management for individual establishments in the NSEZ.
- Periodic monitoring of Emergency Response Plans and the corresponding procedures of individual establishments.
- Organize post-disaster evaluation and update the Disaster Management Plan accordingly.
- Prepare reports and documents on disaster events in NSEZ and preserve a copy of the report. The report shall include but not be limited to a) the date and time of occurrence, b) the source

& cause of the disaster, c) a description of the response efforts, d) a recommendation for preventive & mitigation measures, and e) a plan for upgrading emergency preparedness and response plan.

The organizational structure of the Disaster Management Committee is presented in Figure-7.

Figure-7: Organization Structure of Disaster Management Committee



The disaster management committee of the NSEZ will have the following departments/units/teams:

Disaster Monitoring Unit

The primary function of this unit shall be to keep track of foreseeable natural hazards such as floods, cyclones, tidal surges, earthquakes, tsunamis, etc. The unit shall continuously coordinate with the Bangladesh Meteorological Department (BMD), Pacific Tsunami Warning Center (PTWC), and Flood Forecasting and Warning Center (FFWC), in order to monitor disaster warnings and weather conditions in the region. On account of any extreme event predictions, the unit shall communicate the same to the Disaster/Emergency Response Team which will issue warnings to the entire NSEZ.

Disaster/Emergency Response Team

The Disaster/Emergency Response Team shall perform the following functions:

- Advise the disaster management committee of NSEZ as to whether the declaration of an emergency is recommended.
- Advise the disaster management committee on the need to designate all or part of NSEZ as an emergency area.
- Appoint an Emergency Control Centre.
- Determine if the location and composition of the emergency control center are appropriate.

The Emergency Response Team shall form an Emergency Control Centre in case of any emergencies. The team shall coordinate with other agencies such as the Bangladesh Police, Fire Service and Civil Defense, Hospitals, Ambulance, and technical departments such as Gas Transmission Company Limited, Karnaphuli Gas Distribution Company Limited, Power Grid Company of Bangladesh, Bangladesh Rural Electrification Board, Department of Public Health Engineering, Local Government Engineering Department, Roads and Highways Department, Bangladesh Railway, Bangladesh Telecommunication Regulatory Commission, and Bangladesh Telecommunications Company Ltd., etc., and local authorities/Upazila/District administration.

Training Centre

The training center shall be responsible for the following activities:

- Dissemination of information about the Disaster Management Plan developed for NSEZ.
- Organize capacity-building workshops for the personnel of disaster management.
- Organize training programs such as mock drills, and emergency evacuation procedures in industrial areas and residential areas.

- Work in association with industrial groups to create awareness about disaster preparedness and effective management.

1.7 Emergency Response Preparedness

Effective command and control start with a clear definition of the overall command and control structure, and a description of the duties of key personnel with specific responsibilities for emergency response. The control of emergencies will consider the minimum number of people required to provide an adequate response to emergencies.

All emergencies occurring as a result of project activities shall be managed according to the following order of priorities: a) preservation of life (self, team, and community), b) protection of the environment, c) protection of property/assets, and d) preservation of evidence.

The roles and responsibilities of various departments during emergencies have been discussed in the following sections.

1.7.1 Emergency Control Centre

The Emergency Control Centre (ECC) shall be formulated in case of emergencies by the Disaster Management Committee. The ECC shall be chaired by the head of NSEZ and/or authorized representative and will have representatives from the Bangladesh Police, Fire Service and Civil Defense, Hospitals, Factory Inspectorate, and local authorities/Upazila/District administration. The interaction matrix between the emergency control center and other departments has been presented in Figure-8.

Figure-8: Interaction Matrix between Emergency Control Centre and Other Departments

The emergency control centre shall perform the following functions:

- Coordinate the acquisition, distribution, and arranging of various modes of transport for the purpose of transporting persons and/or supplies, as required.
- Determine if additional transport is required for evacuation or transport of persons and/or supplies.
- Discontinue utilities or services provided by public or private concerns without reference to any consumers in the region, or when continuation of such utilities or services constitutes a hazard to public safety within an emergency area.

- Disperse people not directly connected with the operations who by their presence are considered to be in danger or whose presence hinders in any way the efficient functioning of emergency operations.
- Authorize the evacuation of those buildings or sections within an emergency area that are themselves considered to be dangerous or in which the occupants are considered to be in danger from some other source.
- Authorize casualty collection and evacuation in support of emergency health care authorities.
- Coordinate with other departments such as the Bangladesh Police, Fire Service and Civil Defense, Hospitals, Utility Providers, etc.
- Arrange for services and equipment from local agencies.
- Arrange for accommodation and welfare, on a temporary basis, of any residents who are in need of assistance due to displacement as a result of the emergency.
- Arrange assistance from local, upazila, district, and national levels of Government as per requirements.

The following information and equipment shall be available at the emergency control center.

- Hand tools, wind direction/velocity indications
- Breathing apparatus
- Fire suit/gas-tight goggles/gloves/helmets
- Public address megaphone, handbell, telephone directories
- Emergency lamp/torchlight/batteries
- Emergency shut-down procedures
- Intercom, telephone
- List of key personnel and list of emergency coordinators
- Address with telephone numbers and key personnel, emergency coordinator, and essential employees.
- Important addresses and telephone numbers including Government agencies, neighboring industries and sources of help, outside experts, chemical fact sheets population details.

1.7.2 Police Department

The police department shall perform the following activities:

- Overall responsibility shall be to maintain law and order during pre-disaster, during-disaster, and post-disaster situations in the context of disaster management.
- Prepare a departmental disaster response plan and standard operating procedure (SOPs) in which roles and responsibilities are clearly defined. The plan and SOPs shall be submitted to the disaster management committee of NSEZ.
- Prepare a database of nodal persons at the upazila, district, and national levels and share it with the disaster management committee of NSEZ.
- Police personnel shall be trained in search and rescue (cyclone, flood, collapse structure, etc.) during normal times and the database of such trained personnel shall be shared with the disaster management committee of NSEZ.
- Overall traffic management at the NSEZ site and patrolling.
- Provide security in affected areas, hospitals, and medical centers and identify areas to be cordoned off.
- Establish communication with the emergency control center and nearest police stations.
- Additional deployment of police, if required, to inquire into and record deaths.
- A public information system is to be activated for passing information related to injured, dead, missing persons, etc.
- Regularly conduct mock drills by simulating different disasters to check preparedness, coordination, and scope of improvement. The report shall be submitted to the disaster management committee of NSEZ.

- Assist the disaster management committee and emergency control center in the evacuation of people from vulnerable areas.

1.7.3 Fire Service and Civil Defense Department

The fire service and civil defense department shall perform the following activities:

- The overall responsibility shall be to effectively and efficiently undertake the emergency fire evacuation procedures.
- Prepare a departmental disaster response plan and standard operating procedure in which roles and responsibilities are clearly defined. The disaster response plan and standard operating procedure shall be submitted to the disaster management committee of NSEZ.
- Prepare a database of nodal persons at the upazila, district, and national levels and share it with the disaster management committee of NSEZ.
- Fire safety personnel shall be trained in fire evacuation procedures during normal times and a database of such trained personnel shall be shared with the disaster management committee.
- Establish communication with the emergency control center and nearest fire stations.
- Additional deployment of fire safety personnel, if required, to inquire into and record of deaths.
- Regularly conduct mock drills by simulating different disasters to check preparedness, coordination, and scope of improvement. The report shall be submitted to the disaster management committee of NSEZ.
- Assist the disaster management committee and emergency control center in the evacuation of people from vulnerable areas.

1.7.4 Health Department/Hospitals

The health department shall perform the following activities:

- The overall responsibility shall be to effectively and efficiently undertake emergency health activities in the aftermath of disasters and take measures to check the outbreak of epidemic in the post-disaster situation.
- Prepare a departmental Emergency Health Management Plan including hospital hospital-specific plans. Apart from the plan, a standard operating procedure shall be prepared which clearly delineates the roles and responsibilities.
- The plan shall cover mass casualty management, triage (prioritization of patients), trauma counseling, a mobile team that may be deployed at sites, procedures for coordinating with private hospitals and availing its services, etc.
- Prepare a database of the nodal officers at upazila, district, national, and hospital-specific shall be prepared for emergency health services and shared with the disaster management committee of NSEZ.
- Periodic review of the stock of emergency medicines, and equipment required during disasters.
- Epidemic surveillance and water quality monitoring shall be done in affected areas.
- Establish communication with the emergency control centre, police, and medical team at the disaster sites.
- A public information system to be activated for passing information related to patients admitted at the hospital.
- Mock drills on mass casualty management shall be organized twice a year. The mock drill shall check the activation and response time of emergency medical teams, coordination with other agencies, areas of improvement, etc. The report shall be submitted to the disaster management committee of NSEZ.
- The medical officers and staff shall be trained in triage (a system for the prioritization of patients).

1.7.5 Electricity Department

The electricity department shall perform the following activities:

- The overall responsibility shall be to restore the power supply at the earliest in the aftermath of disasters and ensure uninterrupted power to all vital installations, facilities, and sites.
- Prepare a departmental disaster management plan and submit it to the disaster management committee of NSEZ. In addition to the plan, a standard operating procedure shall be prepared which clearly delineates the roles and responsibilities.
- The departmental disaster management plan of the electricity department shall include basic information, vulnerability analysis, response plan, preparedness measures, and long-term measures.
- A disaster management team and emergency tool kit comprising cable cutters, pulley blocks, jungle knives, axes, crowbars, ropes, hacksaws, and spanners shall be kept in a state of readiness at each sub-station. Tents for work crews shall also be part of the kit.
- A database of nodal officers at the upazila and district shall be prepared for emergency power services and shall be shared with the disaster management committee of NSEZ.
- Standby arrangements for temporary electric supply or generators made for police stations, hospitals, water departments, telecommunications buildings, and other critical buildings and installations in case a warning of disaster is received.
- Immediately undertake inspection of high-tension lines, towers, substations, transformers, insulators, poles, and other equipment from the time of receipt of the alert warning.
- Establish communication with the emergency control centre and teams at the site.
- Mock drills on mass casualty management shall be organized twice in year. The mock drill shall check the activation and response time of emergency power restoration teams, coordination with other agencies, areas of improvement, etc. The report shall be submitted to the disaster management committee of NSEZ.
- The officers and staff shall be trained in emergency management.

1.7.6 Water Supply Department

The water supply department shall perform the following actions:

- The overall responsibility shall be to ensure the supply of regular water at the NSEZ site.
- Prepare a departmental disaster management plan and submit it to the disaster management committee of NSEZ. In addition to the plan, a standard operating procedure shall be prepared which clearly delineates the roles and responsibilities.
- The plan shall cover basic information, a water supply plan in the event of disasters, prioritization of water supply services to critical installations, a water supply restoration plan in the event of a disaster, and the formation of an emergency team.
- A database of nodal officers at the upazila and district shall be prepared for emergency water services shall be prepared and shared with the disaster management committee of NSEZ.
- Several teams of engineers and assistants for the restoration of water supply services shall be constituted as a precautionary measure.
- It shall also make provisions to acquire tankers and establish other temporary means of distributing water in an emergency.
- Keep a required stock of lengths of pipe, connections, joints, hydrants, and bleaching powder. Adequate tools shall be on hand to carry out emergency repairs. Also, a generator shall be identified for the emergency.
- In case of receipt of a disaster warning; wells, intake structures, pumping stations, buildings above ground, pumping mains, and treatment plants shall be monitored.
- After any repair on the distribution system, the repaired main shall be flushed and disinfected with a chlorine solution.
- Establish communication with the emergency control centre and teams at the disaster site.
- A public information center shall be established with a means of communication, to assist in providing an organized source of information. It may keep the community informed of its potential and limitations in disaster situations.

- Mock drills on emergency water management shall be conducted at least once a year. The report shall be submitted to the disaster management committee of NSEZ.

1.8 Management Plan for Natural Hazards

NSEZ is located in Chattogram and Feni District of Bangladesh and on the coastline of the Bay of Bengal. The location is vulnerable to various natural disasters such as cyclones and tidal surges, earthquakes, tsunamis, floods, thunderstorms and lightning, tornadoes, fire, etc. Proper planning can reduce the potential damage from disasters in terms of losses to human lives, assets, environmental damage, and rehabilitation costs.

1.8.1 Management Plan for Cyclones and Tidal Surges

To manage cyclones and associated tidal surges, the following management plan should be followed in the NSEZ site:

- Consideration of cyclonic wind/wind velocity in the design of the NSEZ and associated infrastructures.
- The land elevation of the NSEZ site should be finalized considering the highest tidal water level during cyclones and high astronomical tides as well as the experience of similar projects in the region and the experience of the local community.
- The foundation structure of machines and buildings should be elevated to avoid cyclone-associated storm surges of water.
- Ensure regular monitoring and maintenance of the super dike constructed along the shoreline of the Bay of Bengal.
- Greenbelt development/plantation of selected species at different layers around the NSEZ site specifically parallel to the coastline in response to cyclone wind, tidal surges water, and wave action.
- Continuous monitoring of the weather news/bulletin especially for the cyclone disasters from April to May and October to November.
- Maintain and exchange information continuously with the Bangladesh Meteorological Department (BMD) for continuous updates of meteorological conditions in general and emerging/predicted weather phenomena such as cyclones and rainfall in particular. Also, monitor the new bulletin on radio, television, and newspapers.
- Monitor disaster early warnings via a mobile-based Interactive Voice Response (IVR) system and get weather news and early warnings for flood and river ports by dialing 10941.
- Upon issue of a cyclone warning by the BMD, on signaling of a cyclone alert, the Emergency Control Centre (ECC) of NSEZ will be manned 24 hours a day for disaster management. Establish communication with the Upazila Disaster Management Committee and Union Disaster Management Committee, if any assistance is required from them.
- A pre-alert should be issued for all establishments/industries in the NSEZ regarding suspension of all operations in case of emergency and to await instructions regarding the same.
- Close communication with the volunteers of the Cyclone Preparedness Programme (CPP) and other departments such as police, fire service, hospital, utility providers, etc. for their preparedness and responses to cyclone disasters.
- Ensure every establishment/industry in the NSEZ has individual site emergency evacuation and management plans for the cyclone and tidal surge disaster.
- During the cyclone, the main electric supply could be disconnected temporarily, and alternative power supply can be restored by essential operational areas.
- Instruct all the associates including workmen not to allow them to go outside till the wind and cyclone effect reduces to the normal level.
- After the cyclone, damage would be assessed, and rehabilitation work initiated to restore operations at the earliest.
- Records of the events during the cyclone will be maintained and reviewed for possible enhancements to the Disaster Management Plan.

- Provided training for the NSEZ operating personnel and other key personnel to manage cyclone disasters including first aid training.

1.8.2 Management Plan for Earthquakes

To manage earthquakes, the following management plan should be followed in the NSEZ site:

- Since an earthquake is the most uncertain natural occurrence giving birth to massive calamities on both life and property, adequate care must be taken into account while designing the infrastructure facilities for the NSEZ site as per seismic zone.
- Adopt and enforce the updated building code of Bangladesh National Building Code (BNBC) 2020 provisions to reduce earthquake damage risks and impacts.
- Identify the vulnerable structures/buildings at NSEZ and instruct the relevant authority to remove or retrofit the infrastructures/buildings.
- Make all utilities like water supply systems, communication networks, electricity lines, etc. earthquake-proof.
- EZ operating personnel and other key personnel shall be trained to manage emergencies during an earthquake.
- Emergency firefighting systems should be ensured at the NSEZ site.
- Confirm that fire drills are conducted at least once a year in every establishment/industry located in NSEZ.
- Adequate first aid provision including trained manpower in the NSEZ site healthcare facilities.
- Extensive rescue operations are required to shift the injured persons to the nearest medical center and evacuate the trapped individuals to safer places. Appropriate medical services are necessary to control epidemics in the post-earthquake period.
- Restore all the essential services like electricity, telecommunication, transportation, water, food supply, etc. Proper steps should also ensure the protection and safeguarding of properties.
- Damage to road access would need immediate clearing for which operations in close coordination with the concerned departments/agencies in the upazilas/districts will have to be made.
- Areas indicating signs of liquefaction should be declared out of bounds and should be kept prohibiting trespassing.
- Foundations of the structures prone to liquefaction should require technical assessment.
- Alteration in the river and khal water flow that may inundate the NSEZ areas would require immediate evacuation of properties in coordination with the upazila and district authorities.
- Listen to radio, television, newspaper, and other media for Government announcements.
- Examine walls, floors, doors, staircases, and windows to make sure that the building is not in danger of collapsing.
- Do not enter into unsafe or risky houses or buildings.
- Ensure that all establishments/industries in NSEZ have individual site emergency evacuation plans including emergency assembly points and management plans for the earthquake disaster.
- All employees shall be familiar with the location of first aid kits, fire alarms, and extinguishers, as well as personnel with first aid skills.
- Develop and implement an extensive education and awareness program for the earthquake.

1.8.3 Management Plan for Tsunami

To manage the tsunami, the following management plan should be followed in the NSEZ site:

- Greenbelt development/plantation of selected species at different layers around the NSEZ site specifically parallel to the coastline in response to tsunami waves.
- Maintain and exchange information continuously with the Bangladesh Meteorological Department (BMD) and Pacific Tsunami Warning Center (PTWC) for monitoring tsunami risk on the Bangladesh coast and early warning.

- Get more information from radio, television, and your mobile device (text or data.)
- Tsunami warning dissemination among the industries/establishments in the NSEZ and instruct for their emergency response.
- Instruct all people to stay out of the water and away from beaches and waterways.
- Instruct all establishments/industries to identify and mark high and far inland areas (away from the water) so that the people can evacuate and move quickly to a safe place.
- During the Tsunami the main electric supply should be disconnected, and alternative power supply can be restored by essential operational areas.
- If anyone is near water and feels an earthquake of any size or length, move quickly to high ground or inland (away from the water) as soon as you can move safely.
- Instruct all not to go to the water bodies to watch a tsunami come in. Remember that a tsunami is a series of waves, and the next wave may be larger than the first one.
- Develop and implement an extensive education and awareness program for the tsunami.
- Conduct mock exercises on tsunami warning and evacuation preparedness at the site.
- Provided training for the NSEZ operating personnel and other key personnel to manage tsunamis.

1.8.4 Management Plan for Floods

To manage floods, the following management plan should be followed in the NSEZ site:

- Close communication with the Flood Forecasting and Warning Center (FFWC) and Bangladesh Water Development Board (BWDB) regarding flood early warning.
- Close communication with the Bangladesh Meteorological Department (BMD) regarding rainfall in the hilly area.
- Follow flood forecasting and warning-related bulletins on television, radio, newspapers, and other media.
- Ensure proper communication and coordination with Districts and Upazilas administration regarding emergency response during flood events.
- Instruct all industries/establishments to prepare and respond to flood events.
- Disconnect the electrical supply temporarily to prevent electrocution, where feasible.
- Switch off/discontinue all operations at the installation, where feasible.
- Conduct demos/mock drills in flood-prone areas from time to time and ensure that rescue teams are properly trained and equipped.
- Organize training for various stakeholders involved in flood mitigation and management.
- Organize mock drills on flood rescue.
- Ensure the strengthening of the internal khals and operation of the sluice gates.
- Provided training for the NSEZ operating personnel and other key personnel to manage flood disasters including first aid training.
- Develop and implement an extensive education and awareness program for floods.

1.8.5 Management Plan for Thunderstorm and Lightning Strikes

To manage thunderstorms and lightning, the following management plan should be followed in the NSEZ site:

- Develop and implement an extensive education and awareness program for thunderstorms and lightning strikes.
- Take precautionary measures during pre-monsoon (March-May) and Monsoon (June-September) seasons for the lightning events.
- Enforce the installation of lightning arrestors in each establishment/industry in the NSEZ site.
- Ensure lightning protection devices (lightning rods and grounding) installation.
- Adequate first aid provision and training of the staff to deal with lightning-related injured victims.
- Instruct all staff to move immediately to the nearest building during lightning.
- Instruct all staff to avoid standing under trees and electricity poles during the lightning.

- Instruct all staff to avoid working or standing in upland areas or on the roofs of buildings or open areas.
- Appropriate firefighting equipment and use must be ensured at the EZ site.
- Avoid using your mobile phone in the open area unless it is necessary.
- Stay away from windows and metal doors.
- Develop and implement an extensive education and awareness program for thunderstorms and lightning strikes.

1.8.6 Management Plan for Tornadoes

To manage tornadoes, the following management plan should be followed in the NSEZ site:

- Develop and implement an extensive education and awareness program for Tornadoes.
- Consideration of strong wind in the design of the EZ and related infrastructures.
- Take precautionary measures during pre-monsoon (March-May) and post-monsoon (October-November) seasons for the tornado events.
- Prepare and disseminate an emergency plan describing what the workers should do as a tornado threat.
- Drills can be conducted once a year.
- The tornado warning is still unavailable today in Bangladesh; however, people can perceive the occurrence of tornadoes from their indigenous knowledge.

1.8.7 Management Plan for Fire

To manage fire, the following management plan should be followed in the NSEZ site:

- Ensure the establishment of a dedicated fire service station for the NSEZ by providing adequate experienced manpower.
- Equip fire stations with modern fire engines and other equipment.
- Fireproof devices such as boots, gloves, helmets, etc. for the firefighters should be ensured.
- Fire services should be equipped with protective clothing and firefighting devices including masks, gloves, etc. for dealing with chemicals and toxic materials.
- Make provision for a special fire burn ward in the NSEZ dedicated hospital or an agreement with the nearest hospital near the industrial zone that has a fire burn ward.
- Equip fire services with communication facilities like wireless etc. and wherever such facilities exist, these should be upgraded.
- Ensure that all fire service stations (NSEZ and external) are connected to an effective communication system.
- Ensure that all establishments/industries in the NSEZ use automated fire and safety controls.
- Ensure mock drills for any fire accidents take place in each industry at least once a year.
- Inspect and take the initiative to remove unwanted combustible material.
- Ensure an adequate number of fire extinguishing facilities are available at the site and confirm the periodic inspection.
- A computerized data management system should be introduced to keep the record of all fires including frequency, extent, fatality, economic losses, etc.
- The roles and responsibilities of district/upazila administration, police, fire services, and medical services should be clearly laid down.
- Impart fire management training for fire staff and strengthen their working skills.
- Organize regular demos for the fire brigade to familiarize them with fire equipment.
- Conduct mock drills to check up the departmental preparedness.
- Develop IEC materials on dos and don’ts for public and worker distribution.
- Develop IEC materials in the local language and distribute them in schools, all industries, and local communities.
- Assist in evacuating the people from the fire that occurred surrounding area and send them through a safe exit direction.

- Keep the newest and best-conditioned fire hoses and fire extinguishers readily available.
- Ensure one operator is always present in the Hydrant system area when using the fire Hydrant system.
- If the fire is very small, use the correct Fire Extinguisher for extinguishing the fire.
- Try to isolate the fire by removing the surrounding inflammable material from within reach of the fire.
- In case of a big fire use a local Hydrant system for extinguishing the fire.
- If the fire is beyond control inform the security or higher authority to call the fire brigade and inform the senior manager or emergency response team.
- In case of any accident in human life please call the first aid team and get medical attention as quickly as possible.
- Serious burn cases should be transported to an internal medical or other medical outside of the vicinity.
- Storage of fuel will be as per the rules and guidelines laid down in the relevant statutes.
- Adequate fire safety equipment e.g. extinguishers, dry chemicals, carbon dioxide, foam spray, and water spray should be kept in the complex.

1.9 Climate Risk and Vulnerability Assessment

A Climate Risk and Vulnerability Assessment (CRVA) is a systematic process that evaluates the potential impacts of climate change on a specific system, community, region, or sector. The goal of such an assessment is to identify the vulnerabilities and risks associated with climate change and develop strategies to enhance resilience and adapt to these changes.

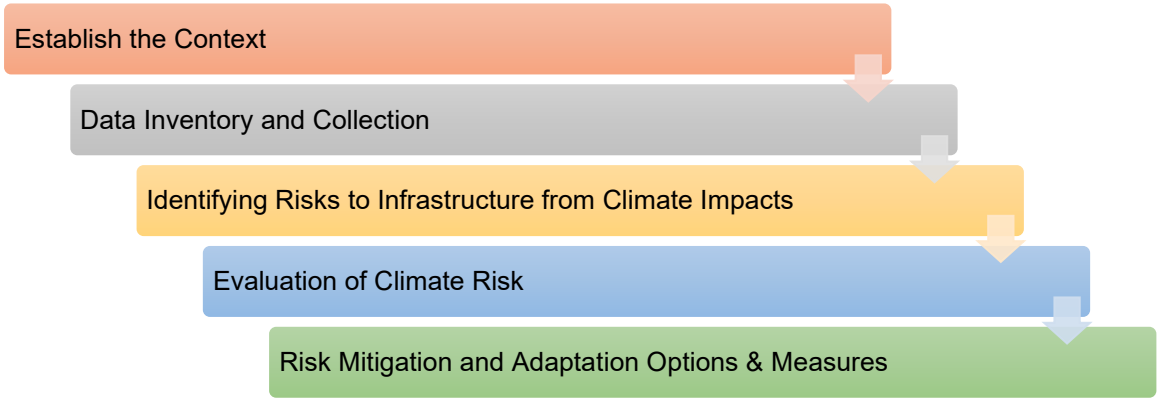
The objectives and scope of the climate risk and vulnerability assessment are to:

- Review the international and national climate change modeling and emissions scenarios.
- Assess the existing climate conditions in Bangladesh.
- Identify the potential impacts of climate change in Bangladesh on the NSEZ.
- Evaluate and determine the significance of the impacts.
- Develop mitigation measures, monitoring activities, and reporting requirements to ensure that such concerns are addressed in the EZ design and mitigation measures.

1.9.1 Approach and Methodology

The RESA Consultant has chosen to adopt a qualitative risk-based methodology for the assessment of both the vulnerability and risk to the infrastructure of the NSEZ. The risk assessment process adopted involves five key steps, as follows:

Figure-9: Five Key Steps of the Risk Assessment Process



A brief description of these five key steps is given in the following section:

i) Establishing the Context

The first step in the CRVA process is to establish the context of vulnerability of the NSEZ, upon which the risk assessment is developed. It allows to examine the potential impacts and risks for each infrastructure component to better understand the cumulative and systematic risks associated with the operation and functioning of the EZ components. The EZ master plan was reviewed to evaluate the existing engineering plans of the EZ, focusing on how climate risk adaptation measures are integrated into the design.

ii) Data Inventory and Collection

Based on current and future climate, the presence (or absence) of climate impacts was discussed, and the emphasis was fundamentally oriented to and focused on the exposure and sensitivity of the EZ. It focuses on two key aspects: (i) the exposure of the asset or infrastructure to climate threats and hazards; and (ii) the relative sensitivity of the asset or infrastructure to the impact of the hazard.

Climate data analysis was performed to:

- Provide an in-depth overview of the current and historical climate conditions of the NSEZ region, identifying typical climate conditions and any noteworthy extreme weather events. Use a minimum 30-year historical climate record for the analysis.
- Analyze shifts from the historical baseline in chosen climate parameters under projected climate situations using the IPCC's Share Socio-economic Pathways (SSPs). Both an intermediate (SSP2-4.5) and a pessimistic (SSP5-8.5) GHG emissions pathway were explored, or their Shared Socio-Economic Pathways counterparts.
- Examine changes in the selected climate parameters across three meaningful timeframes for the EZ's lifespan (e.g., 2020-2039, 2040-2059, and 2060-2079). Extreme climate change scenarios outside the IPCC's 10^{th} to 90^{th} percentile ranges can also be considered.

iii) Identifying Risks to Infrastructure from Climate Impacts

The third step involved broadening the scope by addressing the probability of the climate impacts exploiting the identified vulnerabilities, i.e., going from vulnerability analysis towards risk analysis. Theoretically, it should be a relatively straightforward process to incorporate the probability of threats and hazards using generic failure rated for NSEZ infrastructures and assets. However, there are very few studies in the literature that qualitatively assess the impacts of climate change impacts on similar types of projects i.e., economic zones. Given the low level of knowledge of both the consequences and the probability of the threat or hazard exploiting the vulnerability, the CRVA study was focused on quantifying the exposure of the EZ infrastructure, assets, and facilities to climate change variables, and the sensitivity of the infrastructure to specific or multiple hazards.

iv) Evaluation of Climate Risk

The risk analysis methodology adopted for the assessment of infrastructure risk associated with this study is based on the International Standard for Risk Management, ISO 3100 Risk Assessment Matrix methodology. The terms likelihood (L), consequence (C), and risk (R) are essential to the methodology, and RESA Consultant has adopted the definitions outlined in the International Standard for Risk Management, ISO 3100 risk assessment matrix methodology (2009). Table-10 illustrates a typical risk matrix that links the likelihood (or frequency) of the hazard with the scale of the consequence and the resulting level of risk.

Table-10: Risk Assessment Matrix

	Consequence Level				
Likelihood Level	1 Insignificant	2 Minor	3 Moderate	4 Major	5 Catastrophic
5	L (5)	M (10)	H (15)	E (20)	E (25)

Almost Certain					
4 Likely	L (4)	M (8)	H (12)	H (16)	E (20)
3 Possible	L (3)	M (6)	M (9)	H (12)	H (15)
2 Unlikely	L (2)	L (4)	M (6)	M (8)	M (10)
1 Rare	L (1)	L (2)	L (3)	L (4)	M (5)

E = > 20	**Extreme Risk:** potentially threatening the overall viability of the project and requiring priority action
H = > 12	**High Risk:** the most severe risks that can be accepted as part of the design and routine operation of the water supply infrastructure and facilities.
M = > 5	**Medium Risk:** risk that can be expected to influence the design and routine operation of the water supply infrastructure and facilities and where control measures can be applied and will be sufficient.
L = < 5	**Low Risk:** where existing control measures will be sufficient to mitigate any potential impacts and /or where no action will be required to treat them unless they become more severe.

Source: International Standard for Risk Management, ISO 3100 Risk Assessment Matrix's Methodology

The risk matrix defines the level of risk for a particular combination of consequence and likelihood. The risk ratings are a combination of the probability (or likelihood) of a climate hazard (derived from the climate modelling) and the consequence in terms of impacts on infrastructure (derived in large part from the sensitivity analysis). Using this approach, a standard risk assessment matrix was used to determine the level of infrastructure risk for each category of asset and climate hazard, where risk is defined in terms of the probability of a particular climatic outcome multiplied by the consequences of that outcome. Instead of using fixed values, the use of classes allows for more flexibility and incorporation of expert opinion.

This approach also permits to visualize of the effects and consequences of risk reduction measures and gives a framework to understand risk assessment. The system depends on the quality of the group of experts that are formed to identify the hazard scenarios and carry out the hazard filtering and ranking in several sub-stages characterized by likelihood (probability) and consequences (of impacts) and their corresponding limits.

This risk assessment process also requires a uniform approach to determining the likelihood and consequence of each impact. The qualitative measures of "likelihood" and "consequence" for this assessment are described in Table-11 and Table-12.

Table-11: Qualitative Measures of Likelihood

Level	Description	Likelihood	Annual Exceedance Probability
5	Almost Certain	There is a high possibility the event will occur as there is a history of frequent occurrence. The event is expected to occur in most circumstances.	Will probably occur more than once a year
4	Likely	It is likely that the event will occur as there is a history of casual occurrence. The event has occurred several times or more in the past.	Will probably occur once in 1- 10 years
3	Possible	The event has occurred at least in the past and may occur again.	May occur once in 10-100 years
2	Unlikely	There is a low possibility that the event will occur, however, there is a history of infrequent and/or isolated occurrences.	May occur once in 100 years
1	Rare	It is highly unlikely that the event will occur except in extreme/exceptional circumstances, which have not been recorded historically.	Unlikely during the next 100 years

Source: Adapted from International Standard for Risk Management, ISO 3100 Risk Assessment Matrix methodology

The likelihood can be described as the level of probability that, or the frequency with which, a specific climate change hazard may impact the NSEZ infrastructure. The likelihood levels applied in the assessment of risk are quantified using five categories, ranging from “rare (1) to “almost certain” (5), and are based on experience and climate modeling available for the region.

A consequence on the other hand, can be defined as an outcome or impact from an event occurring. Five categories, ranging from “catastrophic” (5) to “insignificant” (1), as illustrated in Table-12, have been used to describe the type and severity of a consequence of an impact on the infrastructure resulting from a specific climate hazard event or combination of impacts. As multiple consequences may apply to a single hazard or aspect, the approach used was to take the worst credible risk (in terms of consequence versus likelihood).

Table-12: Qualitative Measures of Consequence

Level	Description	
1	Insignificant	● No damage to infrastructure. ● Numerous risk reduction and control measures exist.
2	Minor	● Localized infrastructure services disruption. ● No permanent damage. ● Some minor restoration work is required. ● Early renewal of infrastructure by 5-10%. ● Suitable risk reduction and control measures exist.
3	Moderate	● Widespread infrastructure damage and loss of service. ● Damage is recoverable by maintenance and minor repairs. ● Early renewal of infrastructure by 10-20%. ● Some suitable risk reduction and control measures exist.

Level	Description	
4	Major	• Extensive infrastructure damage requires extensive repair. • Permanent loss of regional infrastructure services e.g., inundation of NSEZ site by flooding. • Early renewal of Infrastructure by 20-50%. • Loss or retreat of usable land for NSEZ project setup. • Few suitable risk reduction and control measures exist.
5	Catastrophic	• Permanent damage and/or loss of infrastructure services. • Loss or retreat of infrastructure support and translocation of NSEZ facilities and services. • No suitable risk reduction and control measures exist.

Source: Adapted from International Standard for Risk Management, ISO 3100 Risk Assessment Matrix methodology

v) Risk Mitigation and Adaptation Options and measures

Step five involves the identification of priority intervention options for risk treatment to reduce asset sensitivity and hazard exposure - and formulate risk management measures to prepare and respond to critical hazard risks and threats. This is the last step in the CRVA process, and necessitates the adoption of a risk management and risk reduction perspective, whereby a number of key questions are addressed, as follows:

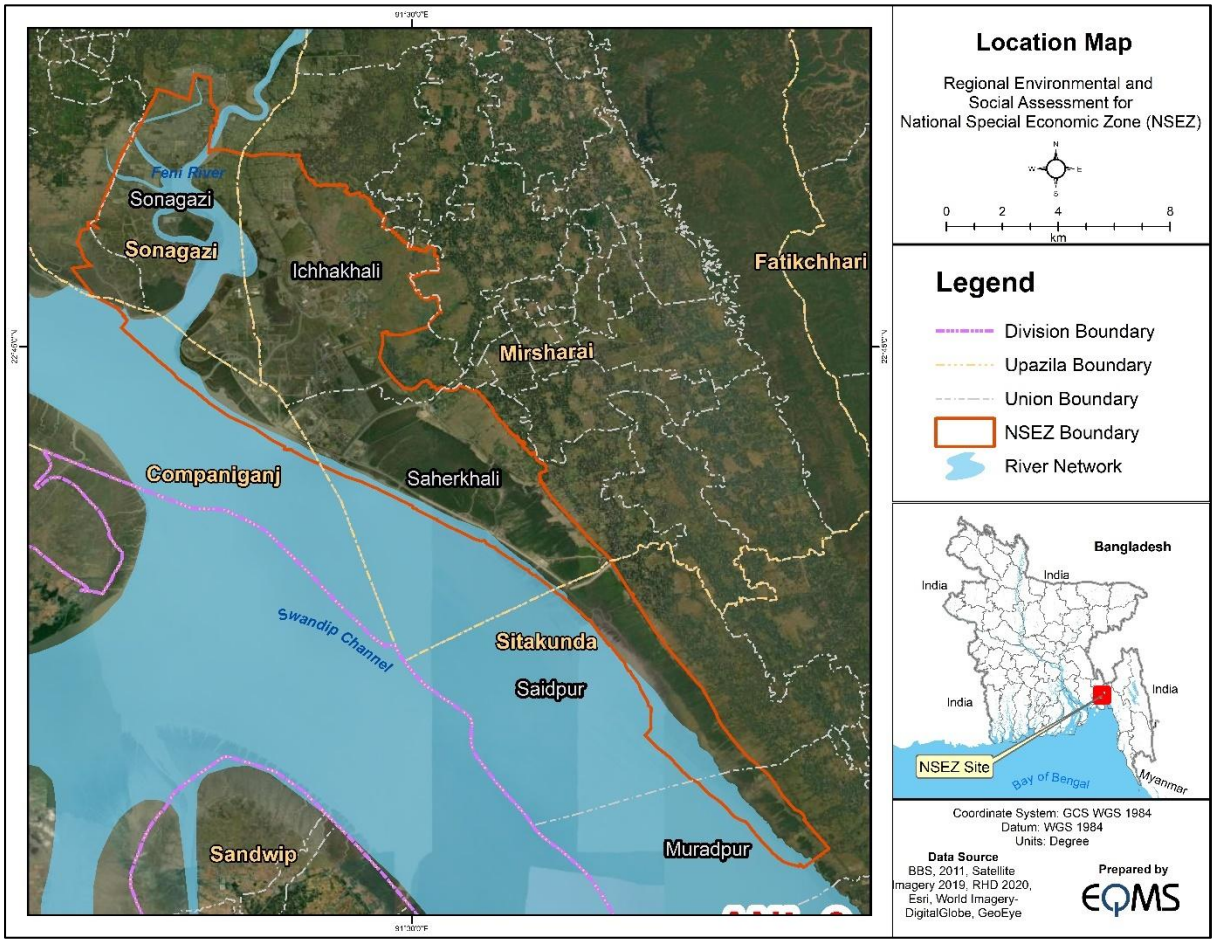
- What can be done and what adaptation and risk management options are available to protect critical project assets and infrastructure?
- What are the priorities for climate-proofing infrastructure and responding to long-term climate change?
- What are the tradeoffs in terms of all the relevant costs (including the costs of impacts, adaptation, or inaction)?
- How can we best finance these climate change investment interventions?
- What are the likely implications of planning, design, and operational decisions now on future options and how can we build flexibility into the adaptation planning and decision-making process?

Clearly, these are questions that the proponent will need to address during the detailed design stage of the EZ. Understanding how the infrastructure associated with the NSEZ is exposed to climate-induced hazards, their vulnerability to impacts and damage from these hazards, and how these may change over time, is the foundation for developing effective and appropriate risk management and risk reduction options and measures. That understanding will provide a foundation from which informed decisions may be made about the acceptable level of risk, and how such risk should be managed or reduced through the introduction of adaptation options and risk management measures.

1.9.2 Physical Climate Context

The NSEZ is located in two districts i.e., Feni and Chattogram. The location map of the EZ region is shown in Figure-10.

Figure-10: Location Map of the Project Region



Source: EQMS

1.9.2.1 Climate Zone

According to the climatic sub-regions of Bangladesh, the NSEZ region is located in the South-East Region. It comprises the Chattogram sub-region and a strip of land extending from southwest Sundarbans to the south of Cumilla. The hills over 300m in height have a north-eastern zone climate. The rest of the area has a small range of temperature, rarely goes over a mean of 32°C and below a mean of 13°C. Rainfall is heavy, usually over 2,540 mm. In winter dew fall is heavy. A brief description of the climatic sub-regions of the study region including a map given in sub-section 4.2.1 of this report.

1.9.2.2 Temperature and Rainfall

The nearest meteorological monitoring stations from the EZ region are Sitakunda, Sandwip, and Feni. The climatic data was obtained from the Bangladesh Meteorological Department. The climatic data has been analyzed in terms of temperature, rainfall, and humidity and incorporated in sub-sections 4.2.1.1 to 4.2.1.3 of this report.

1.9.2.3 Cyclone and Storm Surges

The NSEZ area is located in the high-risk zone for cyclones and its associated disasters like storm surges. The cyclone season in the Bay of Bengal mainly occurs in the pre-monsoon and post-monsoon seasons, between April-May and October-November. The high winds and rainfall associated with cyclones cause flooding, landslides, damage to infrastructure, destruction of crops, and disruption to services, as well as injuries and fatalities. Details of major cyclonic storms and associated tidal surge height on the Chattogram coast including a map of the cyclone storm track are incorporated in sub-section 8.6.1 of this report.

1.9.2.4 Earthquake

Bangladesh can be affected by moderate to strong earthquake events due to its proximity to the collision boundary of the northeast-moving Indian Plate and Eurasian Plate. Strong historical earthquakes with a magnitude greater than 7.0 have affected parts of Bangladesh in the last 150 years, some of them had their epicenters within the country. According to the Bangladesh National Building Code 2020, the NSEZ site and study region fall in both severe seismic intensity zone (zone 3) with coefficients of 0.28 and moderate seismic intensity zone (zone 2) with coefficients of 0.20. Details of major regional earthquakes are incorporated in sub-section 8.6.2 of this report.

1.9.2.5 Tsunami

Considering the state of tsunami vulnerability and potential seismic sources, the coastal belt is classified into three tsunamigenic zones. According to this classification, the NSEZ area falls within Zone-I, which is reportedly the most vulnerable belt. Details of tsunami events on the Bangladesh coast including tsunami vulnerability map are incorporated in sub-section 8.6.3 of this report.

1.9.2.6 Flood

The NSEZ site is located on the shoreline of the Bay of Bengal and is highly vulnerable to coastal floods caused by tidal/storm surges. As a result, a super dyke has been constructed along the NSEZ boundary to protect the EZ from tidal surges/storm surges. Details on flood events in the study region, including a flood risk map are incorporated in sub-section 8.6.4 of this report.

1.9.3 Climate Risk Assessment

This study has reviewed future climate projections based on the Coupled Model Intercomparison Project (CMIP6) including analysis of statistically downscaled climate projections from the World Bank Climate Knowledge Portal. Climate projections are summarized for both SSP2-4.5 and SSP5-8.5, for the time period 2040-2059. SSP2-4.5 is characterized as a 'middle of the road' medium emissions scenario in which the concentration of greenhouse gases is stabilized by 2100, whereas SSP5-8.5 is a 'development first' high emissions scenario with no effective mitigation measures.

In line with EP4 requirements, this section outlines the CCRA methodology applied. Following desk-based research to obtain future climate change projections data for the EZ location (Chattogram)[9], a staged approach was used to identify the potential physical climate-related risks for the EZ.

1.9.3.1 Climate Change Projections

Temperature

Climate projections for SSP2-4.5 and SSP5-8.5 were assessed to determine potential impacts and consequences to the construction and operation of the NSEZ infrastructures. The future projected temperature change data for both scenarios is presented in Table-13.

Table-13: Projected Temperature-related Climate Data for SSP2-4.5 and SSP5- 8.5 Scenarios

	SSP2-4.5[10]			SSP5-8.5		
Mean annual temperature: increase in ºC from the 1992-2021 baseline						
	2020-2039	**2040-2059**	**2060-2079**	**2020-2039**	**2040-2059**	**2060-2079**
Chattogram	0.51	1.05	1.56	0.55	1.52	2.53

[9] Note that only national and sub-national dataset are available in World Bank Climate Change Knowledge Portal as of 15th December 2023 and Project/location site-based datasets are not available for the time being. As the project location lies nearest in Chattogram region, it has been considered for the study.

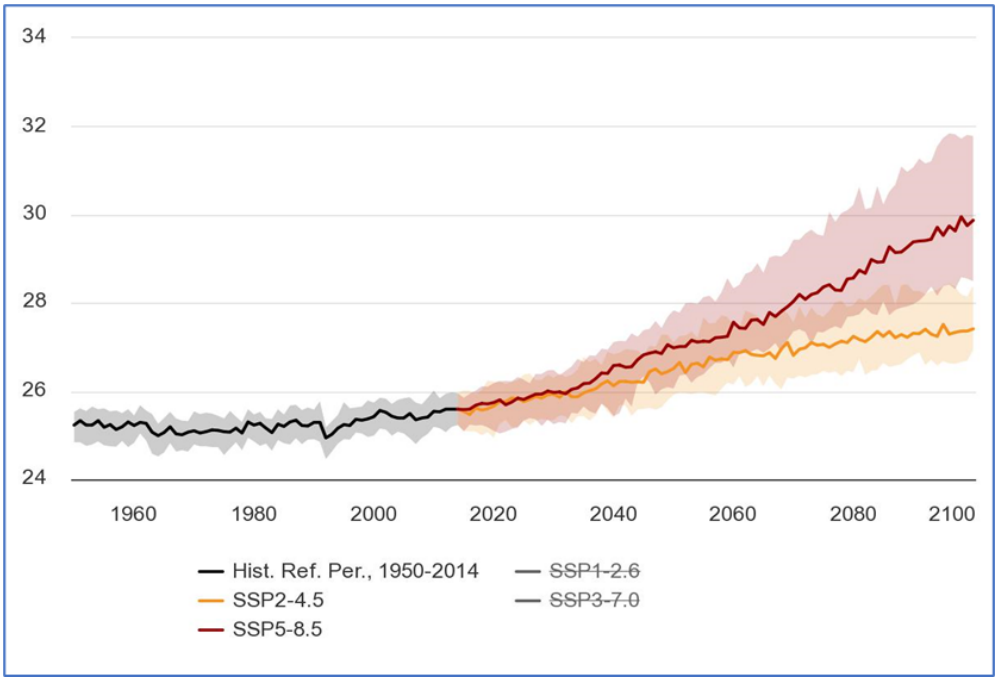
[10] Data presented is CMIP6, derived from the Sixth phase of the CMIPs. The CMIPs form the data foundation of the IPCC Assessment Reports. CMIP6 supports the IPCC's Sixth Assessment Report. https://climateknowledgeportal.worldbank.org/country/bangladesh/climate-data-projections

	SSP2-4.5[10]			SSP5-8.5		
Country	0.48	1.05	1.57	0.51	1.54	2.58
Maximum of daily temperatures: increase in ºC from the 1992-2021 baseline						
	2020-2039	**2040-2059**	**2060-2079**	**2020-2039**	**2040-2059**	**2060-2079**
Chattogram	0.38	0.96	1.55	0.47	1.46	2.51
Country	0.29	0.98	1.51	0.41	1.41	2.48
Number of hot days (over 35º C): increase in the number of hot days from the 1992-2021 baseline						
	2020-2039	**2040-2059**	**2060-2079**	**2020-2039**	**2040-2059**	**2060-2079**
Chattogram	3	10	18	4	17	38
Country	2.88	13.6	23.63	4.5	22.75	51

Source: Climate Change Knowledge Portal, World Bank

Mean temperature, maximum daily temperature, and number of hot days are expected to increase in Chattogram with similar (minute differences/more or less similar) magnitude on average for both Bangladesh as well as Chattogram region under both scenarios. The mean annual temperature in Chattogram is expected to increase by over 0.51°C (2020-2039), 1.05°C (2040-2059), and 1.56°C (2060-2079) as per SSP2-4.5 while it slightly higher in magnitude during 2020-2039 (0.55°C) and again increases towards the end of the period 2040-2059 (1.46°C) as per SSP5-8.5. However, both the SSP's projected a rise in mean annual temperature as compared to the 1992-2021 baseline.

Figure-11: Projected Average Surface Temperature for SSP2-4.5 and SSP5-8.5 for Chattogram Region

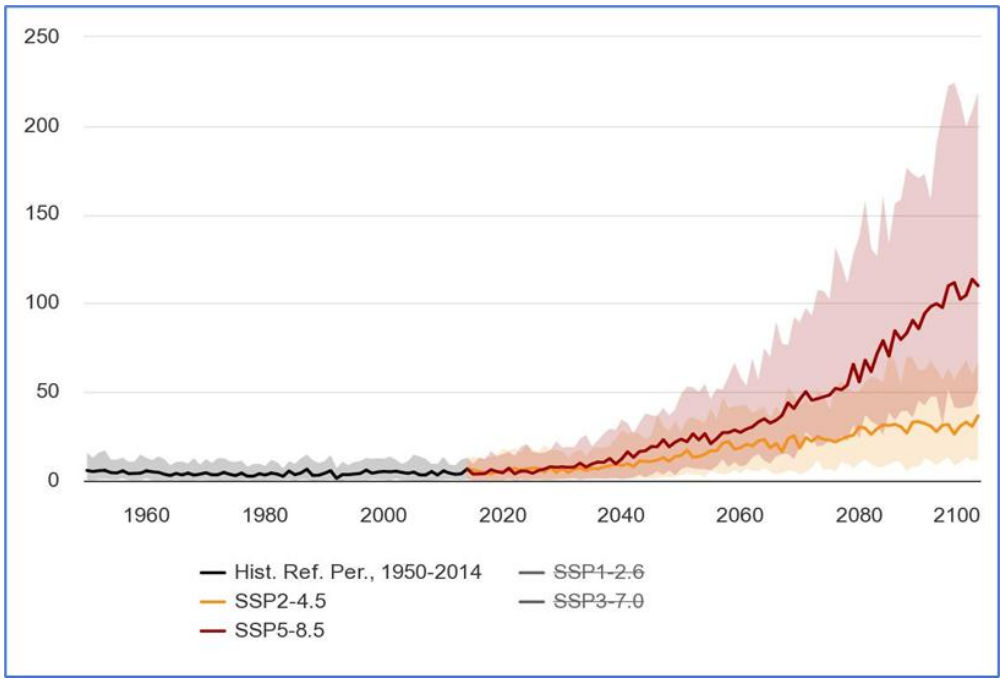


Source: Climate Change Knowledge Portal, World Bank

By mid-century, the number of hot days (over 35° C) is expected to increase by 10 days p.a. (SSP2-4.5) to 17 days p.a. (SSP5-8.5) (Table-13).

Both scenarios indicate a significant increase in anomalies in temperatures and hot spells.

Figure-12: Projected Number of Hot Days (Tmax > 350 C) for SSP2-4.5 and SSP5-8.5 for Chattogram Region



Source: Climate Change Knowledge Portal, World Bank

Precipitation

There will be an impact on precipitation due to climate change. The projected precipitations-related climate data for SSP2-4.5 and SSP5-8.5 is given in Table-14.

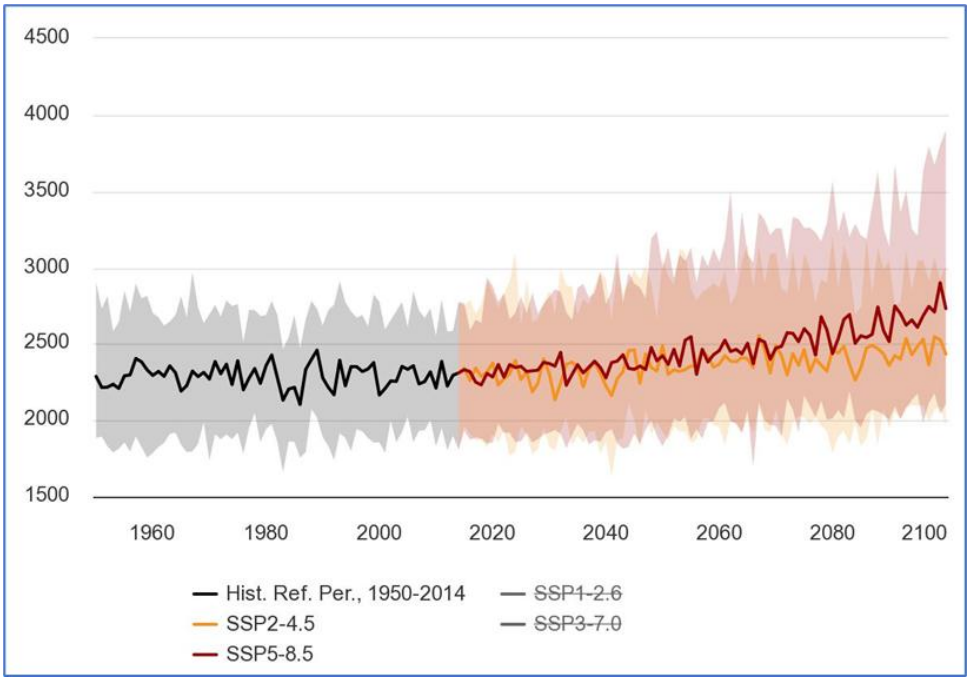
Table-14: Projected precipitation-related climate data for SSP2-4.5 and SSP5-4.5 Scenarios

	SSP2-4.5			SSP5-8.5		
Mean annual precipitation (mm): increase in mm from the 1991-2021 baseline						
	2020-2039	2040-2059	2060-2079	2020-2039	2040-2059	2060-2079
Chattogram	40	58	115	21	103	205
Country	65	35	109	35	87	211
Average Largest 1-Day Precipitation: increase in mm from the 1991-2021 baseline						
	2020-2039	2040-2059	2060-2079	2020-2039	2040-2059	2060-2079
Chattogram	68	70	71	69	72	76
Country	64	65	66	63	66	69
Number of wet days with >50mm rain (mm)						
	2020-2039	2040-2059	2060-2079	2020-2039	2040-2059	2060-2079
Chattogram	4	4	4	4	4	5
Country	3.4	3.4	3.8	3.4	3.6	4.9

Source: Climate Change Knowledge Portal, World Bank

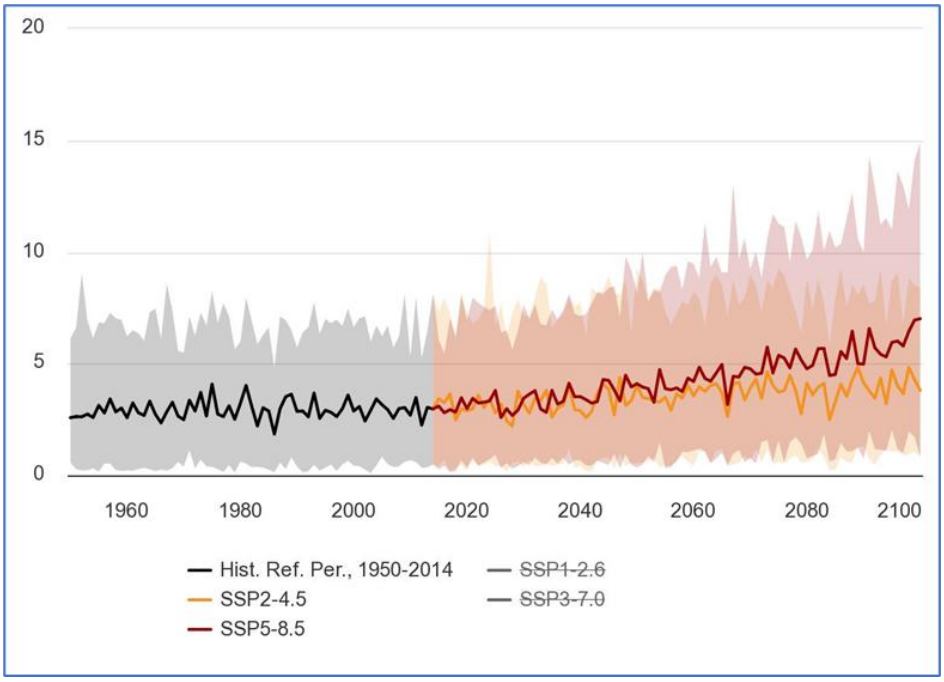
Rainfall will be increased by 1.65% and 5.2% for SSP2-4.5 and SSP5-8.5 scenarios in 2040-2059. The projected number of days with precipitation >50 mm at Chattogram Region for SSP2-4.5 and SSP5-8.5 is shown in Table-14.

Figure-13: Projected precipitation for SSP2-4.5 and SSP5-8.5 for Chattogram Region



Source: Climate Change Knowledge Portal, World Bank

Figure-14: Projected number of days with precipitation>50 at Chattogram Region



Source: Climate Change Knowledge Portal, World Bank

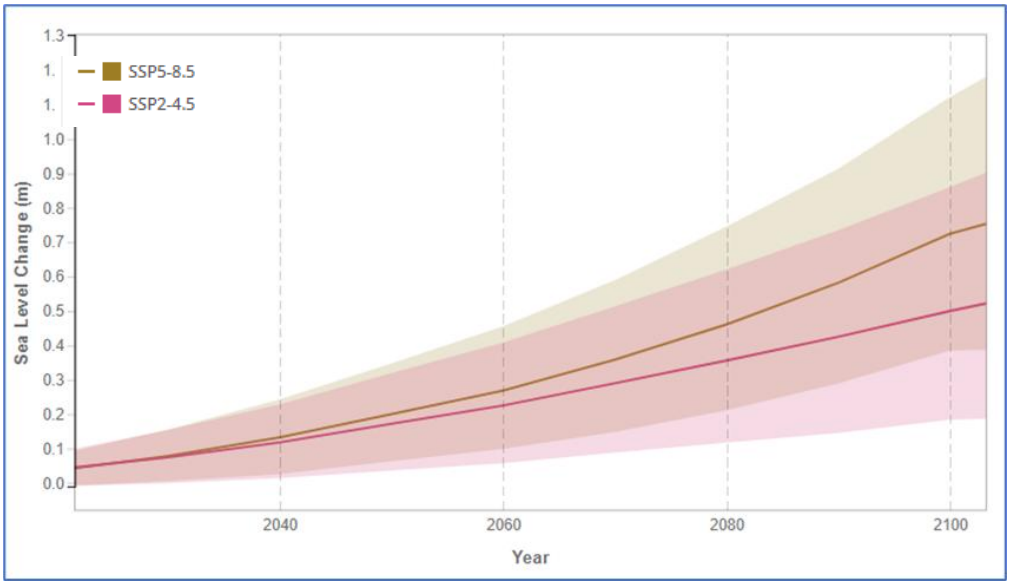
Number of wet days (>50 mm) is expected to be increased in SSP2-4.5 and SSP5-8.5 by mid-century.

Sea Level Rise

The projected[11] sea level rise at the NSEZ coastal area for SSP2-4.5 and SSP5-8.5 is shown in Figure-15.

[11] IPCC AR6 Sea Level Projection Tool. Sea Level Projection Tool – NASA Sea Level Change Portal. Note that the nearest location is at Hiron (coastal zone of Bangladesh) where sea level rise has been projected by this tool.

Figure-15: Projected Sea level rise for SSP2-4.5 and SSP5-8.5 scenario



Source: Sea Level Projection Tool – NASA Sea Level Change Portal

1.9.3.2 Risk Identification

By the end of the planned EZ life, the following changes to the climate in the area are expected:

- Temperatures will increase along with the number of very hot days.
- Precipitation will increase by mid-century, with longer wet spells and shorter dry spells, but little change in the number of wet days with >50mm rainfall insignificantly.
- Sea level is expected to rise by 0.17 m (SSP2-4.5) to 0.20 m (SSP5-8.5) by 2050 and associated coastal flooding is anticipated.
- Furthermore, according to ThinkHazard (Chattogram region but also covers project location), there is greater than a 50% chance of encountering weather that could support a significant wildfire that is likely to result in both life and property loss in any given year. Prolonged exposure to extreme heat, resulting in heat stress, is expected to occur at least once in the next five years. Potentially damaging and life-threatening urban, river and coastal floods are expected to occur at least once in the next 10 years. Potentially damaging waves are expected to flood the coast at least once in the next 10 years. The frequency and intensity of these hazards are expected to increase because of climate change.

Physical climate-related risks were assessed separately for construction and commissioning and the operational design life of the EZ. Risk ratings take planned mitigation measures to reduce, control, and respond to risks, into account. No risks were identified as high for the construction and commissioning phase, although the following moderate risks are noted:

- The potential for heat stress and heat exhaustion of construction workers due to increased temperatures and hot days over 35°C.
- The potential for damage to assets and construction equipment resulting from the increased risk of heatwaves.
- The potential for flooding and waterlogging hampering the construction equipment and EZ infrastructures due to frequent and more intense heavy precipitation.

No risks were identified as high for the operational design life of the EZ, although the following moderate risks are noted:

- Increases in air temperature cause reduced generation efficiency and output, and an increase in operational cost.

- The potential for heat stress and heat exhaustion of workers due to increased temperatures and hot days over 35°C.
- Heavy rainfall events contribute to moderate infrastructure damage and loss of service.
- The potential for increased risk of disease transmission (e.g., malaria and dengue fever, improved growing conditions for algae, and potentially harmful micro-organisms in water courses) is due to both increased temperatures and more intense and frequent heavy precipitation.
- Loss or damage to the EZ equipment and impacts on human health caused by more frequent and severe heatwaves.
- Damage to on-ground assets as a result of an increase in frequency and severity of coastal flooding and siltation.
- Damage to EZ infrastructure due to more intense and frequent heavy precipitation and severe flooding.
- Increased frequency and intensity of cyclones and associated tidal surges.
- Increased sea level rise causes salinity intrusion to affect the intake site.

1.9.3.3 Evaluation of Climate Risk

The potential climate risks have been evaluated using the CRVA Methodology. The physical climate risks for NSEZ infrastructure construction are presented in Table-15.

Table-15: Physical Risk Assessment – Construction activities at NSEZ

Climate Hazard	Climate-Related Impact	Likelihood of Climate-related Impact Occurring	Consequence (Description)	Consequence Level	Risk Category
Higher annual average and daily maximum temperatures and more hot days >35°C	Increased heat stress/ heat exhaustion of workers.	Possible	Reduced revenue and higher costs from negative impacts on the workforce (e.g., health, safety, absenteeism); disruption to the construction activities at the NSEZ region.	Moderate	Medium
Higher annual average and daily maximum temperatures and more hot days >35°C	Overheating of equipment/machinery and safety risks associated with flammable equipment.	Unlikely	Reduced revenue and disruption to the construction activities.	Minor	Low
Higher annual average and daily maximum temperatures and more hot days >35°C	Potential damage to road surfacing due to prolonged exposure to high-intensity temperatures, leading to road subsidence and possible temporary road closure until repairs are conducted.	Unlikely	Difficulties in the delivery of construction materials at the NSEZ area. Workers also face problems in reaching the workplace at NSEZ. This situation delays activities at NSEZ.	Minor	Low
More frequent and longer drought	Increased risk of soil erosion from exposed soils during construction.	Unlikely	Stability risks of ground conditions and potential interruptions to construction at NSEZ.	Minor	Low
More frequent and intense	Potential flooding and water-logged construction site	Moderate	Financial costs; insurance implications; disruption and delay to the construction work at NSEZ of various industries. Hazardous	Moderate	Medium

Climate Hazard	Climate-Related Impact	Likelihood of Climate-related Impact Occurring	Consequence (Description)	Consequence Level	Risk Category
heavy precipitation	hampering movement of machinery, potential damage to structures and construction equipment.		substances may be washed out to nearby khals/rivers due to heavy rainfall from the construction site.		
More frequent and severe heat waves	Damage to structures and construction equipment; risk to human health and life	Moderate	Disrupted construction activities; loss of assets, reconstruction costs & loss of life	Moderate	Medium
Increased frequency of cyclones/tropical storms	Unable to access construction site due to surface water flooding of roads; damage to structures and construction equipment	Low	Disrupted construction activities; loss of assets; reconstruction costs; workers unable to get to the site at NSEZ.	Low	Low
Increased frequency of heavy winds (not related to cyclones)[12]	Damage to structures and construction equipment	Unknown	Disrupted construction activities; loss of assets; reconstruction costs; workers unable to get to the site at NSEZ.	Unknown	Unknown
Increased frequency and severity of coastal flooding	Damage to structures and construction equipment; disruption to access and supply of construction materials	Likely	Disrupted construction activities at NSEZ; loss of assets; reconstruction costs; workers unable to get to the site	Minor	Medium

[12] Due to uncertainty in wind projections, it is not possible to provide a rating here.

The physical climate risks for the NSEZ operation are presented in Table-16.

Table-16: Physical Risk Assessment – Operational Design Life

Climate Hazard	Climate-Related Impact	Likelihood of climate-related impact occurring		Consequence (Description)	Consequence rating	Risk Category	
		2020-2039	2040-2059			2020-2039	2040-2059
Higher annual average and daily maximum temperatures and more hot days >35°C	Increased heat stress/heat exhaustion of workers.	Possible	Possible	Reduced revenue and higher costs from negative impacts on the workforce (e.g., health, safety, absenteeism) at NSEZ.	Moderate	Medium	Medium
Higher annual average temperatures, daily maximum temperatures, more hot days >35°C and more intense and frequent heavy precipitation	Increased risk of disease transmission (e.g., malaria and dengue fever, improved growing conditions for algae, and potentially harmful micro-organisms in water courses).	Unlikely	Moderate	Reduced revenue and higher costs from negative impacts on the workforce (e.g., health, safety, absenteeism) at NSEZ.	Moderate	Low	Medium
Higher annual average and daily maximum temperatures and more hot days >35°C	Overheating of equipment /machinery and safety risks associated with flammable equipment.	Unlikely	Unlikely	Fire, damage to assets, disruption to supply, cost of	Low	Low	Low

Climate Hazard	Climate-Related Impact	Likelihood of climate-related impact occurring		Consequence (Description)	Consequence rating	Risk Category	
		2020-2039	2040-2059			2020-2039	2040-2059
				repair, staff injury at NSEZ.			
Higher annual average and daily maximum temperatures and more hot days >35°C	Potential damage to access road surfacing due to prolonged exposure to high intensity. Temperatures, leading to road subsidence and possible temporary road closure until repairs are conducted. The existing freeboard requirements for road construction in Bangladesh, as outlined in the Pavement Design Guide for the Roads & Highways Department (2005)[13], specify a minimum elevation of 1.0m above the Highest Flood Level (HFL) for dual carriageways and roads with a carriageway width of 6.2m or greater, while narrower roads (with carriageway widths of 3.7m and 5.5m) require a minimum freeboard of 0.9m. These standards are based on 50-year return periods for national and regional highways and 20-year return periods for district roads. However, the impacts of climate change, such as rising sea levels, increased storm surges, and more intense rainfall, are likely to make these thresholds inadequate, particularly in low-lying coastal regions. For example, RHD highlights the importance of recording and updating HFL	Unlikely	Moderate	Financial costs; insurance implications; disruption to the operation of various industries at NSEZ due to disruption of raw material supply.	Moderate	Low	Medium

[13] https://www.rhd.gov.bd/Documents/RoadDesignAndSafety/PavemantDesignGuideforRHD/Index.pdf

Climate Hazard	Climate-Related Impact	Likelihood of climate-related impact occurring		Consequence (Description)	Consequence rating	Risk Category	
		2020-2039	2040-2059			2020-2039	2040-2059
	determinations, as they are critical to road design. To address these challenges, freeboard levels should be increased by at least 20–30% to account for projected sea level rise and intensified flood events. Additionally, the formation level (the top of the sub-grade) currently set at 30 cm above HFL, may need to be adjusted to account for land subsidence in coastal areas. Implementing dynamic flood modeling, localized risk assessments, and climate-resilient design updates is essential to ensure road infrastructure remains sustainable and resilient in the face of increasing flood and climate change risks.						
More frequent and longer drought	Accelerated land degradation, and soil erosion	Unlikely	Minor	Stability risk of ground conditions and potential interruptions to operations at various industries at NSEZ.	Low	Low	Low
More frequent and more intense heavy precipitation	Flooding of EZ area, and infrastructure. Damage to assets including substations. Potential damage to access road surfacing, leading to loss of access for maintenance.	Unlikely	Moderate	Financial costs; disruption to operation; unplanned	Moderate	Low	Medium

Climate Hazard	Climate-Related Impact	Likelihood of climate-related impact occurring		Consequence (Description)	Consequence rating	Risk Category	
		2020-2039	2040-2059			2020-2039	2040-2059
				shut-down. Spill response including remediation plan and activities for operators from potentially impacted larger areas as khals/river currents carry hazardous substances further downstream.			
More frequent and more intense heavy precipitation	Risk of contamination from CETP/STP/WTP entering the surrounding environment	Unlikely	Moderate	Impacts on wildlife and environment	Moderate	Low	Medium
More frequent and more intense heavy precipitation	Potential for erosion	Unlikely	Unlikely	Destruction of assets	Low	Low	Low
More frequent and severe heat waves	Loss or damage to the equipment/infrastructure	Unlikely	Unlikely	Disruption to operations; loss of assets,	Moderate	Medium	Medium

Climate Hazard	Climate-Related Impact	Likelihood of climate-related impact occurring		Consequence (Description)	Consequence rating	Risk Category	
		2020-2039	2040-2059			2020-2039	2040-2059
				reconstruction costs			
Increased frequency and severity of coastal flooding	Damage to on-ground assets because of flooding and siltation. Loss or damage infrastructures passing across the river during the storm surge. Loss of access for maintenance.	Unlikely	Unlikely	Disruption to operations; reconstruction costs; workers unable to get to the site; disrupted utility and raw material supply at NSEZ.	Minor	Low	Low
Increased frequency of cyclones/tropical storms	Loss or damage to assets, including storms damaging WTP, STP, CETP, and pump house. Disrupted access for maintenance.	Unlikely	Unlikely	Disruption to operations; reconstruction costs; workers unable to get to the site; disrupted supply	Minor	Low	Low
Increased frequency of heavy winds (not related to cyclones)	Loss or damage to assets and disrupted access.	Low	Low	Disruption to operations; reconstruction costs;	High	Low	Low

Climate Hazard	Climate-Related Impact	Likelihood of climate-related impact occurring		Consequence (Description)	Consequence rating	Risk Category	
		2020-2039	2040-2059			2020-2039	2040-2059
				disrupted supply			

The forecast of climate change impacts on key installations is presented in Table-17.

Table-17: Forecast of Climate Change Impacts on Key Installations

SN	Aspect	Forecast/Scenario	Potential Impacts	Key Installations at Risk	Mitigation/Management
1.	Climate Change	• Temperature rise by 1.6°C (RCP 4.5) to 2°C (RCP 8.5) by 2050. Increased variability in rainfall patterns. • The number of hot days (>35°C) could increase by 10 to 17 annually. • Annual precipitation is projected to increase by 5.2% under SSP5-8.5, with more intense wet days.	• Heat stress on infrastructure, reduced material lifespan, water scarcity, and increased energy demand. • Potential for accelerated corrosion of key installations like substations and other metal-based infrastructure.	Industrial complexes, residential zones, utilities	Use heat-resilient materials, energy-efficient cooling systems, and rainwater harvesting setups.
2.	Sea Level Rise	• Estimated rise: SLR of 25 cm by 2050 and 1 m by 2100 as per IPCC predictions. • Tidal trends increase at 7–20 mm/year in coastal areas. • 17.5% of land area (coastal zone of 25,000 km²) may be affected in high-end SLR scenarios.	• Submergence of coastal areas, salinity intrusion, damage to ecosystems, and migration pressures. • Structural stress on super dykes designed to protect the region, requiring frequent maintenance and upgrades.	Super-dykes, coastal embankments, aquifers	• Elevate critical infrastructure, enhance dike systems, and implement salinity-resistant water management strategies. • Strengthen flood management systems, including drainage and flood forecasting technologies.

SN	Aspect	Forecast/Scenario	Potential Impacts	Key Installations at Risk	Mitigation/Management
			• Increased salinity intrusion into freshwater systems and agricultural lands.		• Develop relocation plans for vulnerable populations and industries. • Conduct continuous monitoring and periodic reassessment of SLR impacts on infrastructure.
3.	Tidal Surges	• Increased intensity and frequency of cyclones in the Bay of Bengal, with expected storm surges becoming higher due to sea level rise. Example: surge height from 7.1m (current) to 9.1m by 2100. • Cyclones with wind speeds exceeding 225 km/h and tidal surges over 9 meters could breach defenses.	• Damage to super dykes, flooding, and disruption to transport and supply chains. • Disruptions to power supply and transportation networks.	Super dykes, roads, substations, and drainage systems	Regular maintenance of dykes, real-time surge monitoring, and resilient drainage designs.
4.	Flooding	Increased monsoonal floods and intensity due to altered rainfall and rising sea levels.	• Overwhelmed drainage, submersion of facilities, and road infrastructure damage due to inundation. • Recurrent flooding could degrade pipelines and electrical systems. • Increased rehabilitation costs and project delays.	Roads, highways, transportation networks	Ensure road elevation meets or exceeds the specified freeboard values (1.0m for major roads, 0.9m for minor roads). Regular maintenance and monitoring to adjust to updated HFL levels.
5.	Salinity Intrusion	Projected intrusion of saline water deeper inland by 2050, affecting freshwater supplies.	• Reduced freshwater availability for drinking and agriculture impacts etc.	Groundwater aquifers, freshwater storage	Expand desalination facilities, improve freshwater storage, and adopt salinity-tolerant crops.

SN	Aspect	Forecast/Scenario	Potential Impacts	Key Installations at Risk	Mitigation/Management
			• Deterioration of equipment reliant on fresh water (e.g., cooling systems for power plants). • Impact on the availability of potable water for workers and local communities.		
6.	Tsunami	Coastal regions in Zone-I (most vulnerable). Rare but high-impact events.	Potential loss of life, destruction of coastal installations, and long-term economic impacts.	Coastal industries, residential areas	Install tsunami warning systems, develop evacuation plans, and ensure greenbelt buffer zones.

1.9.3.4 Risk Mitigation Measures

Several measures need to be incorporated into the design of the NSEZ along with plans. Potential physical climate risk mitigation measures are given in Table-18.

Table-18: Mitigation and Control Incorporated into the Design

Physical Impact	Mitigation/Control Measures
Potential heat stress/ heat exhaustion of workers caused by higher temperatures and more hot days over 35ºC	EPC Contractors should prepare and implement a Construction EHS Plan prior to commencing work to manage the construction-related environmental aspects such as burning, explosion, electric shock, etc. All workers should be properly informed, consulted, and trained on health and safety issues and a discussion session should be held with the Contractors. On commissioning, the O&M contractor should prepare an EHS plan for the operation phase, which will be dissipated among the workers and adhered to for occupational health and Safety issues management.
Potential damage to heat-sensitive equipment caused by higher temperatures and more hot days over 35ºC	A neutral earthing resistor would be connected between the neutral point of the secondary side winding of all equipment and the earth. Lightning protection would be achieved by providing lightning masts on stacks. Cathodic protection would be provided where required. For electrical fires, non-aqueous agents like ABC Power Choro Bromo Methane or CO_2 gas are utilized for firefighting. Fire extinguishers with these agents shall be liberally provided at static installations and on the rolling stock.
Potential loss or damage of assets and supply disruption caused by flooding (coastal or riverine)	The railways, roads, industries, and other structures at NSEZ should be levelled to a height to avoid floods. The possibility of impoundment of rainwater would be mitigated by channelizing the water towards the river/khal/sea through other low-lying areas outside the EZ boundary. The stormwater drain shall be aligned in a manner to ensure stormwater flow by a gradient from the villages into the river/khal/sea through the stormwater drain constructed around the EZ at its outer periphery. Stormwater drains should be designed considering the projected increased rainfall to address the projected increase in precipitation in the study region.
Potential loss or damage of assets and supply disruption caused by cyclones	Emergency Response and Disaster Management Plan - Based on the detailed risk assessment of the EZ after the finalization of the project design, a firm emergency response and disaster management plan will be developed to delineate procedures in the event of emergencies or disasters to prevent loss of life and reduce the impact on properties and environment. The plan would address on-site and off-site emergencies and would include awareness programs for the EZ personnel, local community, and local administration. It would also involve evacuation procedure, emergency contact, and a flowchart showing the hierarchy of actions & flow of communication in case of an emergency. The flowchart depicting Do's and Don'ts would be displayed at strategic locations in the construction phase within the site.

APPENDIX K

Appendix K: Detailed Impact Assessment for Scenario 1 and Scenario 2

1.1 Impact Assessment on Scenario 1

Scenario 1 involves the development of approximately 16,900 acres (about 50%) of land area by the year 2025.

1.1.1 Impacts During Development Phase

The development activities during the first phase will involves dredging and land reclamation, site development, construction of super dyke (22.5 km at Mirsharai side), access road development (NSEZ Sarani), internal road development, drainage and canal excavation, establishment of groundwater deep tubewell, water distribution line, power plant, electricity transmission line, substation and distribution line, gas pipeline, temporary jetty, telecommunication line establishment, plantation, etc.

1.1.1.1 Impacts on Air Quality

During the development of the 1st phase of EZ, the main pollutant will be the particulate matter (PM), which will be generated during earthwork activities, including vegetation clearing, excavation works, dredging and reclamation, and transportation of construction materials to and from EZ sites. The PM will thus generate blows along the wind direction. Generally, these particles will settle down within 100m to 200m from the construction site. However, during strong wind conditions, they will blow further. At the EZ site, the wind direction is mostly from the southwest to the northeast. Since there are habitations in the downwind direction. The impact is likely to be felt during the development of EZ and would be generally confined locally to the construction site itself. However, when the construction activity is near an inhabited area, it might be a cause of concern. In addition, pollutant emissions will occur due to the operation of diesel fuel generators, and exhaust emissions from transport vehicles such as material transport trucks and administrative vehicles. Therefore, the potential impacts of the project activities on air quality are associated with dust emissions and an increase in the following combustion pollutant concentrations. As most of the construction equipment will be mobile, the emissions are likely to be fugitive and not concentrated at a single place or source. The impacts will be localized in nature.

1.1.1.2 Impacts from Noise

The major sources of noise during the development of the EZ will be vehicular traffic and the operation of heavy construction equipment like dozers, scrapers, concrete mixers, cranes, compressors, generators, pumps, rock drills, pneumatic tools, saws, vibrators, etc. The operation of this equipment will generate noise ranging between 70-85 dB(A). Additionally, noise will be generated from transportation activities during the construction period. The increased noise level can impact workers' health and safety and reduce performance. Heavy vehicle operators, nearby communities, and residents close to access roads are at higher risk of noise nuisance.

Dredging activities in the Sandwip Channel will generate noise from a variety of sources. Additionally, noise will be generated by the onshore plant used to spread the dredged materials and to assemble and periodically relocate pipelines. Generally, a weighted noise intensity from working engines at the noise source shall not exceed a continuous level above approximately 120 dB(A). Underwater noise during the temporary jetty construction will result from the equipment that is used for underwater activities, such as dredging, reclamation, or the construction of the bund wall, piling, and ship movements.

1.1.1.3 Impacts on Surface Water

During the first phase of development of EZ, all the required water will be arranged from groundwater sources. Sources of pollutants that may impact surface water quality during the construction period include domestic wastewater from workers and sediment from runoff, particularly in land development activities where vegetation clearing is needed. The present surface water (internal khals and Sandwip

Channel) may be impacted due to non-point discharges of solids from soil loss and sewage generated by the construction workforce stationed at the site. Sewage discharge and runoff during the construction phase may lead to contamination of surface water if not managed properly. Septic tanks should be provided to treat the sewage from temporary toilets at the construction site and workers' accommodation. The septic tanks will need to be adequately designed so that untreated sewage due to leakage or overflows does not have the potential to enter surface water.

During the rainy season (April-September), the surface water quality is likely to be affected due to the construction work and loosening of topsoil. This is likely to increase the sediment as a result of increased soil erosion due to earthworks entering surface waters, causing increased turbidity. Dredging activities will also increase the turbidity in the marine water. Improper handling of lubricants, hazardous substances, and hydrocarbons may also cause water pollution of surface water.

1.1.1.4 Impacts on Groundwater

According to the discussion with BEZA, during the first phase of development, about 10 MLD of water will be extracted from the groundwater aquifer. Groundwater, especially shallow tubewells, is the main water supply source for local people in the surrounding communities of EZ. From the stakeholder consultation, it was observed that currently, there is a groundwater crisis in the region for domestic uses as well as irrigation during the dry season. The water will be produced from groundwater sources at the site camp and for construction purposes, which may cause a groundwater supply crisis and conflict with the surrounding community.

Groundwater can get worse in quality because proper treatment of generated wastewater is neglected in EZ. At this phase, there is a likelihood of having an adverse impact on groundwater quality through sewage disposal from temporary workers' facilities, debris, and solid waste deposits in case of a lack of proper management. Improper handling of lubricants, hazardous substances, and hydrocarbons may also cause groundwater pollution.

1.1.1.5 Impacts on Topography and Soil

The topography will change due to activities such as soil excavation, land development, super dyke, internal roads, access roads construction, pipelines, utility lines, etc. The topography of approximately 16,900 acres (50% area) will be impacted. The land elevation on the site varies from the site's lowest point at -3.33m MSL to the highest point at +8.71m MSL[14]. According to the consultation with BEZA, the project site has been partially filled with an elevation of 6.5 m, and the rest of the site will be filled with an elevation of 6.5 m.

The impacts on soil during the construction phase shall be mainly due to loss of topsoil in the construction areas and contamination of the soils of the surrounding area due to solid waste generation from site activities, as well as liquid waste such as lubricants, slurry, accidental spills, and leaks occurring from storage and work areas. The rainfall and surface runoff can cause soil erosion. Accidental spillage of oil from construction vehicles might cause soil contamination. In addition to that, municipal waste due to construction workers, domestic sewage, and sullage from the construction labor facilities and office at the project site, etc., will contribute to changing the soil characteristics.

1.1.1.6 Impacts of Sediment

Construction activities i.e., piling of buildings, excavation, concrete work, construction of temporary jetty, accidental spillage of hazardous chemicals like oil and lubricants from the construction vehicles, improper storage and disposal of construction waste, solid and liquid waste from the worker's facilities may mix with rainfall water and it can accumulate on the adjacent khals, Rivers, and Sandwip Channel through runoff. Besides the above-mentioned sources of impact, there are some additional sources, i.e., runoff and erosion of exposed bare soil, slopes, earth, and stockpiles, the release of cement materials with rain, and washing water of dust suppression sprays and vehicle wheels.

[14] https://bsmsn.gov.bd/?page_id=639

From the sediment quality analysis results, nickel concentration was found in the range moderately polluted (20-50 ppm), and chromium concentration was found in the range of moderately polluted (25-75 ppm). It is recommended to confirm the sediment quality/contamination level of the dredge materials prior to dredging that will be used for landfill in the EZ. Dredging disturbance of sediments can release contaminants into the water column, which has the potential to change the chemical properties of the sediment and reduce water quality at both extraction and dumping sites for some time after dredging has ceased.

1.1.1.7 Impact due to Changes in Land Use

During the development of the first phase, about 16,900 acres of land use and land cover will be changed. The existing vegetation and trees will be cleared for the development of the EZ and its allied facilities; therefore, the land use of the existing area will be changed to an industrial area which results in the loss of existing vegetation. Also, it will have an impact on the existing drainage pattern in the EZ as well as in the adjoining area if the development is not properly planned.

There will be a large number of personnel moving into EZ and the surrounding area, and the majority will be construction crews with low wages. They will likely depend in part on the locals to provide certain low-cost basic services, such as food, cleaning, transportation, and entertainment or relaxation. Naturally, there will be temporary structures set up to provide such services at the places most convenient for the workers, predictably near the access roads and the entrance to the site. These squatted temporary settlements will take more permanent forms over time.

1.1.1.8 Impact due to Solid Waste Generation

Construction activities will generate different categories of solid waste. Solid materials such as domestic/canteen waste, food packet wrappers, paper, plastic drums, paints, oil containers, packaging from construction materials, generation from earthwork, debris, excess construction materials, site establishment activities, removal of vegetation/bush/trees, and others will be generated. Hazardous waste, i.e., oil, chemicals, lubricants, paints, compressed gases, varnishes, etc., will be generated. The dripping of oil from construction vehicles might cause soil contamination. Medical waste will be generated from the first aid facilities at the construction sites. Due to a lack of proper solid waste management systems during the construction stage, it may cause environmental degradation at the EZ site as well as its immediate surroundings if adequate measures are not taken.

1.1.1.9 Impacts from Liquid Waste Generation

The primary wastewater issues relate to stormwater events and sanitary wastewater generated by construction activities on-site. Stormwater has the potential to run off into areas containing hazardous materials and either leach into the soil or carry these off the site, potentially contaminating other areas, groundwater, or marine waters. Sewage will be generated from the construction workers' facilities and the project site. Wastewater generation at construction sites includes surface runoff also which may contain pollutants and traces of solvents, paints, metal compounds, etc., which may impact the nearby surface water resources if not managed properly. The impact is that until the construction phase is completed as infrastructure for the wastewater conveying network and treatment plants will be available.

1.1.1.10 Impacts on Drainage

During the first phase development, about five khals, including Ichakhali, Daborkhali, Bamansunda, Hoania, and Saherkhali, will be impacted in the Mirsharai area will be impacted. In addition, approximately 22.5 km of the embankment/super dyke and 9 nos. of sluices will be constructed.

The EZ site is sloping from north-east to south-west. Storm runoff generated from the entire area of the EZ, and its surroundings, gets drained to the sea through a number of natural drainage channels passing through the EZ, viz. Ichakhali, Daborkhali, Bamansundar, Hoania, Saherkhali, Domkhali, etc. Altogether there are 13 drainage channels, all getting discharged to the sea, apart from the Feni River, which passes through EZ before conferencing to the sea (Master Plan, 2020). All these rivers and khals are influenced by the tidal effect. The development activities, specifically the land development, will

have the potential to change the topography of the land, which may also disrupt the natural drainage of the region. The cut-and-fill works will normally change the natural topography of the land, which will result in a disruption of the natural drainage of the land and the surrounding area. The effects might include an increase in sediment or a change in river/khals velocity or direction.

1.1.1.11 Impacts of Traffic

The first phase of development will generate an increase in traffic volume on the local road networks. Construction traffic will include vehicles transporting equipment, materials, and personnel. The main transportation route corridor from the Chattogram Sea Port is the Dhaka-Chattogram Highway. Currently, NSEZ Sarani is the main route to access the EZ from the Dhaka-Chattogram Highway (N1), which has been improved to bitumen standard. The length of the road is approximately 10 km. Improving this road is not only beneficial for the EZ but also for the inhabitants of different villages located along the roads. The increased traffic volumes will place an additional burden on the existing roads within the study region. The volume of vehicles involved in transporting raw materials has a lot of potential for traffic accidents and potential injuries to public road users, especially residents staying close to the access roads.

1.1.1.12 Loss of Ecosystem Services

The local community benefits from a wide range of provisioning, regulating, supporting, and cultural ecosystem services within the NSEZ site and surrounding areas. These include fishing, groundwater abstraction for drinking and irrigation, livestock grazing, fuelwood collection, limited medicinal plants, natural hazard protection, and aesthetic values. Under Scenario-1, approximately 16,900 acres will be developed around half of the full 33,805-acre plan through partial dredging, road construction, embankments, boundary walls, groundwater abstraction, and some infrastructure development. While impacts on ecosystem services are expected, the overall magnitude will be less than under full-scale development.

Fishing, a key provisioning service, will experience moderate impacts from dredging (~225.33 million m^3), temporary jetty construction, and increased maritime traffic. These activities may disturb aquatic habitats and fish migration, though at a smaller scale compared to full development. Relocation of landing sites such as Saherkhali, Domkhali, Muhuri, and Bamonsundor Ghats will create difficulties for local fishers, 2,557 registered in Mirsharai, 800 in Sonagazi, 300 seasonal Hilsa fishers, and many informal ones. However, as only part of the coastline is being developed, alternative fishing grounds and sites are expected to remain available, reducing overall livelihood disruption compared to the full build-out.

Groundwater abstraction (10 MLD) will place some stress on local aquifers, particularly for household and irrigation use. Yet, as abstraction demand remains limited in this phase, risks of widespread depletion or salinity intrusion are comparatively lower than in the full development scenario.

Vegetation clearance for partial boundary walls, roads, substations, and industrial plots will reduce fuelwood and grazing availability, but not to the extent of total conversion. Buffalo and cattle herders will face localized pasture loss and some increase in fodder costs, though open grazing areas outside the developed footprint will still remain accessible. Impacts on medicinal plants remain minimal given their already limited presence.

Regulating services, such as natural flood and cyclone protection, will be minimally affected. Partial landfilling and embankment construction may alter drainage in developed zones, though large natural buffers outside the project area will still provide protection. Absence of CETPs and STPs in this stage can pose a localized risk of wastewater discharge.

Supporting and cultural services will face slight declines, primarily from habitat loss and reduced aesthetics. However, as large tracts of undeveloped land and natural landscapes remain outside the 16,900-acre footprint, cultural identity and biodiversity loss are expected to be less severe.

1.1.1.13 Impacts on Terrestrial and Mangrove Flora

Under Scenario-1, development activities such as partial land acquisition, dredging, dyke construction, road and boundary wall development, and industrial establishment over 16,900 acres will lead to clearance of terrestrial vegetation and disturbance of mangrove areas, though at a smaller scale compared to the Scenario-2 and full development scenario (Scenario-3).

The common terrestrial plant species present in the NSEZ site, including Akashmoni, Jhao Ghas, and Karoi, will be removed within the developed footprint, resulting in localized reduction of vegetation cover. Since these species are abundant in the region, their partial destruction is not expected to significantly affect overall species diversity but will contribute to decreased canopy cover and reduced ecological functions within the affected zones.

The NSEZ site supports mangrove patches and intertidal mudflats, which provide habitat for mud crabs, fishes, shrimps, and waterbirds. Partial dyke construction, dredging, and vegetation clearance during Scenario-1 may impact these habitats, but since only about half of the land will be developed, large stretches of mangroves and intertidal areas outside the project footprint will remain undisturbed. In this phase limited focus on afforestation programs could lead to increased vulnerability of coastal areas to erosion and tidal surges. Therefore, while localized mangrove loss is expected, the overall ecological connectivity will be less severely affected compared to full development.

Indirect impacts on vegetation may occur from dust deposition generated during dredging, soil filling, and vehicular movement. Dust accumulation on leaves can interfere with physiological processes such as photosynthesis and transpiration, reducing plant growth near active construction sites. However, the smaller scale of industrial activity during Scenario-1 will limit the extent of these impacts.

Habitat disturbances caused by vegetation clearing may also facilitate the spread of invasive and opportunistic species. Open gaps in cleared land, coupled with soil movement and transportation, may increase colonization by weedy species. Exotic species could also be introduced during landscaping or inadvertently through human activities. Nonetheless, since a substantial portion of the site will remain undeveloped during this phase, invasive species expansion is expected to be moderate rather than widespread.

1.1.1.14 Impacts on Terrestrial Mammals

Development activities during Scenario-1, including partial vegetation clearance, land development, and construction of roads, embankments, and industrial plots, will cause localized habitat loss for terrestrial mammals. The reduction of tree cover and undergrowth will limit food availability for herbivores such as spotted deer, while carnivores like Jungle Cat (*Felis chaus*) and Fishing Cat (*Prionailurus viverrinus*) may face reduced prey due to declining habitat complexity.

Baseline surveys documented 11 mammal species within the NSEZ site, including Rhesus Macaque (*Macaca mulatta* - Vulnerable), Jungle Cat (*Felis chaus* - Near Threatened), and Fishing Cat (*Prionailurus viverrinus* - Endangered). These species are expected to be disturbed by habitat disturbance and construction activity. However, since a substantial portion of the site will remain undeveloped in this phase, alternative habitats and foraging grounds will continue to exist in the surrounding landscape, reducing the overall severity of impacts compared to full development.

Displacement of mammals into nearby areas could increase human-wildlife interactions, though the likelihood of significant conflict is lower at this stage. Construction noise, vibration, and lighting will continue to disturb sensitive and nocturnal species, potentially affecting foraging and breeding behaviors. Road networks and construction traffic may cause roadkill incidents, but these risks remain limited due to the smaller extent of infrastructure.

While impacts on mammals will occur through habitat loss, displacement, and disturbance, the retention of open spaces and undeveloped areas within and around the zone provides some ecological buffer.

1.1.1.15 Impacts on Birds/Avifauna

Birds are key ecological indicators, reflecting the condition of habitats and the availability of resources. During Scenario-1, vegetation clearance, dredging, dyke and road construction, and increased human presence will affect bird populations, though the scale of impact will remain lower compared to full development (Scenario – 3).

The NSEZ lies along the Sandwip Channel, adjacent to the Ganges-Brahmaputra-Meghna delta and close to Muhuri Dam, both recognized as Important Bird and Biodiversity Areas (IBAs). The mudflats and intertidal areas provide crucial feeding and resting grounds for migratory species. Baseline surveys recorded 89 bird species within the site, including the Black-headed Ibis (*Threskiornis melanocephalus* – Vulnerable). In the wider study region, 161 species were documented, including the Grey-headed Fish Eagle (*Ichthyophaga ichthyaetus* – Near Threatened), and 65 migratory species in total.

Vegetation clearance in parts of the site will lead to localized habitat loss, particularly for species dependent on mudflats, shrubs, and trees for feeding or nesting. However, since large tracts of land and intertidal zones remain outside the current development footprint, alternative habitats will still be available, limiting the overall decline in species diversity at this stage.

Disturbance from noise, vibration, and movement of vehicles and machinery during construction may temporarily displace birds, especially sensitive and migratory species. Artificial lighting at night could disorient nocturnal and migratory birds, though the partial scale of construction reduces the overall area affected. Increased human activity and waste generation may attract scavenging and invasive species such as Indian House Crows, which could compete with or prey upon native species. Nevertheless, the expansion of such opportunistic species is expected to be moderate during this phase, as large undisturbed habitats remain nearby.

While some bird species are likely to relocate to surrounding habitats, opportunistic and generalist species will persist in disturbed areas. Migratory birds may reduce stopover use of the project footprint, but the availability of adjacent mudflats in the wider region provides some ecological buffer.

1.1.1.16 Impacts on Herpetofauna

Herpetofauna, including reptiles and amphibians, are sensitive to habitat alteration and changes in microclimatic conditions. Baseline surveys and literature review recorded 28 reptilian species and 9 amphibian species in the study region. Among these, the Asian Water Monitor *(Varanus salvator)* is categorized as Vulnerable, while the Bengal Monitor *(Varanus bengalensis),* Yellow Monitor (*Varanus flavescens*), Monocled Cobra (*Naja kaouthia*), Spectacled Cobra (*Naja naja*), and Red-necked Keelback (*Rhabdophis subminiatus*) are listed as Near Threatened. The Cascade Frog (*Amolops marmoratus*) is categorized as Vulnerable. All these species are legally protected under the Bangladesh Wildlife (Conservation and Security) Act, 2012.

In Scenario-1, vegetation clearance, soil excavation, and terrain modification will still result in the loss of ground habitats such as shrubs, grasses, tree stumps, and fallen logs. This will temporarily disturb food chains by reducing insect prey for lizards, which in turn serve as prey for snakes. However, as only part of the site is under development during this phase, significant areas of alternative habitats remain available, limiting large-scale displacement.

Herpetofauna moving out of cleared areas may encounter increased risks of predation and road kills, particularly during the wet season when mobility is higher. Some snakes and lizards may move closer to human settlements or worker camps, potentially causing minor human-wildlife conflicts (snake encounters, bites). However, due to the reduced development footprint, the intensity of such interactions is expected to be lower compared to full build-out.

Pollution risks, such as oil or chemical spills and dust emissions, may still affect sensitive amphibians that rely on skin respiration. Contamination of water bodies could impair egg and larval survival. Nonetheless, the scale of disturbance is expected to be moderate, as fewer habitats and water channels will be directly affected during this stage.

Light, noise, and vibrations from machinery and vehicles will disturb some species, though these effects will be spatially restricted under Scenario-1. Opportunistic species like house lizards may increase near construction zones due to food availability, indirectly attracting snakes.

1.1.1.17 Impacts on Aquatic Mammals

Baseline surveys confirm the presence of the Irrawaddy Dolphin (*Orcaella brevirostris*), listed as Endangered on the IUCN Red List, and the Indo-Pacific Humpback Dolphin (*Sousa chinensis*), categorized as Vulnerable. Both species are highly dependent on the Sandwip Channel and surrounding waters, where they forage, navigate, and reproduce.

Under Scenario-1, project activities will still involve jetty construction, limited dredging, and vessel operations, but at a reduced scale compared to full-phase development. These activities can generate localized sediment disturbance, temporarily increasing turbidity and lowering water quality, which may indirectly affect dolphins by reducing prey visibility and availability. However, with fewer dredging and disposal sites, the extent of disturbance will be spatially restricted.

Underwater noise from pile driving and construction machinery may still interfere with dolphin communication, echolocation, and navigation. Yet, because of the smaller scale of marine works, the intensity and duration of underwater noise will be lower than under full development. Vessel traffic will increase during construction, but at a reduced frequency, decreasing the risk of disturbance and ship strikes.

Potential risks of accidental oil or chemical spills remain, though the reduced activity footprint makes such risks less likely and easier to manage. Amphibious works and nearshore disturbances may cause some temporary behavioral changes (avoidance of the immediate area, stress responses), but dolphins are expected to recolonize once construction pressures subside.

Overall, while sensitive species like Irrawaddy and Indo-Pacific Humpback Dolphins remain vulnerable to construction-related pressures, the lower scale of activities in Scenario-1 is expected to reduce the significance of impacts.

1.1.1.18 Impacts on Ichthyofauna (Fish)

The NSEZ and surrounding areas support diverse fisheries resources, including 22 species of finfish, 2 species of crab, and 6 species of shrimp, along with several cultured species in local aquaculture practices. The Sandwip Channel and associated estuarine and riverine habitats provide critical spawning, feeding, and migration grounds for these species.

During Scenario-1 development, partial land reclamation, infrastructure construction, and limited dredging will alter some aquatic habitats, leading to localized loss and modification of estuarine and riverine environments. Construction of partial jetties, roads, and embankments may disrupt fish movement and reduce habitat complexity in affected zones. The loss of riparian vegetation in specific areas can reduce food sources and shelter, potentially impacting fish diversity and abundance.

The absence of a Sewage Treatment Plants (STPs) and Central Effluent Treatment Plants (CETPs) during this phase increases the risk of untreated wastewater and effluent entering nearby water bodies, potentially causing localized contamination. Combined with dredging and construction runoff, this may elevate turbidity, reduce light penetration, and impair photosynthesis in aquatic plants, indirectly affecting fish feeding and growth. Oil, lubricants, and construction material spills pose additional localized toxicity risks, particularly for sensitive juvenile stages.

Noise and vibrations from dredging, pile driving, and vessel movement can disturb fish communication, spawning behavior, and predator-prey interactions. However, since development is limited to only part of the site, large portions of the Sandwip Channel and surrounding habitats will remain undisturbed, allowing fish populations to persist in nearby areas. Temporary behavioral changes and localized population displacement are expected, but these impacts are not likely to cause permanent population declines.

Sedimentation and turbidity will be moderate and spatially restricted, reducing widespread ecological stress. Overall, the partial development footprint, combined with the continued presence of functional aquatic habitats in surrounding areas, mitigates the severity of impacts compared to full-phase development (Scenario – 3).

1.1.1.19 Impacts on Hilsa Fisheries

Hilsa (*Tenualosa ilisha*) is a commercially important and national fish of Bangladesh, with spawning and breeding grounds located in the Sandwip Channel near Mayani Point, Mirsharai. The peak spawning period occurs around the full moon in the Bengali month of Ashwin. While Hilsa is categorized as Least Concern on the IUCN Red List, its population is sensitive to habitat disturbance, sedimentation, and water quality changes.

During Scenario-1, partial land reclamation, dredging, and infrastructure development may temporarily alter localized aquatic habitats, including sections of the hilsa spawning grounds. Sedimentation from dredging and construction runoff can reduce water clarity, smother eggs and larvae, and affect submerged aquatic vegetation, which serves as critical nursery habitat.

The absence of a Sewage Treatment Plants (STPs) and Central Effluent Treatment Plants (CETPs) during this phase increases the risk of untreated or inadequately treated wastewater entering the Sandwip Channel, potentially introducing heavy metals, organic pollutants, and other construction-related contaminants. This may negatively affect hilsa health, reproduction, and larval survival in the immediate vicinity of construction areas.

Construction activities, including pile driving, vessel movement, and increased maritime traffic, can generate underwater noise that may disturb hilsa spawning behavior, particularly during the critical full moon period. However, since only part of the EZ footprint is being developed, the majority of hilsa habitats remain undisturbed, allowing alternative spawning and feeding grounds to persist. The development may also increase accessibility to waterways for fishing vessels, but the scale of fishing pressure is expected to be limited during this partial development phase.

1.1.1.20 Impacts on Plankton and Benthos

Plankton and benthic organisms form the base of aquatic food webs and are critical for nutrient cycling, sediment transport, and the overall health of aquatic ecosystems. Baseline surveys in the Sandwip Channel and downstream areas recorded 19 species of phytoplankton, 14 species of zooplankton, and 16 species of benthos, indicating a diverse and productive aquatic community.

Under Scenario-1, partial dredging, land reclamation, and infrastructure development will temporarily increase turbidity, alter sediment composition, and disturb localized habitats for plankton and benthic organisms. Sedimentation from construction activities may smother benthic species and reduce light penetration, affecting phytoplankton photosynthesis. However, the limited footprint of development ensures that the majority of the Sandwip Channel and adjacent water bodies remain undisturbed, providing refuge for planktonic and benthic communities.

The absence of a Sewage Treatment Plants (STPs) and Central Effluent Treatment Plants (CETPs) increases the risk of untreated wastewater and construction-related runoff entering nearby waterways. This may temporarily degrade water quality, potentially affecting the survival, reproduction, and species composition of plankton and benthos in the immediate vicinity of construction areas. Chemical spills, oils, lubricants, or cement residues can further exacerbate localized stress.

Changes in water flow due to embankments, drainage, and partial infrastructure may slightly alter nutrient cycling and oxygen levels in nearby channels. However, the resilient nature of plankton, with short life cycles and rapid reproductive rates, allows for quick recovery within weeks to months once disturbances cease. Benthic communities, which require longer recovery periods (1–3 years), may experience only minor localized declines given the reduced scale of development.

Overall, while localized disturbances and temporary water quality issues are expected, the partial development footprint, limited sedimentation, and remaining undisturbed habitats substantially mitigate the overall ecological impact.

1.1.1.21 Impacts of Dredging on Marine Ecosystems

Dredging is required to source soil for partial land development within the NSEZ. In Scenario-1, approximately 225.33 million m³ of sediment will be dredged, primarily from the Sandwip Channel, which serves as the nearest suitable source. While dredging remains necessary for land reclamation and construction, the reduced volume and phased execution limit the extent and intensity of impacts on marine ecosystems compared to full-phase development.

Dredging activities will disturb benthic habitats, temporarily impacting bottom-dwelling organisms such as mollusks, crustaceans, and benthic fish species, which form the base of the marine food web. The smaller scale of dredging ensures that only localized areas are affected at any given time, allowing adjacent habitats to serve as refuges and enabling recovery once activities move to the next phase.

Suspended sediment generated during dredging will increase water turbidity, limit light penetration and potentially affect photosynthesis in aquatic plants, algae, and phytoplankton. However, with reduced dredging volume, turbidity plumes are spatially restricted, and the majority of the Sandwip Channel remains unaffected. This minimizes long-term impacts on oxygen production and marine biodiversity.

Dredged sediments may release pollutants, including heavy metals or organic contaminants, but the smaller scale of dredging limits the quantity and dispersion of these substances. Sensitive habitats such as seagrass beds, intertidal zones, and mangroves may experience localized smothering, but the reduced dredging footprint allows most of these ecosystems to remain intact.

Hydrodynamic changes, including minor alterations in tidal flow or sediment transport, are expected to be localized, reducing the risk of widespread coastal erosion or habitat redistribution. Fish spawning and recruitment may experience temporary disturbances in the immediate dredged areas, but alternative habitats in the undisturbed portions of the channel provide continuity for populations.

1.1.1.22 Ecologically Critical Areas

An Ecologically Critical Area (ECA) is an environmental protection zone in Bangladesh. As per the legal mandate, the Ministry of Environment, Forest, and Climate Change (MOEFCC) till now declared thirteen ECA areas in Bangladesh. According to the literature review, there is no ECA area located inside the EZ master plan area. Therefore, no impacts on ECAs are anticipated due to the development of Scenario-1 of EZ.

1.1.1.23 Protected Areas

According to the Wildlife (Conservation and Security) Act 2012, types of protected areas are national parks, sanctuaries, eco-parks, botanical gardens, community conservation areas, safari parks, Kunjaban, etc. According to the Bangladesh Forest Department's list of protected areas, there is no protected area located within the EZ area. Therefore, no impacts on protected areas are anticipated due to the development of Scenario-1 of EZ.

1.1.1.24 Critical Habitat Assessment

While the NSEZ area does not meet the World Bank ESS6 criteria for Critical Habitat (Criteria a–e), some species presents are still Endangered, Vulnerable, or Near Threatened and remain sensitive to habitat alteration, noise, pollution, and increased human presence. Under Scenario-1, these disturbances will be lower in intensity and extent due to partial clearing, reduced dredging, limited infrastructure construction, and phased scheduling of activities. This allows larger portions of natural habitat to remain undisturbed, providing refuges for species and mitigating risks associated with habitat disturbance.

1.1.1.25 Impacts due to Land Acquisition, Resettlement, Rehabilitation, and Speculation

For Scenario-1, the total land area considered for development of the EZ is 16,800 acres, which is about half of the full 33,800 acres outlined in the master plan. To date, BEZA has already received approximately 17,000 acres of land from the Deputy Commissioner (DC) offices of Feni and Chattogram districts, though only 16,800 acres are proposed for development under this scenario. Much of the land has been reclaimed from the Sandwip Channel. At this stage, the priority remains the development of Zone 2A and Zone 2B in Mirsharai, while land acquisition in Sonagazi and Sitakunda for heavy industrial zones and accommodation facilities will be more limited.

Both physical and economic displacement have already occurred, and additional displacement is anticipated though at a smaller scale than in the full implementation scenario. To date, 76 households (135 persons)—mainly poor fishermen—have been displaced due to access road construction, with 10 households resettled. Similar displacement patterns are expected in Scenario-1, but the overall magnitude of impact will be lower because of the smaller footprint. Economic displacement of buffalo owners, grazers, and fishermen will still occur, but with fewer affected individuals compared to scenario 3.

Further land acquisition and resettlement will be required for railway, road development, and worker housing, though the scale will be reduced:

Railway: Around 89 acres may be needed, with a proportionately lower number of households and structures affected than in scenario 3.

Roads: Corridors such as Feni–Sonagazi Road, Sonagazi–Muhuri Road, Muhuri Road, Bamonsundar Road, Barodarogarhat–Mohanagar Road, and NSEZ Saroni will still require some resettlement, but impacts will be lower in number than at full implementation.

Housing: Demand for worker housing will be smaller but still relevant. The NHA's township proposal (200–300 acres) may still require acquisition of community-owned land, but at a reduced urgency.

The Resettlement Policy Framework (RPF) prepared by BEZA under PRIDE will continue to guide RAP preparation and compensation. Four resettlement sites (RS1–RS4) remain available, and the earlier relocation of 36 households to Bangla Bazar demonstrates precedent. Under Scenario-1, the need for new resettlement sites will be less pressing.

However, land speculation remains an issue. Even at scenario 1 development, investors continue to purchase land near proposed roads and EZ boundaries. Land values are rising in Mirsharai and Sonagazi, complicating compensation planning. Poorer groups—fishermen, grazers, and informal settlers—remain at risk of exclusion or being pushed into informal settlements.

1.1.1.26 Community Health, Safety, and Security

In scenario 1 of the NSEZ development, spanning approximately 16,900 acres, the area undergoes moderate transformation with limited infrastructure and industrial activity. Key activities include selective dredging, construction of a 2-lane NSEZ Saroni road, partial internal road networks, a 22.5 km embankment, a 23 km boundary wall, basic utilities (10 MLD groundwater supply, partial power and gas distribution), a single BIWTA jetty, and foundational waste and stormwater management systems. 7 industries are operational, with 132 investors allocated land, though most are yet to begin operations. This partial development introduces a range of health, safety, and security challenges for local communities, particularly in Mirsharai.

Construction activities, including dredging and road building, generate dust, noise, and air pollution, moderately affecting nearby communities. Residents in Mirsharai may experience respiratory issues or discomfort due to these environmental disturbances. Traffic risks rise with the movement of trucks, excavators, and other heavy equipment, though the smaller road network and single jetty keep these risks localized. The absence of Central Effluent Treatment Plants (CETPs) and Sewage Treatment Plants (STPs) during this phase heightens the risk of water contamination from untreated industrial effluents and sewage, posing potential health threats to communities reliant on local water sources.

The influx of migrant workers, while moderate, introduces risks of communicable diseases such as HIV/AIDS, malaria, dengue, hepatitis, and tuberculosis. Social disturbances linked to alcohol, substance abuse, and petty crimes may also emerge, further impacting community well-being. Additionally, the transport of hazardous materials like fuel, lubricants, and solvents raises the risk of fires, chemical leaks, or accidents, though such incidents are expected to be less frequent in this smaller-scale phase.

The presence of construction laborers and service providers creates localized security risks, including theft, harassment, or minor conflicts. The Bangladesh Economic Zones Authority (BEZA) has deployed 25 police officers, with plans for a 500-personnel industrial police unit, which is sufficient to manage security demands at this stage.

Resource competition is evident, with restricted fishing zones, reduced grazing land, and resettlement pressures sparking localized conflicts among fishermen, buffalo owners, and gazers. Employment competition between locals and migrant workers fuels moderate tensions, particularly as industrial activities begin. With limited township development, most workers reside outside formal housing, straining community services such as schools, clinics, and sanitation facilities. Vulnerable groups, particularly women and informal settlers, face heightened risks of exclusion and gender-based violence (GBV), sexual exploitation and abuse (SEA), or sexual harassment (SH).

1.1.1.27 Occupational Health, Safety, and Security

At the Scenario 1 development stage, when approximately 16,900 acres of the Economic Zone are developed, occupational health and safety concerns will already be notable, given the intensity of land acquisition, resettlement, land development, dredging, and infrastructure construction. Workers will be directly engaged in activities such as large-scale dredging (over 225 million m^3), embankment construction, internal and external road building, excavation of stormwater canals, and boundary wall development. These activities will expose them to risks of physical injury such as falls, cuts, blunt trauma, burns, and electrical hazards from partial electricity installations. The development of jetties and gas pipeline connections at Mirsharai will add risks of fire, explosion, and drowning incidents.

Since no central effluent treatment or sewage treatment facilities are established at this stage, workers may be exposed to untreated wastewater and localized contamination, which could result in communicable diseases. Furthermore, partial waste management facilities and limited sanitation provisions will contribute to poor hygiene conditions, increasing the probability of diarrhea, hepatitis, malaria, dengue, and other locally prevalent diseases. With a large portion of the workforce living in temporary settlements with limited amenities, stress, anxiety, and fatigue may arise due to long working hours and harsh conditions. Substance use, including alcohol and tobacco, may become a coping mechanism for some workers, further impacting their health.

The absence of advanced medical facilities within the site at this stage will mean that occupational injuries and diseases must be managed through first-aid arrangements and referrals to nearby healthcare centers. Fire incidents due to mishandling construction materials, fuels, or reactive chemicals will remain a significant risk.

1.1.1.28 Labor Influx

During the development of NSEZ scenario 1, covering approximately 16,900 acres, labor influx will primarily support early construction and infrastructure works including land acquisition, partial dredging of 225.33 million m^3, construction of the NSEZ Saroni external road, partial internal roads within zones 2A and 2B, construction of the 22.5 km super dyke at Mirsharai, boundary walls, installation of partial electricity transmission lines, substations, distribution lines, gas pipeline, establishment of a 10 MLD groundwater tubewell, partial stormwater network excavation, water transport via one BIWTA jetty, partial telecommunication network with 22 km optical fiber cable, plantation, and dredging and landfill activities. Existing operational projects and early incoming investors will further demand workforce presence.

The workforce will consist of unskilled laborers for general construction, semi-skilled workers for machinery operation and installation, and skilled and highly skilled staff including engineers, technicians, and supervisors. Temporary housing and accommodation facilities will be established close to Mirsharai and other active construction zones. Follower populations such as family members, traders, informal vendors, and service providers will also settle in nearby areas, forming early informal settlements. In the initial development stage, corresponding to early construction and infrastructure setup, 0.7 million employees are projected to be engaged in the NSEZ. Of these, 0.28 million will be single employees and 0.42 million will be employees living with families, generating approximately 1.26 million dependents.

The rapid workforce influx is expected to strain local services, including healthcare, water, sanitation, drainage, and waste management systems. Health risks such as waterborne diseases, malaria, dengue, respiratory infections, and sexually transmitted diseases, including HIV/AIDS, may increase. Temporary settlements may also experience social tensions due to differences in lifestyle, culture, and income between local communities and incoming workers. The predominantly male workforce increases the risk of gender-based violence, harassment, and exploitation, particularly where informal settlements lack proper safeguards. Environmental pressures are anticipated from increased demand for water, raw materials, fuel, and construction-related waste, alongside higher traffic volumes leading to congestion, accidents, and noise and air pollution.

To address these risks, the Labor Influx Management Plan for Scenario 1 emphasizes organized temporary settlements, provision of basic water, sanitation, healthcare, and occupational safety services, registration of early service providers, and community awareness programs.

1.1.1.29 Child Labor, and Forced Labor, and Bonded Labor

During the scenario 1 of NSEZ development, covering approximately 16,900 acres, the demand for labor will be concentrated on partial land acquisition and development, dredging of 225.33 million m³, construction of the external NSEZ Saroni road, partial internal roads in zones 2A and 2B, super dyke construction at Mirsharai, boundary walls, partial electricity and gas infrastructure, a 10 MLD groundwater extraction and distribution line, partial stormwater network excavation, one BIWTA jetty, partial telecommunication network, plantation, and dredging and landfill works. Operational projects and early incoming investors will also require workforce engagement.

The urgent labor demand in this scenario may lead contractors and subcontractors to utilize informal labor supply channels that operate without strict oversight. Recruitment through unregistered brokers increases the risk that children below the legal working age, vulnerable individuals, or undocumented migrant workers may be employed. Economic vulnerability among local populations could push families to involve children in informal, low-skill roles such as housekeeping, canteens, waste sorting, or support services within the NSEZ. Migrant laborers without legal documentation may face exploitative conditions, including delayed or withhold wages, excessive working hours, confiscation of personal documents, and coercion, which are characteristics of forced labor.

The partial development of infrastructure and industrial facilities, coupled with temporary housing, informal settlements, and complex supply chains involving multiple tiers of contractors and subcontractors, may hinder monitoring and allow exploitative practices to go undetected. Without robust grievance mechanisms, worker representation, and regulatory oversight, victims of abuse may be unable to report violations.

1.1.1.30 Gender-Based Violence (GBV), Sexual Exploitation and Abuse (SEA), and Sexual Harassment (SH)

During the scenario 1 of NSEZ development (approximately 16,900 acres), labor demand will focus on partial land acquisition and development, dredging (225.33 million m³), construction of external and partial internal roads, super dyke at Mirsharai, boundary walls, partial electricity and gas infrastructure, 10 MLD groundwater extraction and distribution, partial stormwater network, one BIWTA jetty, partial

telecommunication network, plantation, and dredging/landfill activities. Operational projects and incoming investors will also require workforce engagement.

In this scenario, the workforce will predominantly consist of male construction workers, many recruited from outside the local area. Temporary housing, informal settlements, and camps will lead to an influx of predominantly male populations, disrupting the local demographic balance. These men, separated from their families and accountability structures, may engage in inappropriate behavior, increasing the risk of GBV, SEA, and SH in host communities, particularly among women, adolescent girls, and vulnerable groups.

The absence of strict behavioral codes, lack of training, and informal after-hours interactions in local markets, leisure spaces, and worker facilities may exacerbate these risks. Economic pressures may lead some women and girls from host communities to engage in transactional sex, raising the likelihood of sexually transmitted infections (STIs), including HIV/AIDS, and unwanted pregnancies. Limited access to functioning grievance mechanisms, survivor support services, and legal protection may hinder reporting, allowing abuse to remain unaddressed.

The implementation of a SEA/SH Action Plan during this phase is critical. Key measures include mandatory Codes of Conduct for all workers, behavioral training, establishment of safe spaces and survivor support services, and a confidential Grievance Redress Mechanism (GRM) with multiple reporting channels. Complementary community awareness campaigns and workshops will empower local populations to recognize, prevent, and respond to GBV and SH incidents.

1.1.1.31 Violence Against Children

At the stage of the NSEZ is development scenario 1, a significant inflow of workers, contractors, and support staff will take place. The demand for low-cost labor to meet construction and ancillary needs may indirectly create risks of child labor. In contexts where poverty is prevalent, families may push their children into hazardous or exploitative forms of work to supplement household income. Such practices expose children to risks of physical and emotional abuse, neglect of education, and adverse impacts on their long-term development. Additionally, with more migrant laborers arriving from different parts of the country, there may be heightened risks of children being exposed to various forms of violence, including exploitation, harassment, or trafficking, as social control and monitoring mechanisms become strained. While institutional safeguards and legal provisions exist, weak enforcement at this stage of rapid expansion could leave space for violations.

1.1.1.32 Impact on Social Infrastructures

During the development of approximately 16,900 acres under Scenario 1, the partial implementation of land acquisition, resettlement, internal and external roads, super dyke, boundary wall, electricity and gas infrastructure, water supply, waste management, stormwater network, and telecommunication systems will attract a significant number of construction workers and supporting service personnel. The presence of these workers and their families will increase demand for social infrastructure in Mirsharai, Sitakunda, and Sonagazi, including healthcare, education, transport, housing, sanitation, and community services.

Existing healthcare facilities (112 beds, 56 doctors, 21 nurses, 398 other staff) are insufficient for the expected increase in injuries, occupational hazards, and illnesses. Education facilities, including primary, secondary, and vocational institutions, are also limited. Public roads and transport are inadequate for the additional traffic from construction activities. Housing shortages and limited sanitation infrastructure could result in unplanned settlements, waterlogging, and public health risks.

Planned measures in this scenario include initial planning and construction of priority healthcare facilities, upgrade of existing clinics, site selection and layout for worker townships with water and sanitation design, installation of partial sewage and waste management systems, and development of internal and external roads (NSEZ Saroni, Barotakia-Bamonsundor Road, zone 2A and 2B internal roads).

1.1.1.33 Impacts on Fishermen's Livelihood and Fishery Activity

Under the development scenario 1 of the National Special Economic Zone (NSEZ), approximately 16,900 acres of land undergo partial development, marking the initial phase of transformation in Mirsharai, Sitakunda, and Sonagazi Upazilas. This phase involves dredging 225.33 million cubic meters, constructing partial internal and external roads (including a 2-lane NSEZ Saroni), building a 22.5-kilometer super-dyke, and establishing basic utilities such as partial electricity, gas, and water pipelines (10 MLD groundwater supply), alongside supporting infrastructure like a single BIWTA jetty, a 23-kilometer boundary wall, and limited waste and stormwater management systems. Seven industries are operational, with 132 investors allocated land, though most are yet to commence operations. These activities significantly disrupt the livelihoods of fishermen and fishery-dependent communities, with ripple effects across the local economy and social structure.

The construction of the 22.5-kilometer super-dyke and associated sluice gates severely restricts access to traditional khals and rivers, which have long served as critical fishing grounds and cyclone shelters for communities in Mirsharai, Sitakunda, and Sonagazi. Fish landing stations and boat parking areas, vital for fishing operations, have been relocated two to three kilometers away from communities, forcing fishermen to travel longer distances. This increases operational costs, time, and exposure to risks, particularly during severe weather events such as cyclones, when safe access to shelters is critical. The partial dredging of 225.33 million cubic meters and increased marine traffic in the Sandwip Channel exacerbate these challenges by reducing fish stocks and causing frequent damage to fishing nets, further straining the economic viability of fishing activities.

The impacts extend beyond fishermen to a broader network of fishery-dependent workers, including boat owners, vendors, mechanics, and those involved in post-harvest activities. Women, who play a significant role in post-harvest tasks such as cleaning, drying, and selling fish, face particular challenges. The relocation of landing sites, coupled with inadequate sanitation and storage facilities, hinders their ability to process and market fish efficiently, reducing their income and increasing their workload. The disruption to fishing activities threatens the economic stability of artisanal fishing households, which often rely on traditional methods and lack the resources to adapt quickly to these changes.

The restricted access to fishing grounds and the relocation of landing stations contribute to a decline in fish availability, affecting local markets and the livelihoods of vendors and other fishery-related workers. The increased travel time and costs for fishermen, combined with damaged nets, reduce their profit margins and economic resilience. Socially, the displacement of fishing infrastructure disrupts community routines and cultural practices tied to fishing, which is not only an economic activity but also a way of life for many in these coastal areas. Women and vulnerable groups face heightened risks of exclusion from economic opportunities, as their traditional roles in the fishery value chain are undermined by these changes.

To address these immediate challenges, mitigation measures include the establishment of designated sea access points and boat parking facilities to maintain some level of fishing activity has been implementing by NSEZ. The Social and Skills Development Program and Enterprise Skills Agency interventions aim to support affected communities through alternative livelihood training, microenterprise support, and integration into SEZ-related employment opportunities. These programs target fishermen and their dependents, offering vocational training and entrepreneurship support to diversify income sources. However, the transition to alternative livelihoods or SEZ employment is expected to be limited in this phase, as only a small number of individuals may secure jobs within the seven operational industries or related sectors. Medium-term disruptions to fishery-based livelihoods are anticipated, as the scale of development and the slow pace of adaptation limit immediate recovery.

1.1.1.34 Impacts on Livestock Population and Dependent Community

Under the development scenario 1 of the National Special Economic Zone (NSEZ), approximately 16,900 acres of land in Mirsharai, Sitakunda, and Sonagazi Upazilas undergo partial development. This

phase includes land acquisition, dredging of 225.33 million cubic meters, construction of partial internal and external roads (including a 2-lane NSEZ Saroni), a 22.5-kilometer super-dyke, partial electricity, gas, and water supply infrastructure (10 MLD groundwater supply), telecommunication networks, a single BIWTA jetty, a 23-kilometer boundary wall, and limited waste and stormwater management systems. Seven industries are operational, with 132 investors allocated land, though most are yet to commence operations. These activities significantly disrupt livestock-dependent communities, particularly those relying on grazing lands for buffaloes, cows, sheep, and goats, with profound economic and social consequences.

The construction of the super-dyke and associated infrastructure drastically reduces access to grazing lands, including char areas and khals traditionally used by livestock in Mirsharai, Sitakunda, and Sonagazi. This restriction forces many buffalo owners and livestock-dependent households to sell their animals or relocate them to temporary grazing areas, which often face regulatory restrictions from the forest department. The livestock population has already seen a sharp decline, with buffalo and sheep numbers dropping from approximately 20,000 to 8,000, and grazing households and herders decreasing from 700 owners and 400 grazing boys to 300 owners and 150 grazing boys. These reductions disrupt the livelihoods of buffalo owners, grazing boys, vendors, and participants in dairy and livestock-related value chains, including milk production and meat processing.

The loss of grazing land increases economic pressures, as households struggle to maintain livestock without adequate pasture or affordable fodder. The partial relocation of infrastructure, such as roads and embankments, further limits access to viable grazing areas, exacerbating financial strain. Women and youth, who often play key roles in dairy processing, small livestock care, and fodder management, face heightened challenges due to reduced resources and increased workloads. The decline in livestock numbers also disrupts local dairy and meat markets, affecting vendors and other value chain participants, and threatening the economic stability of these communities.

The reduction in grazing land and livestock numbers undermines the economic foundation of livestock-dependent households, many of which rely on traditional practices for their livelihoods. The forced sale of animals and relocation to restricted grazing areas reduce household income and resilience, pushing some families toward economic vulnerability. Socially, these changes disrupt community structures and cultural practices tied to livestock rearing, which is a significant part of the identity and heritage of these coastal communities. The loss of grazing boys' employment opportunities further exacerbates economic pressures on households, particularly for youth who rely on herding as a primary income source. Women, who are integral to dairy processing and small livestock management, face increased risks of exclusion from economic opportunities as their traditional roles are constrained.

To address these immediate challenges, short-term interventions include the allocation of temporary designated grazing areas and the provision of fodder supply to sustain livestock populations. Youth will be enrolled in vocational and skill development programs through the Social and Skills Development Program (SSDP) to diversify income sources and reduce dependency on livestock rearing. Medium-term support focuses on linking households to job placements within SEZ tenant industries, improving dairy value chains through better collection and processing systems, and promoting small-scale poultry and livestock enterprises. Long-term measures aim to build resilience by integrating livestock enterprises with SEZ supply chains, forming cooperatives for marketing and resource management, and providing ongoing reskilling through the SSDP. These interventions seek to mitigate economic pressures and support the transition to alternative livelihoods, though the scale of disruption limits immediate recovery for many households.

1.1.1.35 Tourism

Under the development scenario 1 of the National Special Economic Zone (NSEZ), approximately 16,900 acres of land in Mirsharai, Sitakunda, and Sonagazi Upazilas are partially developed. This phase involves partial land acquisition, dredging of 225.33 million cubic meters, construction of internal and external roads (including a 2-lane NSEZ Saroni), a 22.5-kilometer super-dyke, partial electricity, gas, and water supply infrastructure (10 MLD groundwater supply), telecommunication networks, a single

BIWTA jetty, a 23-kilometer boundary wall, and limited waste and stormwater management systems. Seven industries are operational, with 132 investors allocated land, though most are yet to commence operations. The impacts on tourism during this phase are limited but notable, with both positive and negative effects on the region's tourism potential.

The majority of key tourist destinations in the region, including Mahamaya Lake, Khoiyachara Waterfalls, Napittachora Waterfall, Sitakunda Eco Park, Botanical Garden, Sohosrodhara Waterfall, Jharjhari Waterfalls, Bhatiari Lake, Komoldoho Trail, and the Muhuri Project, are located outside the core EZ boundary and remain unaffected by direct construction activities. However, Guliakhali Sea Beach, a significant tourist attraction within the proposed EZ boundary, faces potential disruption unless excluded from the master plan to preserve its tourism value. The NSEZ authorities are actively working to ensure its exclusion to safeguard its appeal as a recreational site.

Construction activities, including dredging, road development, and embankment construction, generate localized increases in noise, dust, and vehicular traffic, which may temporarily reduce the aesthetic and environmental quality of nearby tourist locations. These disturbances could detract from the visitor experience at sites close to the development zones, particularly those accessible via newly constructed roads. The influx of migrant workers during this phase may also increase visitation to nearby tourist areas, placing additional pressure on natural and recreational sites. This heightened activity could lead to temporary congestion, minor habitat disturbance, and resource competition, particularly for water and waste management facilities at popular destinations.

The increased presence of workers and construction activities presents both challenges and opportunities for tourism. On the positive side, the development of roads and infrastructure improves accessibility to tourist destinations outside EZ, potentially boosting local tourism-related businesses such as food vendors, guides, and accommodation providers. The influx of workers may also stimulate demand for recreational services, creating short-term economic opportunities for local communities. However, the negative effects include temporary environmental degradation due to dust and noise, which may deter visitors seeking pristine natural experiences. The strain on local resources, such as water and sanitation facilities, could further impact on the quality of tourist sites, particularly those with limited infrastructure.

The NSEZ is implementing a continuous process of mitigation measures to minimize adverse impacts on tourism. These include excluding Guliakhali Sea Beach from the EZ master plan to preserve its tourism potential, enforcing strict environmental management practices to reduce noise, dust, and waste from construction activities, and monitoring visitor influx to prevent overcrowding at nearby tourist sites. Additionally, the NSEZ is promoting sustainable tourism practices by coordinating with local authorities to manage resource competition and maintain the environmental quality of recreational areas. These ongoing efforts aim to balance development with the preservation of the region's tourism assets.

1.1.1.36 Cultural Heritage

During the development scenario 1 of the National Special Economic Zone (NSEZ), approximately 16,900 acres of land in Mirsharai, Sitakunda, and Sonagazi Upazilas undergo partial development. This phase includes land acquisition, dredging of 225.33 million cubic meters, construction of internal and external roads (including a 2-lane NSEZ Saroni), a 22.5-kilometer super-dyke, partial utilities (10 MLD groundwater supply, partial electricity and gas distribution), a single BIWTA jetty, a 23-kilometer boundary wall, telecommunication networks, and limited waste and stormwater management systems. Seven industries are operational, with 132 investors allocated land, though most are yet to commence operations. The impact on cultural heritage during this phase is expected to be minimal, with no known tangible or intangible cultural heritage sites identified within the EZ master plan boundary.

According to the baseline survey and stakeholder consultations, no documented tangible or intangible cultural heritage sites, such as archaeological remains, historical structures, or culturally significant locations, exist within the current EZ master plan boundary. However, construction activities, including

excavation, dredging, and land leveling, pose a risk of disturbing unknown or undiscovered cultural heritage materials, such as buried archaeological deposits or artifacts. These activities, particularly in areas with significant earth-moving, could inadvertently uncover subsurface cultural resources that were not identified during initial surveys. While the likelihood of such discoveries is low due to the absence of known heritage sites, the potential for chance finds remains, especially in areas with historical or prehistoric significance that may not yet have been documented.

However, the discovery of previously unknown artifacts or deposits during construction could have cultural significance for local communities, potentially requiring consultation and preservation efforts to respect their heritage. Any disruption to such finds, if mishandled, could lead to community concerns or loss of valuable cultural resources. Conversely, the identification and proper management of chance finds could provide opportunities for cultural enrichment, such as documenting and preserving newly discovered heritage for educational or tourism purposes.

1.1.1.37 UNESCO World Heritage Sites

As per the UNESCO cultural heritage listing, there are two cultural heritage sites in Bangladesh i.e., Historic Mosque City of Bagerhat and Ruins of the Buddhist Vihara at Paharpur, and one natural heritage site i.e., the Sundarbans. No heritage sites available in the EZ master plan area as well as the study region. Therefore, no impacts on UNESCO heritage sites are anticipated by the development of NSEZ.

1.1.1.38 Impacts on Community Dynamics

During the development scenario 1 of the National Special Economic Zone (NSEZ), approximately 16,900 acres of land in Mirsharai, Sitakunda, and Sonagazi Upazilas undergo partial development. This phase includes land acquisition, dredging of 225.33 million cubic meters, construction of internal and external roads (including a 2-lane NSEZ Saroni), a 22.5-kilometer super-dyke, partial utilities (10 MLD groundwater supply, partial electricity and gas distribution), a single BIWTA jetty, a 23-kilometer boundary wall, telecommunication networks, and limited waste and stormwater management systems. Seven industries are operational, with 132 investors allocated land, though most are yet to commence operations. The influx of workers during this phase is moderate, and the resulting impact on community dynamics is expected to be limited but noticeable, with manageable effects on local social structures and practices.

The moderate influx of workers from different parts of the country introduces new cultural influences to the host communities in Mirsharai, Sitakunda, and Sonagazi. These workers, primarily engaged in construction and early industrial activities, interact with local residents through shared spaces such as markets, public transport, and community events. These interactions foster cultural exchange, as incoming workers bring diverse traditions, languages, and lifestyles that may subtly influence local norms and practices. For example, local markets may see shifts in demand for goods and services, such as food preferences or clothing styles, reflecting the needs of the incoming workforce. Labor patterns may also begin to change, with some locals engaging in temporary jobs related to construction or service provision for workers, potentially altering traditional employment structures.

Informal networks, such as community gatherings or local trade systems, may experience minor adjustments as new social connections form between locals and migrant workers. These changes could lead to increased diversity in social interactions and the gradual integration of new cultural elements into community life. However, the limited scale of development and relatively small number of workers mean that these shifts are not widespread or deeply disruptive. The host communities are likely to maintain their core social structures and cultural practices, with changes remaining localized and manageable.

The introduction of migrant workers creates opportunities for cultural enrichment and economic activity, as local businesses, such as food stalls, shops, and small-scale service providers, may benefit from increased demand. This can stimulate local economies and foster cross-cultural understanding. However, minor tensions may arise if cultural differences lead to misunderstandings or if local

resources, such as housing or public services, face increased pressure. For instance, competition for rental accommodations or access to community facilities could create friction, though the moderate scale of the workforce influx limits the extent of these challenges. Women and vulnerable groups may experience subtle shifts in social dynamics, particularly if migrant workers' presence influences gender norms or access to community spaces, though such impacts are expected to be minimal at this stage.

1.1.1.39 Changes of Landscape - Visual Impact

Impacts on the physical environment will consist of landscape transformation, causing visual impacts. The first phase of development activities will alter the landscape of the EZ site, which has an area of 16,900 acres. These impacts will remain during the operational phase.

1.1.1.40 Impacts due to Disasters

Natural hazards anticipated at the EZ site are cyclones, earthquakes, tsunamis, and floods/flash floods. As per the seismic zone map, the EZ site and study region fall into a severe seismic intensity zone (zone 3) with coefficients of 0.28. Bangladesh has experienced several earthquakes in the past, and there is a possibility that earthquakes will occur in and around the EZ. If an earthquake occurs during the construction phase, the damage would be extended to some extent, such as the collapse of buildings and injury from falling objects.

Another natural hazard associated with the EZ site is cyclones. The site is located in the high-risk zone for cyclones and its associated disasters like storm surges. As per the tsunamigenic zones map of Bangladesh, the EZ site falls within zone-I, which is reportedly the most vulnerable belt. Though the Indian subcontinent is in a seismically active region, tsunamis along the coastline of India and Bangladesh have been rare, but not unprecedented.

All the interventions will be developed along the shoreline of the Bay of Bengal thus are highly vulnerable to coastal floods caused by tidal surges. According to the UDMP of Mirsharai and Sitakunda, both upazilas are flood-prone areas, specifically vulnerable to flash floods. At the Mirsharai site, an embankment/super dyke approximately 22.5 km in length is already developed along the Sandwip Channel; thus, the site is not prone to flooding. Further, a 12.5 km embankment will be constructed along the coastline from Domkhali in Mirsharai to Guliyakhali in Sitakunda.

1.1.1.41 Climate Change and Greenhouse Gas Emissions

Development activities will lead to emissions emanating from fuel-powered equipment, i.e., vehicle engines, vessels, construction equipment, etc. The exhaust will contain pollutants notably Carbon Dioxide (CO_2), Nitrogen Oxides (NOx), Sulphur Dioxides (SO_2), Carbon Monoxide (CO), Hydrocarbons, and Particulate Matter (PM). These greenhouse gases (GHGs) are known to interfere with temperature regimes and cause climate change effects. CO_2 is the main GHG gas that contributes maximum to the warming of the atmosphere, and increased CO_2 concentration is one of the major drivers of climate change. It is noteworthy to mention that the quantity of emissions during the development phase will depend on the vehicles/vessels/equipment type, amount, and condition (e.g., level of maintenance).

1.1.2 Impacts During Operation Phase

The operational activities during the first phase will involve factory/industry establishment and operation (approximately 7 nos.), operation of other facilities, waste generation and disposal, operation of the power plant, etc.

1.1.2.1 Impacts on Air Quality

During the operation of the 1st phase of EZ, there will be an increase in the movement of traffic, and hence, emissions from the moving vehicles will also increase. Increased traffic on the access road has the potential to cause an impact on the air quality experienced by the residents along the access roads, specifically an increase in pollutants such as NOx and particulate matter. Concentrations of primary pollutants generated by road traffic decrease exponentially with increasing distance from the road.

Combustion of fossil fuels during the operation of industries and power plants will the one of the main sources of air pollution during the 1st phase operation. Methane gas, one of the greenhouse gas groups, will be generated from landfill sites. During the operation, air pollution is generated from various sources, in the production process, and from the stacks. Air pollutants of concern and their major sources from the activities expected to take place in EZ include:

- Particulate matter (PM_{10}) will be generated from combustion processing, which includes fuel combustion in manufacturing, and vehicle exhaust.
- Sulfur dioxide (SO_2) will be generated from the combustion of fossil fuels, which contain sulfur, in boilers and power plants.
- Nitrogen oxide (NOx) is a result of the reaction between oxygen and nitrogen in the air in the combustion process.
- Volatile Organic Compounds (VOCs) will be generated from electronic manufacturing industries.
- Dioxin will be generated from waste incinerators.

Potential impacts from the above air pollutants are mostly focused on human health, particularly on those living in the vicinity of the sources, in this case around the economic zone.

1.1.2.2 Impacts from Noise

During the operation of 1st phase, vehicle movements in the access roads for staff mobilization, materials/product transportation in and out of EZ, and the operation of industries will be the major sources of noise pollution from EZ. Noise will be generated due to industrial activities (operation of heavy-duty machinery like boilers, compressors, pumps, hydraulic systems, various industrial operations, etc.) involved in raw material/product handling and transportation and the same will be felt upon work personnel and nearby settlements. Noise sources in the operation phase will vary depending on the production processes of each facility/industry in the economic zone.

1.1.2.3 Impacts on Surface Water

During operation of the 1st phase activities, the EZ will not use the surface water resources. According to the discussion with BEZA, no CETPs and STPs will be established in this phase. However, the individual industries that will generate highly polluting/hazardous substances including toxic chemicals, heavy metals, and solvents, etc. will be pretreated to their own ETP facility to meet the requirements according to the ECR 2023.

Raw sewage can impact surface water quality by promoting the growth of algae and delivering pathogens that may be harmful to human and ecological receptors if not properly managed. Sewage is generally characterized as having a high concentration of suspended solids and dissolved solids, biochemical oxygen demand, chemical oxygen demand, nutrients (nitrogen, ammonia), and fecal coliform counts. Organic substances are decomposed in water, and the decomposition of organic matter will reduce the oxygen content dissolved in water.

1.1.2.4 Impacts on Groundwater

During the operation of the 1st phase, the economic zone will extract groundwater for industrial operation. According to the discussion with BEZA, about 10 MLD groundwater will be extracted during this phase. Accidental spillage or leaks of chemicals, hydrocarbons (oil, fuel, or other substances), and leachate from the landfill site could percolate into the subsurface and potentially contaminate the groundwater. Any leachate in the groundwater would have adverse impacts on hydrology.

The project activity that might impact groundwater quality is the waste management facilities where sanitary landfills and secure landfill sites will be located. A groundwater monitoring program will be required particularly for the waste management facilities.

1.1.2.5 Impacts on Topography and Soil

Impacts on topographic conditions are expected to be very small, limited to each plot of the land where individual industries or factories may adjust the elevation and level of their land plot. Potential impacts on the soil environment are envisaged due to hazardous and non-hazardous waste generated due to the operation of various industries in EZ. Poor management of hazardous waste from the operations is a potential risk of soil contamination. The waste disposal facility is another area where potential soil contamination may occur.

1.1.2.6 Impacts of Sediment

The operation of industries in EZ will produce various types of waste. If not properly handled, the waste can contaminate water and sediment quality in internal khals and Sandwip Channel.

1.1.2.7 Impact due to Changes in Land Use

During this phase, approximately 16,900 acres of areas land use and land cover will be changed. Potential negative impacts on land use are predicted to affect the surrounding area of EZ. One of the major concerns is the unplanned land use in EZ's surrounding areas because of the increasing demand for social infrastructures by the influx of workers. As the industries in EZ will start operation, there will be a need for services other than those day-to-day services. Naturally, it can be predicted that the EZ surrounding area, with a certain level of infrastructure and social services, will rapidly grow to accommodate the requirements of project personnel.

The major negative impact due to land use changes around EZ is the problem of uncontrollable use. Currently, the locals are facilitating workers by providing food, services, and even temporary shelters for additional income. Therefore, they are developing their houses and markets haphazardly and in an unplanned way. Without proper control, at the time of the EZ operation, the surrounding area will become permanent communities over time at the unfitted location and even endanger both efficient and safe operations of the project and also the residents themselves.

1.1.2.8 Impact due to Solid Waste Generation

During the operation of the 1st phase, it is likely to generate solid waste which can be broadly categorized as municipal waste, hazardous waste, and non-hazardous waste. Further, the generated solid waste generated may include biodegradable, recyclable, reusable, and inert compounds from municipal and nonindustrial occupants and industrial occupants. Solid waste will be generated from the canteen, office, workers facilities, medical, maintenance workshop, etc. According to the Master Plan, total 339,194 tons/year of solid waste will be generated including 122,822 tons/year of industrial solid waste and 216,372 tons/year of municipal solid waste from the EZ by the year 2025.

Apart from those listed, e-waste from both domestic and industrial segments is also expected to be generated in EZ. If the solid waste generated is not properly managed and disposed of in an unauthorized manner, it will impact the air quality, soil quality, and groundwater quality.

1.1.2.9 Impacts from Liquid Waste Generation

EZ is anticipated to generate various forms of wastewater. The source of wastewater generation from EZ operational activities is industrial process wastewater/ effluent, domestic wastewater/sewage, equipment cleaning, floor washings, etc. According to the discussion with BEZA, STPs and CETPS will not be established during the 1st phase operation. As such this wastewater might be a major health hazard if proper measures are not put in place. The untreated wastewater, if discharged into nearby surface waters may affect the surface water and/or if disposed of land without treatment may pollute the ground and surface water.

1.1.2.10 Impacts on Drainage

During the operation, surface water flow would be the same as the flow at the end of the development phase because the drainage system and structures on the surface during this phase would undergo no change since they will be completed in the different phases. According to the EZ master plan, storm water drains shall be provided on either side of the proposed road network of the area to collect the

storm runoff generated from the catchment and get it discharged to the drainage channel for ultimate disposal to the Sandwip Channel. Indicative command area (catchment area) for each of the existing drainage channels passing through EZ with locations of the pumping stations, proposed at the location close to its outfall to the sea.

From the stakeholder consultation, it was revealed that currently, the local community is constructing their structures haphazardly and without keeping adequate drainage facilities in the EZ surrounding area. Heavy and continuous rainfall during the monsoon and cyclones may expose the risk of rapid flooding locally including cumulative flooding in regional areas. The flood control infrastructures, if not well maintained, will be subject to negative impacts such as local flooding, due to inadequate maintenance of the drainage system.

1.1.2.11 Impacts of Traffic

Traffic volume on the improved roads is predicted to increase during the operation, specifically during the morning and afternoon peaks. Improvement of regional road networks may prompt high-speed driving, which is likely to cause accidents for pedestrians unless adequate road safety measures are adopted. In addition to the risk of accidents, increased traffic will lead to inconvenience to the local public, and road users, and increase the potential for nuisance in the region.

The increased traffic volumes will increase the potential of incidents on the internal road as well as access roads within the study region, specifically at intersections and passing through busy (market, schools, etc.) areas, resulting in serious injuries or even fatalities.

1.1.2.12 Loss of Ecosystem Services

Ecosystem services are the benefits provided by functioning natural systems, including provisioning services such as food, water, and fodder; regulating services like climate moderation, flood control, and water purification; supporting services such as habitat provision and nutrient cycling; and cultural services including aesthetic, recreational, and heritage values. During the operation phase of NSEZ under Scenario-1, these services continue to be supplied by remaining natural landscapes, wetlands, vegetation patches, and water bodies within and surrounding the partially developed zone.

Under Scenario-1, approximately 16,900 acres of the Economic Zone will be operational, with partial infrastructure such as roads, embankments, boundary walls, a jetty, partial electricity and gas distribution, and groundwater extraction (10 MLD). While industrial activities commence in operational plots, the scale is limited compared to full development, moderating the overall impact on ecosystem services.

Provisioning Services - aquatic resources, including fish populations, will experience some localized pressure from partial dredging and jetty operation, yet alternative fishing areas along the Sandwip Channel remain available, reducing overall livelihood disruption. Groundwater extraction supports industrial and domestic use but is unlikely to significantly affect aquifer availability given the limited operational footprint. Livestock grazing and fuelwood collection may be reduced in operational zones, though extensive open areas outside active plots continue to sustain these activities. Impacts on medicinal plants remain minimal.

Regulating Services - partial land conversion and operational infrastructure may slightly reduce flood and cyclone buffering capacity in developed areas. The absence of fully functional ETPs and STPs can pose localized risks to water quality, but untreated effluent discharge is limited to operational plots, leaving surrounding ecosystems largely unaffected. Vegetation in non-operational areas continues to support air purification, climate moderation, and soil stabilization.

Supporting and Cultural Services - habitat for wildlife is partially impacted within operational zones, but broader ecosystems remain intact. Reduced landscape aesthetics and recreational value are confined to industrial plots, while surrounding natural and planted areas maintain scenic and cultural benefits.

1.1.2.13 Impacts on Terrestrial and Mangrove Flora

During the operational phase of the NSEZ under Scenario-1, approximately 16,900 acres of land (half of the full EZ footprint) will be operational, with industrial facilities, partial infrastructure, and utilities fully functional. The majority of land conversion within this footprint will have already occurred during the development phase. However, the remaining terrestrial and mangrove habitats in adjacent areas and preserved zones will continue to provide ecological functions while being subject to ongoing operational pressures.

Terrestrial vegetation, particularly in preserved green belts, roadside plantings, and buffer areas, may be affected by soil compaction, vehicular traffic, and deposition of airborne pollutants such as dust, heavy metals, and particulate matter from industrial operations. These factors can reduce plant health, photosynthetic activity, and regeneration capacity. Similarly, mangrove habitats within designated preserved areas are expected to remain largely intact, but they may experience indirect operational impacts, including air and water pollution, altered hydrological patterns due to stormwater discharge, and localized salinity changes. Such stressors could affect mangrove growth, resilience, and ecological functions if not adequately managed.

Increased human activity and transport associated with the operation of facilities including partial roads, jetties, and industrial traffic may facilitate the spread of invasive plant species. These species can outcompete native flora, reduce biodiversity, and gradually degrade habitat quality, even within preserved zones, if active vegetation management is not maintained.

The remaining habitats, including secondary vegetation, green belts, and mangrove patches, will continue to support native wildlife such as birds, reptiles, insects, and small mammals. However, disturbances from operational noise, light, and human presence may limit habitat use for species that rely on intact vegetative cover or low-disturbance areas. Some wildlife may shift their ranges or experience localized population reductions.

1.1.2.14 Impacts on Terrestrial Mammals

Under Scenario-1, partial industrial facilities, roads, utilities, and infrastructure will be operational. The operational phase will continue to influence terrestrial mammals primarily through habitat modification, human activity, and infrastructure presence, although the scale of impacts is reduced compared to full-phase development.

Habitat disturbance within the partially developed EZ footprint may limit movement corridors for mammals, particularly for species that depend on continuous vegetative cover. Preserved green belts, secondary vegetation, and mangrove patches outside the developed areas will remain available, providing refuge and foraging opportunities. However, traffic on partial internal and external roads, maintenance activities, and industrial operations may generate disturbances that disrupt daily and seasonal movements of mammals.

The availability of food resources for herbivorous mammals may be locally reduced within operational zones due to partial land conversion and restricted access to natural vegetation. Carnivorous mammals could be indirectly affected through reduced prey availability in the developed areas. The partial extent of development ensures that larger contiguous habitats remain outside the operational footprint, maintaining some ecological connectivity and reducing risks of population isolation.

Operational noise, machinery vibrations, and human presence may create localized stress and behavioral disturbances, particularly near active industrial sites. Artificial lighting from facilities and streetlights may affect nocturnal species, influencing foraging, navigation, and predator-prey interactions. Nevertheless, the impact is expected to be less severe than full-scale operations due to limited infrastructure and partial development of the EZ.

The risk of human-wildlife encounters remains, though reduced in intensity, as only part of the EZ is operational. Accidental spills, emissions, and industrial pollutants may affect mammals within operational zones, but their overall exposure is limited compared to full-phase operations. Areas outside

the 16,900-acre operational footprint continue to support mammalian populations with minimal disturbance.

1.1.2.15 Impacts on Birds/Avifauna

During the operation phase under Scenario-1, preserved forested areas and green open spaces within and around the NSEZ will continue to provide shelter and breeding habitat for various residents and migratory bird species. The nearby Sandwip Channel and its mudflats remain important foraging grounds for waterbirds. However, operational activities, including industrial operations, partial infrastructure use, and localized lighting, may cause minor disturbances to bird behavior, particularly during breeding and migration. Noise and light pollution may lead to temporary displacement from specific sites, but large tracts of foraging and nesting areas outside operational zones remain accessible.

Human-bird interactions may increase slightly near operational areas, particularly along roads, jetties, and partial industrial zones, but overall conflicts are expected to be limited due to the partial scale of development. Invasive bird species may establish in localized disturbed areas, yet significant impacts on native bird populations are expected to be minimal.

Air and noise pollution from operational activities such as vehicular movement, machinery, and maintenance work may affect communication and foraging, but these effects are likely to be restricted to immediate operational zones. Artificial lighting from operational facilities and streetlights may have localized effects on nocturnal species, potentially altering navigation or feeding patterns, though large surrounding dark areas continue to support natural behavior.

Accidental spills or minor contamination events could affect soil or runoff water, including small portions of the Sandwip Channel, potentially impacting local invertebrate populations that serve as prey for birds. However, given the partial operational footprint and the presence of extensive undisturbed habitats, such impacts are expected to be minor and localized.

Overall, the combination of preserved green spaces, buffer zones, and proximity to extensive natural habitats reduces the vulnerability of bird populations during Scenario-1 operations. While localized disturbances may occur from noise, lighting, and human activity, sufficient alternative habitats and foraging areas remain available to sustain resident and migratory species.

1.1.2.16 Impacts on Herpetofauna

During the operation phase under Scenario-1, herpetofauna habitats within the NSEZ are expected to experience only localized pressures due to partial industrial and infrastructure operations. Preserved green areas, buffer zones, and patches of secondary vegetation provide continued shelter and foraging opportunities for reptiles and amphibians, although some habitat disturbance may occur along operational roads, jetties, and partial industrial plots.

Operational activities, including vehicle movement, maintenance work, and localized industrial operations, may generate noise and light disturbances, temporarily affecting the behavior of herpetofauna. Amphibians and reptiles may be displaced from areas adjacent to active operational zones, but sufficient alternative habitats remain available nearby, reducing the risk of long-term population declines. Human-wildlife interactions, such as encounters with snakes or lizards, may occur in localized areas, but these are expected to be minimal given the partial scale of operations.

The introduction or spread of invasive species may occur in disturbed microhabitats; however, the limited operational footprint reduces the likelihood of significant competition with native herpetofauna. Airborne pollutants, minor water contamination, or accidental leakage of oils, fuels, and lubricants could affect localized habitats, particularly near operational jetties or stormwater channels. Amphibians with permeable skin remain sensitive to these changes, yet the overall exposure is limited due to the partial development scenario.

Partial dredging, stormwater channel excavation, and land use changes may alter microhabitats or water flow patterns in localized areas, but the majority of natural hydrological features and green patches remain intact, supporting the persistence of herpetofauna populations. Efforts to maintain green belts and buffer areas further mitigate operational impacts on local reptiles and amphibians.

1.1.2.17 Impacts on Aquatic Mammals

Under Scenario-1, the operation of the NSEZ will involve only partial industrial, port, and transport activities, which will result in more localized and limited pressures on aquatic mammals in the Sandwip Channel, particularly Irrawaddy Dolphins and Indo-Pacific Humpback Dolphins. Vessel traffic associated with partial jetty operation, maintenance dredging, and limited industrial shipping may generate underwater noise and pose a risk of collisions. However, the reduced scale of operations compared to full development lowers both the frequency and intensity of these disturbances.

Effluent discharge remains a concern as there are not fully operational ETPs or STPs in this scenario. Localized contamination from untreated or partially treated wastewater, minor oil or lubricant spills, and stormwater runoff could temporarily affect water quality and prey availability for dolphins. These pollutants may lead to localized stress or avoidance behavior, although the limited operational footprint and partial industrial load reduce the overall risk of chronic exposure.

Partial dredging for maintenance of the jetty and channel may disturb the seabed and temporarily affect benthic and pelagic prey species. While minor habitat alteration could occur in dredged areas, the overall habitat availability in the Sandwip Channel remains largely intact, allowing dolphins to utilize nearby undisturbed areas.

Operational activities such as maintenance and industrial operations may generate moderate noise and human presence, potentially causing localized behavioral changes, temporary displacement, or avoidance of high-traffic zones. Chronic stress and effects on reproductive success are expected to be minimal under Scenario-1 due to the partial scale of development and operational activity.

1.1.2.18 Impacts on Ichthyofauna (Fish)

Under Scenario-1, the NSEZ will be partially operational, with limited industrial, port, and infrastructure activities. The operation phase may affect fish populations in nearby water bodies, particularly in the Sandwip Channel, though the scale and intensity of impacts will be lower compared to full development.

Discharge of untreated or partially treated industrial effluents and domestic wastewater, due to the absence of a fully functional ETP and STP, could locally degrade water quality. Contaminants such as heavy metals, organic compounds, and minor oil or lubricant spills may temporarily affect fish health, reproduction, and feeding behavior. However, the limited operational footprint and partial industrial load will reduce the overall spatial extent and severity of pollution-related impacts.

Partial dredging and jetty operation may disturb the seabed and benthic habitats, temporarily affecting spawning grounds and food availability for fish. Increased vessel movement associated with partial port operations can generate localized noise, turbidity, and minor habitat disturbance, which may alter fish behavior and reduce access to certain foraging areas.

Habitat degradation from infrastructure operation, including roads, embankments, and partial industrial zones, may limit some local fish migration routes, but most aquatic habitats in the channel and adjacent areas remain intact. The risk of overfishing is lower than full development since partial access to water bodies and limited port operations will reduce fishing pressure.

Surface runoff from partially developed areas may carry sediments or pollutants into nearby water bodies, temporarily increasing turbidity and reducing light penetration. While this may impact fish feeding and growth in localized areas, overall ecosystem functions and fish diversity are expected to remain largely unaffected due to the limited scale of development.

Accidental spills or improper disposal of waste during partial operations could pose localized risks to fish, though the overall impact remains less extensive than in full-scale operation. Maintenance of waste management practices, coupled with careful operational control, can minimize these effects.

1.1.2.19 Impacts on Hilsa Fisheries

Under Scenario-1, the NSEZ will be partially operational with limited industrial and port activities. The operation phase may affect Hilsa fish in the Sandwip Channel and their spawning grounds near Mayani Point, though impacts are expected to be less extensive compared to full-scale development.

Discharge of untreated or partially treated industrial and domestic wastewater, due to the absence of fully operational ETPs and STPs, may degrade local water quality. Pollutants such as heavy metals, organic compounds, and minor oil or lubricant residues can temporarily affect Hilsa health, feeding behavior, and reproductive success.

Partial jetty operations and limited dredging may alter sediment dynamics and temporarily disturb shallow-water habitats used by Hilsa for feeding and spawning. Disturbance of migration routes is possible, but most of the Sandwip Channel remains accessible, reducing the overall risk to spawning success.

Stormwater runoff from partially developed industrial and urban areas may carry sediments, fertilizers, and other pollutants into the water, affecting localized water quality and prey availability for Hilsa. However, the reduced operational footprint limits the spatial extent of these impacts.

Increased vessel traffic and limited port activities may generate underwater noise, potentially disturbing Hilsa communication and spawning behavior. Artificial lighting in partial operational zones may also affect nocturnal behavior and migration, though impacts will be localized.

The partial operation of the NSEZ may attract some additional fishing activity near accessible areas, increasing the risk of incidental catch. However, because the development is only partial, alternative fishing grounds remain available, mitigating the overall pressure on Hilsa populations.

Operational activities could facilitate the introduction and spread of invasive species in localized areas, potentially competing with Hilsa for food and habitat, but the limited scale reduces the risk of significant population decline.

1.1.2.20 Impacts on Plankton and Benthos

Under Scenario-1, with partial operation of the NSEZ, the planktonic and benthic communities in the Sandwip Channel may experience localized and limited impacts. Ongoing industrial and port activities, although restricted in scale, can lead to minor habitat alteration and sediment disturbance. Maintenance dredging, partial jetty operations, and vessel movement may resuspend sediments, temporarily affect benthic organisms and reduce light penetration for plankton.

Discharge of untreated or partially treated wastewater due to the absence of fully operational ETPs and STPs may degrade local water quality. Elevated nutrient levels and organic matter in runoff could trigger minor shifts in planktonic communities and affect benthic species in immediate areas near operational zones. Chemical pollutants such as low concentrations of heavy metals or industrial effluents may have localized adverse effects, though the overall spatial extent is limited.

Operational maritime traffic may generate noise, sediment resuspension, and physical disturbances, which could temporarily impact plankton and benthic habitats. However, as only part of the NSEZ is active, large areas of the Sandwip Channel remain undisturbed, allowing for ecological recovery and resilience.

Partial industrial operations and urban runoff may contribute minimally to stress on plankton and benthos, but the magnitude of these effects is expected to be lower than during full-scale operations. Natural hydrological and ecological processes in undisturbed areas are likely to support recovery of affected populations over time.

Climate-related stressors, such as temperature fluctuations, salinity changes, or minor changes in oxygen levels, may compound localized operational impacts, but these effects are not expected to be significant at the scale of Scenario-1.

1.1.2.21 Impacts due to Land Acquisition, Resettlement, Rehabilitation, and Speculation

This impact will happen during the development phase only.

1.1.2.22 Community Health, Safety, and Security

At the stage when scenario 1 of NSEZ becomes operational, approximately 16,900 acres of industrial land will have been developed, with a range of industries in production alongside supporting infrastructure such as partial road networks, limited utilities, and one operational jetty. In this phase, community health, safety, and security will begin to experience direct pressures linked to industrial and gas emissions from operating plants. Without a centralized effluent treatment plant or sewage treatment facilities, waste and effluent discharges will likely be managed on an ad-hoc basis by individual industries, raising the risk of localized water and soil pollution. Such pollution can deteriorate community health conditions by contributing to respiratory problems, gastrointestinal diseases, and skin irritations among residents in the surrounding areas.

The presence of seven operational industries and more than a hundred allocated investors will also lead to increased material transport, with trucks, heavy machinery, and construction-support vehicles sharing local roads with community traffic. This raises the probability of road accidents and injuries, particularly given the partial nature of external and internal road development at this stage. As worker settlements grow around Mirsharai, pressure on existing public health services and sanitation facilities will intensify. Local infrastructure, which already has limited capacity, may struggle to meet the growing demands for clean water, waste management, and healthcare support.

The influx of migrant laborers, including foreign workers, will also create new public health challenges. In areas with poor hygiene, communicable diseases and sexually transmitted infections, including HIV/AIDS, may find greater opportunity to spread. If not managed through awareness programs, workplace health checks, and collaboration with local health authorities, such risks could exacerbate community vulnerability.

1.1.2.23 Occupational Health, Safety, and Security

In Scenario 1, when approximately half of the NSEZ is operational, a substantial number of diversified industries such as steel manufacturing, paint production, textiles, plastics, electronics, food processing, and packaging begin functioning. Even at this stage, occupational health and safety risks are already significant, given the intensity of industrial processes and the large labor force involved. In the steel sector, workers face hazards from high-temperature furnaces, molten metal handling, welding activities, and the operation of heavy machinery. The risks of severe burns, heatstroke, and crush injuries are high, particularly where confined spaces and toxic gas accumulations may occur in kilns and storage tanks. These hazards are exacerbated by the limited preparedness and training of many unskilled workers employed in these operations.

In paint manufacturing facilities, exposure to hazardous chemicals such as solvents and volatile organic compounds becomes a critical concern. At this stage of development, inadequate ventilation systems, unsafe storage of flammable materials, and inconsistent use of personal protective equipment may lead to chemical inhalation, fire hazards, or skin burns. Textile industries within the zone expose workers to dust, fibers, and dyes, which can cause respiratory illnesses, skin conditions, and musculoskeletal problems from prolonged repetitive work on machinery. Light industries such as plastics, electronics, and food processing further add to the OHS risks, where exposure to chemical adhesives, lead-based solders, hot surfaces, and biological contaminants becomes a source of both immediate injuries and long-term health issues.

Across industries in Scenario 1, the risks are magnified by insufficient enforcement of occupational safety standards, limited emergency preparedness, and weak grievance redress systems. Migrant

workers are particularly vulnerable due to poor accommodation facilities and inadequate access to sanitation and healthcare, increasing the likelihood of communicable disease outbreaks. Psycho-social stressors also emerge during this stage as workers cope with long hours, separation from families, and lack of recreational opportunities, which may contribute to anxiety, depression, and substance abuse.

1.1.2.24 Labor Influx

During the operation phase of the development scenario 1, the NSEZ, covering approximately 16,900 acres in Mirsharai, Sitakunda, and Sonagazi Upazilas, attracts a steady but manageable inflow of skilled, semi-skilled, and unskilled workers from within Bangladesh. This phase includes partial land acquisition, dredging of 225.33 million cubic meters, construction of internal and external roads (including a 2-lane NSEZ Saroni), a 22.5-kilometer super-dyke, partial utilities (10 MLD groundwater supply, partial electricity and gas distribution), a single BIWTA jetty, a 23-kilometer boundary wall, telecommunication networks, and limited waste and stormwater management systems. Seven industries are operational, with 132 investors allocated land, though most are yet to commence operations. The moderate labor influx influences local communities and infrastructure, but proactive planning keeps impacts within a manageable range.

The influx of workers, many relocating with their families, generates increased demand for housing, education, and healthcare services in nearby towns. This population growth drives the need for additional rental accommodation, school capacity, and medical facilities, particularly in Mirsharai and Sitakunda. Local service providers, such as vendors, transport operators, and mechanics, migrate to the area to meet the consumption needs of the resident workforce, creating a secondary migration. This expansion of economic activity stimulates local markets, with new opportunities for food stalls, retail, and repair services catering to workers.

However, without proper zoning or planning, this influx could lead to localized challenges. Informal settlements may emerge as workers and service providers seek affordable housing, potentially causing overcrowding and sanitation issues in areas with limited infrastructure. Contractors providing facility management, logistics, or security services introduce small, rotating labor groups, often housed in rented rooms or temporary camps with minimal support facilities, such as sanitation or water supply. These arrangements could strain local resources if not managed effectively. Real estate pressures may arise as demand for housing grows, but in this scenario 1 influx scenario, land speculation and price distortion remain contained, minimizing significant disruptions to local housing markets.

Competition from external vendors and service providers could challenge local businesses, particularly small-scale vendors with limited resources. However, the moderate scale of the influx ensures that these competitive pressures do not significantly disrupt local economies. Socially, the integration of workers from different regions introduces cultural diversity, which may lead to minor adjustments in community norms and practices but is unlikely to cause significant friction at this stage.

The increased demand for housing, education, and healthcare could strain existing infrastructure, particularly in towns with limited prior capacity. Informal settlements and inadequate sanitation facilities pose risks of public health issues, such as waterborne diseases, if not addressed. Socially, the presence of migrant workers fosters cultural exchange but may also lead to minor tensions if local communities perceive external vendors as competitors or if resource access becomes uneven. Vulnerable groups, such as women and low-income households, may face challenges accessing services if infrastructure development lags behind demand.

The NSEZ is implementing a continuous process of mitigation measures to manage the impacts of the moderate labor influx. These ongoing measures ensure that the moderate influx is managed effectively, minimizing social and infrastructural stress while maximizing economic benefits.

1.1.2.25 Child Labor, and Forced Labor, and Bonded Labor

During the operation phase under a moderate influx scenario, the NSEZ will require a significant labor force, largely consisting of unskilled and semi-skilled workers recruited locally and regionally. While the

scale of employment is substantial, a moderate influx allows for better monitoring and implementation of labor policies. Child labor risks remain present due to economic vulnerabilities of nearby communities, but these can be managed through strict enforcement of the Labor Act 2006, ensuring no worker under 14 is employed and that children aged 14–17 are engaged only in non-hazardous work that does not interfere with education or health. Forced and bonded labor risks arise mainly through informal recruitment channels or advance payments by employers or labor agents, potentially trapping workers in exploitative conditions. With proactive oversight, periodic inspections by BEZA, and proper recruitment and grievance mechanisms, these risks are expected to be mitigated to a manageable level. Nonetheless, vigilance is required in labor-intensive sectors such as packaging, light manufacturing, food services, and facility management to prevent child labor and exploitation.

1.1.2.26 Gender Based Violence & Sexual Exploitation and Abuse/Sexual Harassment

The operation phase of the National Special Economic Zone (NSEZ) in Mirsharai, Sitakunda, and Sonagazi Upazilas introduces risks of gender-based violence (GBV) and sexual exploitation and abuse/sexual harassment (SEA/SH) due to the influx of workers and socio-economic changes. GBV, encompassing rape, sexual assault, sexual harassment, sexual exploitation and abuse, sexual favors, physical assault, forced marriage, denial of resources, and psychological/emotional abuse, is rooted in systemic gender inequalities, with women and girls as primary victims. The increased population and economic activity may exacerbate power imbalances, heightening GBV risks.

In Scenario 1, the NSEZ operates across approximately 16,900 acres, with infrastructure including partial land acquisition, dredging of 225.33 million cubic meters, a 2-lane NSEZ Saroni, internal roads (zones 2A and 2B), a 22.5-kilometer super-dyke, partial utilities (10 MLD groundwater supply, electricity, and gas distribution), a single BIWTA jetty, a 23-kilometer boundary wall, telecommunication networks (22 km optical fiber cable), and partial waste and stormwater management systems. Seven industries are operational, with 132 investors allocated land.

The moderate influx of workers, primarily male, into Mirsharai and Sitakunda increases the risk of GBV and SEA/SH, particularly for women and girls in local communities. Economic pressures and social disruption from the influx may exacerbate power imbalances, leading to incidents of sexual harassment, exploitation, or abuse in workplaces, informal settlements, or public spaces. Women working in low-skill jobs, such as packaging or food services, or those in informal settlements like Magadia and Ichakhali, are particularly vulnerable to harassment or exploitation by supervisors or external workers.

GBV and SEA/SH undermine the safety and dignity of women and girls, eroding community trust and cohesion. Victims may face stigma, limiting their access to support and exacerbating mental health challenges. Economically, GBV reduces women's participation in the workforce, impacting household incomes and economic resilience, particularly for vulnerable families.

1.1.2.27 Violence Against Children

During the operation of the NSEZ under a labor influx scenario 1, children in nearby communities may occasionally become involved in operational activities, such as running errands or assisting in light tasks for families of workers or local service providers. These engagements may reduce school attendance and expose children to minor accidents or injuries. The moderate scale of workforce influx allows local authorities and EZ management to maintain better oversight of child activities and mitigate risks. Increased economic opportunities in the surrounding community, such as vending or small-scale services for workers, could result in children contributing to household income; however, with proactive monitoring, awareness campaigns, and enforcement of labor and child protection laws, the occurrence of violence against children can be managed and kept at relatively lower levels.

1.1.2.28 Impact on Social Infrastructures

The operation phase of the National Special Economic Zone (NSEZ) is expected to drive significant demographic and socio-economic transformation in Mirsharai, Sitakunda, Sonagazi, and surrounding areas of Chattogram and Feni districts due to a large-scale population influx of workers, their families,

informal workers, and service providers. By 2040, the NSEZ is projected to generate approximately 1.4 million employment opportunities, placing considerable pressure on social infrastructures, including housing, education, healthcare, transportation, sanitation, commercial facilities, and religious and social institutions.

Under Scenario 1, the NSEZ operates across approximately 16,900 acres, with completed infrastructure including partial land acquisition, dredging of 225.33 million cubic meters, a 2-lane NSEZ Saroni, internal roads (zones 2A and 2B), a 22.5-kilometer super-dyke, partial utilities (10 MLD groundwater supply, electricity, and gas distribution), a single BIWTA jetty, a 23-kilometer boundary wall, telecommunication networks (22 km optical fiber cable), and partial waste and stormwater management systems. Seven industries are operational, with 132 investors allocated land.

The operation phase under Scenario 1 sees a steady influx of workers, their families, and service providers, increasing demand for social infrastructures in Mirsharai and Sitakunda. Housing faces significant pressure, as stakeholders have highlighted insufficient infrastructure to accommodate the population surge. Informal settlements emerge in peri-urban areas like Magadia and Ichakhali, driven by lower costs and accessibility. These unregulated developments, often initiated by small-scale entrepreneurs, risk “slumification,” leading to land-use conflicts, disrupted drainage patterns, and increased vulnerability to waterlogging during monsoons.

Education infrastructure is strained by the growing number of school-age children, with existing schools struggling to provide adequate classrooms, trained teachers, and support services like counseling or inclusive education for children with disabilities. The absence of higher educational institutions, such as technical or engineering colleges, limits opportunities for local youth and workers’ families. Healthcare facilities, already inadequate, face increased demand, with risks of communicable diseases due to overcrowding and limited sanitation. Transportation systems, including roads and public transit, experience congestion and safety hazards as worker mobility and commercial activity grow. Sanitation and waste management are challenged by residential and commercial waste, with informal settlements often lacking septic systems or waste collection, increasing environmental and health risks.

Commercial facilities, such as traditional hat-bazars, are unprepared for the increased demand, leading to overcrowding and potential food safety issues from unregulated vendors. Religious and social institutions, including mosques and community centers, face overcrowding, risking social tensions among diverse groups. The lack of institutional capacity, with the pending implementation of the Mirsharai Development Plan, hinders coordinated service delivery, exacerbating risks of resource competition an informal settlements and inadequate infrastructure deepen social divisions, with newcomers occupying marginal, hazard-prone lands, leading to spatial inequality. Vulnerable groups, such as persons with disabilities, older adults, and low-income families, risk exclusion from non-inclusive services, exacerbating social inequality. Competition over housing, jobs, and resources may lead to minor social tensions, potentially increasing crime or exploitation of undocumented laborers. The lack of higher education limits economic mobility, while healthcare deficiencies raise public health risks, such as disease outbreaks, if not addressed.

1.1.2.29 Impacts on Fishermen's Livelihood and Fishery Activity

The operation phase of the National Special Economic Zone (NSEZ) in Mirsharai, Sitakunda, and Sonagazi significantly impacts fishermen’s livelihoods and fishery activities due to increased shipping, infrastructure development, and exclusion zones. These activities restrict access to traditional fishing grounds, create safety hazards for small boats, and disrupt fish habitats, affecting not only fishing but also related sectors like boat building, net repair, and fish marketing. Socio-economic challenges, including poverty and limited alternative livelihoods, heighten the vulnerability of fishing communities. The NSEZ is implementing continuous mitigation measures, such as reskilling programs, enterprise development, and infrastructure improvements, to restore livelihoods and enhance resilience.

In Scenario 1, the NSEZ operates across approximately 16,900 acres, with completed infrastructure including partial land acquisition, dredging of 225.33 million cubic meters, a 2-lane NSEZ Saroni,

internal roads (zones 2A and 2B), a 22.5-kilometer super-dyke, partial utilities (10 MLD groundwater supply, electricity, and gas distribution), a single BIWTA jetty, a 23-kilometer boundary wall, telecommunication networks (22 km optical fiber cable), and partial waste and stormwater management systems. Seven industries are operational, with 132 investors allocated land, most yet to commence operations.

Increased shipping through the BIWTA jetty creates safety hazards, as large vessels' bow waves and washes threaten small fishing boats, which are difficult to spot from larger decks. An exclusion zone around the jetty, established for safety and security, restricts fishermen's access to traditional fishing grounds in Mirsharai's coastal and khal areas. Shipping channels further limit mobility, while coastline modifications, such as the super-dyke and khal maintenance, disrupt fish habitats, reducing fishery productivity. These changes impact related activities, including boat building, net and trap repair, fish marketing, and transportation, leading to reduced incomes. The lack of resting facilities, sanitation, drinking water, and safe boat parking in relocated fishing areas, combined with cyclone risks, exacerbates challenges for fishermen, particularly in ensuring safe operations and access to basic amenities.

Economically, reduced fish catches lower incomes for fishermen and related businesses, such as fish markets and boat repair services, disproportionately affecting vulnerable households reliant on fishing. Socially, the disruption of traditional fishing practices undermines community identity and cohesion, as fishing is a cultural cornerstone in coastal areas. The lack of adequate facilities increases health and safety risks, particularly for women and youth involved in fish processing. However, the NSEZ's operation creates job opportunities in industries and services, which can offset losses if fishermen are integrated into alternative livelihoods.

1.1.2.30 Impacts on Livestock Population and Dependent Community

The operation phase of the National Special Economic Zone (NSEZ) in Mirsharai, Sitakunda, and Sonagazi Upazilas will impact livestock-dependent communities, particularly those relying on buffalo for food, nutrition security, and income. The conversion of open-access grazing lands into industrial zones, coupled with restricted access due to boundary fencing, will significantly reduce available grazing areas. This loss threatens the livelihoods of communities dependent on livestock rearing.

In Scenario 1, the NSEZ operates across approximately 16,900 acres, with completed infrastructure including partial land acquisition, dredging of 225.33 million cubic meters, a 2-lane NSEZ Saroni, internal roads (zones 2A and 2B), a 22.5-kilometer super-dyke, partial utilities (10 MLD groundwater supply, electricity, and gas distribution), a single BIWTA jetty, a 23-kilometer boundary wall, telecommunication networks (22 km optical fiber cable), and partial waste and stormwater management systems. Seven industries are operational, with 132 investors allocated land.

During the operation phase, the construction of a 23-kilometer boundary wall to secure the NSEZ restricts access to existing grazing lands in Mirsharai, significantly reducing the area available for livestock, particularly buffalo. This loss disrupts the local community's ability to graze animals, which serve as a critical source of food, nutrition, and income through sales of milk, meat, and live animals. The reduction in grazing lands leads to economic losses for livestock-dependent households, many of whom rely on open-access lands due to limited alternative income sources in areas marked by poverty.

Economically, the loss of grazing lands reduces livestock productivity, lowering incomes for communities dependent on buffalo rearing and related activities, such as dairy sales. Socially, this disruption affects community livelihoods and food security, particularly for vulnerable households, including women who often manage livestock activities. The loss of grazing lands may force communities to seek alternative, less viable grazing areas, increasing labor and costs. However, the NSEZ's operation creates job opportunities in industries and services, which can offset losses if livestock-dependent communities are integrated into alternative livelihoods.

1.1.2.31 Tourism

During the operation of the EZ, the increase in population attributed to the number of workers to be engaged in the EZ will translate to more visitors to the EZ's surrounding tourist spots. This will create extra pressure on the existing infrastructures and local resources, i.e., energy, food, fuel, road, accommodation, water resources, health facilities, waste management, etc. Tourist activity can cause the same forms of pollution as any other industry, i.e., air emissions, noise, solid waste and littering, releases of sewage, oil, and chemicals, and even architectural/visual pollution. Water, specifically groundwater, is one of the most critical natural resources in the region. The use of water for hotels, swimming pools, and personal use of water by tourists can result in water shortages and degradation of water supplies, as well as generate a greater volume of wastewater. More solid waste will be generated from the tourist facilities, and there will be a possibility of impact on the environment if adequate measures are not taken. In addition, tourist activity can put enormous stress on local land use and can lead to soil erosion, increased pollution, natural habitat loss, and more pressure on wildlife.

1.1.2.32 Cultural Heritage

No impact is expected during the operation phase.

1.1.2.33 UNESCO World Heritage Sites

No impact is expected during the operation phase.

1.1.2.34 Impacts on Community Dynamics

The operation phase of the National Special Economic Zone (NSEZ) in Mirsharai, Sitakunda, and Sonagazi Upazilas will drive a rapid and continuous influx of outside populations, including workers, their families, and service providers, leading to a blend of social and cultural practices. This assimilation may enrich community dynamics through cultural exchange but also risks reducing social cohesion due to competition over resources, potential community conflicts, and increased crime rates.

The moderate influx of outside workers and their families introduces diverse cultural practices, such as festivals, social norms, and traditions, fostering cultural exchange in Mirsharai and Sitakunda. However, this assimilation risks decreasing social cohesion as locals and outsiders compete over common resources like housing, water, and jobs. Differences in social practices may lead to misunderstandings or minor conflicts, particularly in communities with strong local identities. The limited integration of outsiders, who may lack empathy for local customs, could contribute to an increase in petty crimes, such as theft, due to social disconnection.

Economically, the influx boosts local markets through increased demand for goods and services, benefiting vendors and service providers. Socially, cultural exchange enriches community life but risks tensions if resource competition or cultural differences are not managed. Vulnerable groups, such as women and low-income households, may face challenges accessing resources, potentially deepening social divides. The risk of increased crime, though limited in this moderate scenario, could strain community trust if outsiders remain poorly integrated.

1.1.2.35 Changes of Landscape - Visual Impact

The landscape of the 1st phase area (approximately 16,900 acres) will be changed during the development phase, and it will continue during the operation phase. Therefore, no changes are expected during the operation phase due to the operational activities.

1.1.2.36 Impacts due to Disasters

If an earthquake occurs during the operation phase, the damage would be extended in EZ including industries/buildings of individual industries and infrastructure such as roads, gas pipelines, power plant, electricity transmission lines, etc. which will be constructed.

All the interventions will be developed along the shoreline of the Bay of Bengal thus are highly vulnerable to coastal floods caused by tidal surges. According to the Upazila Disaster Management Plan of Mirsharai and Sitakunda, both upazilas are flood-prone areas specifically vulnerable to flash floods. According to the consultation with BEZA, the whole EZ site will be filled with an elevation of 6.5

m. The finished level of both the off-shore and on-shore structures should be above the high flood level of the sea and rivers/khals to prevent flood hazards. At the Mirsharai site, an embankment/super dyke having approximately 22.5 km length is already developed along the Sandwip Channel thus the site is not prone to flooding.

1.1.2.37 Climate Change and Greenhouse Gas Emissions

Increasing greenhouse gases (GHGs) due to the operation of the industries will result in global warming and climate change. Its consequences are devastation for the environment such as the rising temperature, sea level change, impacts on the ecosystem, etc. The activities and sectors associated with EZ are transportation and industry will emit greenhouse gases into the atmosphere. One of the most significant of these gases is carbon dioxide (CO_2), which will be generated when fossil fuels, such as oil and natural gas, are burned (e.g., in industry, electricity generation, and automobiles) and changes in land use (i.e., deforestation). In the long run, the accumulation of CO_2 and other GHGs in the atmosphere can cause global climate change.

Transportation will be one of the major sources of GHGs in the region. GHGs from transportation will be carbon dioxide (CO_2), Carbon monoxide (CO), Non-Methane (CH_4), Organic compounds (VOCs), Oxides of nitrate (NOx), Sulphur dioxide (SO_2), and Hydrocarbons. The total amount of GHGs will depend on the population and transportation activities, types of vehicles, choices of fuel, and condition of vehicles (e.g., level of maintenance). The operation of equipment and machinery will lead to GHG emissions.

The operation of industry during 1st phase operation will include iron/steel, chemicals, paints, or similar will emit GHGs. The type of energy input or fuel used in the industries is an important factor that will contribute to the amount of GHG emission. It is recommended to keep a record of resource utilization to analyze greenhouse gas emissions in each industry and report to the EZ authority.

Greenhouse Gases (GHGs) Estimation

The total amount of GHG emission potential is calculated following the scenario where the EZ is implemented in partial operation in the year 2025. For calculation, all factories are considered running 16 hours daily throughout 300 days in a year.

The total electrical energy to be consumed is estimated keeping the maximum demand in mind, whereas for natural gas consumption total gas demand per day (m^3/day) values are used. The GHG estimation is demonstrated in Table-1.

Table-1: GHG Estimation for EZ Operation

Consumption Type	Demand**	Operation Time Considered	Yearly Demand	Emission Factor	GHG Emission (million tons CO_2 e)
Electricity	189.56 MW	300 days, 16 hours/day	9098688 MW-h	0.648 tons CO_2 eq/ MW-h	5.895
Natural Gas	2719717.70 m^3/day		815,915,310 m^3	1.885 kg CO2 eq/ m3	1.538
Total GHG Emission Estimated for 2025					7.433

** Electricity and Natural Gas demand values are taken from Master Plan

Note: Emission Factors used in GHG Calculation

1. Natural Gas: EF = 1.885 kg- CO_2 eq /m^3 [GHG Protocol]
2. Bangladesh Grid Electricity: EF = 0.648 kg CO_2 eq /kWh [GEF of Bangladesh (SREDA)]

To minimize GHG emissions, mitigation measures shall be taken by the investors and contractors, such as management of operation time of construction machinery, avoidance of excessive loading operation, and education of construction workers/drivers about the idling stop practice for machinery and vehicles. In order to reduce GHG emissions, the usage of solar light and the usage of LED in the EZ area is planned. In addition, energy-saving equipment and fuels that emit less GHG will be recommended to be installed in all industries for their operations as much as possible.

Besides, the utilization of commuter buses and or industrial electric vehicles for workers to reduce traffic GHG emissions shall be initiated by the industries. Gases-based fuels tend to emit lower amounts of GHGs than liquid fuels and solid fuels. Thus, clean fuel alternatives or low-emission GHG fuels and technologies that will be established in the EZ shall be promoted. In order to reduce GHG as part of the carbon footprint incentive program, energy conservation, recovery of heat, or power efficient consumption shall be implemented. Therefore, this issue is recommended in GHG mitigation measures or as an alternative option for future development of the EZ.

The operation of industrial facilities within EZ may contribute to greenhouse gas emissions and exacerbate climate change impacts on the Sandwip Channel ecosystem. Changes in temperature, precipitation patterns, and ocean acidification associated with climate change could further stress planktonic and benthic organisms, compounding existing threats to their survival and reproductive success.

The EZ itself may be vulnerable to changes in the environment due to climate change. The EZ is located on the coastline of Bangladesh which is highly vulnerable to Cyclones disaster and its associated tidal surges. The frequency of Cyclones has already increased in the Bay of Bengal.

1.2 Impact Assessment on Scenario 2

Scenario 2 involves the development of approximately 25,350 acres (about 75%) of land area by the year 2030.

1.2.1 Impacts During Development Phase

The development activities during the second phase will involves dredging and land reclamation, site development, construction of super dyke (at Feni side), access road development (NSEZ Sarani North, NSEZ Sarani South, and EZ site to Sonagazi-Feni road), bridges, internal road development, railway, drainage and canal excavation, establishment of groundwater deep tubewell, WTP and water transmission and distribution line, CETPs, electricity transmission line, substation and distribution line, gas pipeline, permanent jetties, telecommunication line establishment, township development, plantation, etc.

1.2.1.1 Impacts on Air Quality

During the development of the 2nd phase of the EZ, the main pollutant will be particulate matter, which will be generated during earthwork activities, including vegetation clearing, excavation works, utility construction, road and railway construction, dredging and reclamation, and transportation of construction materials to and from EZ sites. The particulate matter will thus generate blows along the wind direction. Generally, these particles will settle down within 100m to 200m from the construction site. In addition, pollutant emissions will occur due to the operation of diesel fuel generators, and exhaust emissions from transport vehicles such as material transport trucks and administrative vehicles. Therefore, the potential impacts of the project activities on air quality are associated with dust emissions and an increase in the following combustion pollutant concentrations. This has the potential to cause temporary impacts on the ambient air quality. As most of the construction equipment will be mobile, the emissions are likely to be fugitive and not concentrated at a single place or source.

1.2.1.2 Impacts from Noise

The major sources of noise will be vehicular traffic and the operation of heavy construction equipment like dozers, scrapers, concrete mixers, cranes, compressors, generators, pumps, rock drills, pneumatic

tools, saws, vibrators, etc. The operation of this equipment will generate noise ranging between 70-85 dB(A). The noise produced during the construction will have a significant impact on the existing ambient noise levels. The construction equipment may have high noise levels, which can affect the personnel operating the machines. However, these impacts will be short-term and intermittent in nature. Additionally, noise will be generated from transportation activities during the construction period. The increased noise level can impact workers' health and safety and reduce performance. Heavy vehicle operators, nearby communities, and residents close to access roads are at higher risk of noise nuisance.

Dredging activities in the Sandwip Channel will generate noise from a variety of sources, including dredgers, pumps, generators, and tugboats. Additionally, noise will be generated by the onshore plant used to spread the dredged materials and to assemble and periodically relocate pipelines. Generally, a weighted noise intensity from working engines at the noise source shall not exceed a continuous level above approximately 120 dB(A). Underwater noise during the jetty construction will result from the equipment that is used for underwater activities, such as dredging, reclamation, or the construction of the bund wall, piling, and ship movements.

1.2.1.3 Impacts on Surface Water

During the development of the EZ, water will be required for the construction of structures, sprinkling on roads for dust suppression, and domestic and non-domestic uses of the construction workers. During the second phase development and operation, about 130 MLD water will be extracted (30 MLD from groundwater and 100 MLD from Feni Reservoir).

Sources of pollutants that may impact surface water quality during the construction period include domestic wastewater from workers and sediment from runoff, particularly in land development activities where vegetation clearing is needed. The present surface water (internal khals and Sandwip Channel) may be impacted due to non-point discharges of solids from soil loss and sewage generated by the construction workforce stationed at the site. Sewage discharge and runoff during the construction phase may lead to contamination of surface water if not managed properly. Septic tanks should be provided to treat the sewage from temporary toilets at the construction site and workers' accommodation. The septic tanks will need to be adequately designed so that untreated sewage due to leakage or overflows does not have the potential to enter surface water.

During construction activity in the rainy season, the surface water quality is likely to be affected due to the construction work and loosening of topsoil. This is likely to increase the sediment as a result of increased soil erosion due to earthworks can enter surface waters, cause increased turbidity and hence impact aquatic fauna and flora by altering the aquatic environment. Improper handling of lubricants, hazardous substances, and hydrocarbons (fuels, gasoline, etc.) may also cause water pollution of surface water. Surface water could be affected during the construction of individual industries in the economic zone.

1.2.1.4 Impacts on Groundwater

According to the discussion with BEZA, during the second phase, about 30 MLD of water will be extracted from the groundwater aquifer. Withdrawing groundwater in excess of the rate of recharge may result in the lowering of the water table, land subsidence, and decreased water quality. Therefore, sustainable use of groundwater will require proper utilization and groundwater recharge techniques.

Groundwater, especially shallow tubewells, is the main water supply source for local people in the surrounding communities of the economic zone. From the stakeholder consultation, it was observed that currently, there is a groundwater crisis in the region for domestic uses as well as irrigation during the dry season.

The Hydro-Geological Survey under MUDP 2018 recommends that the aquifer condition in the EZ area is not suitable for the heavy groundwater withdrawal required for the project. The shallow groundwater in this part of the Upazila is brackish, while the deep groundwater is fresh and occurs in a thin confined

aquifer below a thick and soft clay layer. Heavy pumping from that aquifer would cause the compression of the aquitard and result in land subsidence. Besides, there is a high risk of later intrusion of seawater (salinity intrusion) into groundwater from the adjacent sea.

The groundwater quality of observed locations showed that most parameters are within the standard of groundwater for drinking. Groundwater can get worse in quality because proper treatment of generated wastewater is neglected in EZ. At this phase, there is a likelihood of having an adverse impact on groundwater quality through sewage disposal from temporary workers' facilities, debris, and solid waste deposits in case of a lack of proper management. Treating toilets and lavatories in labor camps and the other wastewater from various activities of workers by proper treatment units shall prevent groundwater contamination. Improper handling of lubricants, hazardous substances, and hydrocarbons may also cause groundwater pollution through gradual seepage.

1.2.1.5 Impacts on Topography and Soil

The topography will change due to activities such as soil excavation, land development, super dyke, internal roads, stormwater drainage, construction of access roads, pipelines, etc. The topography of approximately 25,350 acres (75% area) will be impacted. These changes are accounted for as being the adverse impact of the project, as these kinds of activities usually cause changes to the natural status of the land. This negative impact is limited to the length of the construction period, which occurs with great intensity; however, it is accounted for as an irreversible effect.

Construction of the individual industries in the economic zone will involve a large amount of earth movement. The project area is in the coastal region of Bangladesh. The land elevation on the site varies from the site's lowest point at -3.33m MSL to the highest point at +8.71m MSL[15]. According to the consultation with BEZA, the project site has been partially filled with an elevation of 6.5 m, and the rest of the site will be filled with an elevation of 6.5 m.

The construction of the access road development (NSEZ Sarani North, NSEZ Sarani South, and EZ site to Sonagazi-Feni Road), internal road development, railway, WTP, water transportation pipeline, pump stations, super dyke, township development, and utility services may cause physical damage to the destruction of soil crust and horizons. The main impacts on soil will occur due to increased erosion potential as a result of vegetation clearing and earth-moving activities. Construction activities in the EZ will involve leveling, excavation, and removal of existing vegetation will invariably disturb the soil of the area. The impacts on soil during the construction phase shall be mainly due to loss of topsoil in the construction areas and contamination of the soils of the surrounding area due to solid waste generation from site activities, as well as liquid waste such as lubricants, slurry, accidental spills, and leaks occurring from storage and work areas. The rainfall and surface runoff can cause soil erosion. The disturbances would be more pronounced during the summer and monsoon seasons with strong rains, as the project site is located near the sea. Accidental spillage of oil from construction vehicles might cause soil contamination. In addition to that, municipal waste due to construction workers, domestic sewage, and sullage from the construction labor facilities and office at the project site, etc., will contribute to changing the soil characteristics.

1.2.1.6 Impacts of Sediment

Construction activities i.e., piling of building, excavation, concreting work, construction of a jetty at the Sandwip Channel, accidental spillage of hazardous chemicals like oil and lubricant from the construction vehicles, improper storage and disposal of construction waste, solid and liquid waste from the worker's facilities may mix with rainfall water and it can accumulate on the adjacent water bodies through runoff. Besides the above-mentioned sources of impact, there are some additional sources, i.e., runoff and erosion of exposed bare soil, slopes, earth, and stockpiles, the release of cement materials with rain, and washing water of dust suppression sprays and vehicle wheels.

[15] https://bsmsn.gov.bd/?page_id=639

From the sediment quality analysis results, nickel concentration was found in the range moderately polluted (20-50 ppm), and chromium concentration was found in the range of moderately polluted (25-75 ppm). It is recommended to confirm the sediment quality/contamination level of the dredge materials prior to dredging that will be used for landfill in the EZ. Dredging disturbance of sediments can release contaminants into the water column, which has the potential to change the chemical properties of the sediment and reduce water quality at both extraction and dumping sites for some time after dredging has ceased. These pollutants can have a negative impact on water quality, posing risks to both aquatic marine life and human health.

1.2.1.7 Impact due to Changes in Land Use

About 25,350 acres of land use and land cover will be changed during the 2nd phase of development. Before the development of the economic zone, the site comprised barren lands (27.6%), mangroves/forest/vegetation (31.65%), water bodies (8.71%), and underdevelopment (6.53%)[16]. The existing vegetation and trees will be cleared for the development of the project and its allied facilities; therefore, the land use of the existing area will be changed to an industrial area which results in the loss of existing vegetation. Also, it will have an impact on the existing drainage pattern in the EZ as well as in the adjoining area if the development is not properly planned.

There will be a large number of personnel moving into the economic zone and the surrounding area. The majority will be construction crews with low wages. They will likely depend in part on the locals to provide certain low-cost basic services, such as food, cleaning, transportation, and entertainment or relaxation. Naturally, there will be temporary structures set up to provide such services at the places most convenient for the workers, predictably near the access roads and the entrance to the site. These squatted temporary settlements will take more permanent forms over time. In terms of land use, such temporary service activities and structures set up for workers' needs must be planned out and monitored regularly.

1.2.1.8 Impact due to Solid Waste Generation

Construction activities will generate different categories of solid waste. Solid materials such as domestic/canteen waste, food packet wrappers, paper, plastic drums, paints, oil containers, packaging from construction materials, generation from earthwork, debris, excess construction materials, site establishment activities, removal of vegetation/bush/trees, and others will be generated. This may cause environmental degradation at the EZ site as well as its immediate surroundings if adequate measures are not taken. Hazardous waste, i.e., oil, chemicals, lubricants, paints, compressed gases, varnishes, etc., generated during the development of EZ should be dealt with separately from non-hazardous waste. The dripping of oil from construction vehicles might cause soil contamination. Medical waste will be generated from the first aid facilities at the construction sites.

1.2.1.9 Impacts from Liquid Waste Generation

The primary wastewater issues relate to stormwater events and sanitary wastewater generated by construction activities on-site. Stormwater has the potential to run off into areas containing hazardous materials and either leach into the soil or carry these off the site, potentially contaminating other areas, groundwater, or marine waters. Storm events can potentially have adverse impacts on water resources, resulting in large amounts of silt-laden run-off.

Sewage will be generated from the construction workers' facilities and the project site. Wastewater generation at construction sites includes surface runoff also which may contain pollutants and traces of solvents, paints, metal compounds, etc., which may impact the nearby surface water resources if not managed properly. The impact is that until the construction phase is completed as infrastructure for the wastewater conveying network and treatment plants will be available.

1.2.1.10 Impacts on Drainage

[16] https://bsmsn.gov.bd/?page_id=639

During the 2nd phase development, no khals will be impacted by the development activities because the activities will be carried out at the Feni site, where there is no presence of khals. In addition, a super dyke will be constructed in the Sonagazi area to protect the site from tidal surges and intrusion of seawater.

The township, access roads and bridges, internal roads, railways, electricity lines, gas transmission line, WTP and water transmission and distribution lines, etc., undertake minimum cutting for making traces for the construction of buildings while making minimum modifications in the terrain conditions, and implementing appropriate environmental measures.

The EZ site is sloping from north-east to south-west. Storm runoff generated from the entire area of EZ and its surroundings get drained to the sea through a number of natural drainage channels passing through EZ. Altogether there are 13 drainage channels, all getting discharged to the sea, apart from the Feni River, which passes through EZ before conferencing to the sea. All these rivers and khals are influenced by the tidal effect. In the case of project development, rivers and khals may be affected by the project construction activities. Excavation, earthwork, and levelling activities are possible to obstruct the water drainage. The effects might include an increase in sediment or a change in river/khals velocity or direction.

1.2.1.11 Impacts of Traffic

The 2nd phase development activities will increase in traffic volume on the local road networks because the 1st phase operation will be running parallelly. Construction traffic will include vehicles transporting equipment, materials, and personnel. Access roads including (NSEZ Sarani North, NSEZ Sarani South, and EZ site to Sonagazi-Feni Road) and bridges on the Feni River will be developed in this phase to enhance the road connectivity between Mirsharai and Feni site. The improvement and development of the local road conditions will enhance various socio-economic activities.

There will be an increase in the traffic volumes on the local road networks in the region day by day. The increased traffic volumes will place an additional burden on the existing roads within the study region. Traffic congestion may occur by vehicles of the construction site and vehicles of entry and exit to the industrial zone. The volume of vehicles involved in transporting raw materials has a lot of potential for traffic accidents and potential injuries to public road users, especially residents staying close to the access roads.

1.2.1.12 Loss of Ecosystem Services

The local community benefits from a wide range of provisioning, regulating, supporting, and cultural ecosystem services within the NSEZ site and surrounding areas. These include fishing, groundwater abstraction for drinking and irrigation, livestock grazing, fuelwood collection, limited medicinal plants, natural hazard protection, and aesthetic values. Under Scenario-2, approximately 25,350 acres will be developed, representing about 75% of the full 33,805-acre plan. Development activities will include dredging (~338.08 million m^3), road construction (internal and external roads), embankments, super dyke construction, railway development, jetty establishment, township construction, water and electricity infrastructure, gas pipelines, stormwater networks, and partial landfilling. While ecosystem services will be affected, the magnitude of impacts will be less than the full-scale development scenario.

Fishing, a key provisioning service, will face moderate impacts due to dredging, jetty construction, and increased maritime and industrial traffic. These activities may disturb aquatic habitats, affect fish migration, and reduce the productivity of fisheries. Relocation of landing sites such as Saherkhali, Domkhali, Muhuri, and Bamonsundor Ghats will create challenges for local fishers, including 2,557 registered in Mirsharai, 800 in Sonagazi, 300 seasonal Hilsa fishers, and numerous informal fishers. However, some alternative fishing grounds are expected to remain accessible, partially mitigating livelihood disruption.

Groundwater abstraction for construction and operational activities, including surface water from Meghna River (250 MLD), reservoir supply (100 MLD), and desalination, will place localized stress on

aquifers. While some depletion or salinity intrusion may occur, adequate water management measures are expected to reduce risks.

Vegetation clearance for roads, embankments, industrial plots, and township areas will reduce fuelwood and grazing availability. Buffalo and cattle herders will experience localized pasture loss and higher fodder costs, though remaining open areas outside the developed footprint will continue to provide grazing. Impacts on medicinal plants remain minimal due to their limited presence in the area.

Regulating services, including natural flood and cyclone protection, may be slightly affected by embankments, landfilling, and drainage modifications within developed zones. However, extensive undeveloped areas and natural buffers outside the project footprint will maintain overall protective functions. CETPs under construction will reduce localized wastewater risks upon operation.

Supporting and cultural services may experience minor declines due to habitat loss, reduced aesthetics, and partial landscape conversion. Nevertheless, significant natural areas will remain, preserving biodiversity, recreational opportunities, and cultural identity to a large extent.

1.2.1.13 Impacts on Terrestrial and Mangrove Flora

Under Scenario-2, development activities such as extensive land acquisition, dredging (338.08 million m^3), dyke and super dyke construction, internal and external road expansion, railway development, jetty construction, township establishment, and industrial facility development over 25,350 acres will lead to more substantial clearance of terrestrial vegetation and disturbance of mangrove areas compared to Scenario-1.

The common terrestrial plant species present in the NSEZ site, including Akashmoni, Jhao Ghas, and Karoi, will be cleared across a larger footprint. This will result in a more significant reduction of vegetation cover, canopy density, and ecological functions within the developed zones. Although these species are widespread in the region, the magnitude of clearance in Scenario-2 may lead to localized loss of habitat for small mammals, insects, and bird species that rely on these plant communities.

Mangrove patches and intertidal mudflats, which provide critical habitat for mud crabs, fishes, shrimps, and waterbirds, may experience increased indirect impacts. Partial embankments, dredging, and landfilling across Scenario-2 areas could modify hydrology, sedimentation patterns, and salinity regimes, potentially stressing mangrove communities and associated fauna. BEZA allocated 13,646.28 acres (40.37%) of land as mangrove, green areas, vegetation, and open spaces to maintain ecological connectivity and habitat improvement. Nevertheless, the larger developed footprint in Scenario-2 increases the risk of disturbance and localized degradation of these habitats.

Indirect impacts on vegetation are expected from dust deposition during dredging, soil filling, and increased vehicular movement. Dust accumulation on leaves can impair photosynthesis and transpiration, reducing plant growth, particularly near construction corridors.

Habitat disturbance and vegetation clearing may promote the spread of invasive and opportunistic plant species. Soil movement, construction activities, and increased human presence can facilitate colonization by weeds and exotic species. Compared to Scenario-3 (full development), Scenario-2 has a slightly reduced impact because 25% of the land remains undeveloped, providing some space for terrestrial and mangrove flora. However, relative to Scenario-1, Scenario-2 poses higher risks due to the larger scale vegetation clearance during the development phase.

1.2.1.14 Impacts on Terrestrial Mammals

Development activities during Scenario-2, including extensive vegetation clearance, land development, and construction of roads, embankments, railways, industrial plots, and township facilities over ~25,350 acres, will lead to more significant habitat loss and disturbance for terrestrial mammals compared to Scenario-3. The reduction of tree cover, undergrowth, and secondary vegetation will limit food availability for herbivores such as spotted deer, while carnivores like Jungle Cat (*Felis chaus*) and Fishing Cat (*Prionailurus viverrinus*) may experience reduced prey due to declining habitat complexity.

Baseline surveys documented 11 mammal species within the NSEZ site, including Rhesus Macaque (*Macaca mulatta* – Vulnerable), Jungle Cat (*Felis chaus* – Near Threatened), and Fishing Cat (*Prionailurus viverrinus* – Endangered). These species are likely to be further disturbed by the increased extent of habitat disturbance and construction activity under Scenario-2. Although some undeveloped areas will remain, the larger development footprint increases pressure on alternative habitats and foraging grounds in the surrounding landscape, raising the potential for population stress.

Displacement of mammals into adjacent undeveloped areas may increase human–wildlife interactions, including potential conflicts, though widespread incidents are expected to be limited. Construction noise, vibration, and artificial lighting will disturb sensitive and nocturnal species, potentially affecting foraging, breeding, and movement patterns. The expanded road and railway networks, along with higher construction traffic, increase the risk of roadkill and direct mortality compared to Scenario-1.

Compared to Scenario-3 (full development), Scenario-2 has a slightly reduced impact because ~25% of the land remains undeveloped, providing some refuge for terrestrial mammals. However, relative to Scenario-1, Scenario-2 poses higher risks due to the larger scale of habitat loss, disturbance, and operational disturbance during the development phase.

1.2.1.15 Impacts on Birds/Avifauna

During the development phase under Scenario-2, extensive vegetation clearance, land development, road and railway construction, embankment and industrial plot establishment, and partial township development over ~25,350 acres will lead to potential habitat disturbance for resident and migratory birds. The preserved forested areas and green open spaces will be partially affected, reducing available shelter and nesting sites. Mudflats and intertidal areas along the nearby Sandwip Channel, which serve as important foraging grounds for waterbirds, may experience localized disturbances due to construction-related activities, dredging, and increased human presence.

Noise, vibration, and dust generated by heavy machinery, dredging (~338.08 million m^3), and construction of roads, jetties, and railways may temporarily displace birds from affected areas. The expansion of internal and external roads and railway lines will disturb habitats, potentially disrupting breeding and foraging patterns, particularly for sensitive or ground-nesting species. Artificial lighting from construction sites, equipment, and temporary facilities may also alter nocturnal behavior and navigation for some species.

Human-bird interactions are likely to increase during construction, especially near access roads, jetties, and industrial plots. Invasive species may colonize disturbed areas, potentially outcompeting native species for resources, though the presence of remaining undeveloped green areas can provide refuges. Accidental spills, runoff, or sedimentation from construction may affect small portions of the Sandwip Channel and associated prey populations, but impacts are expected to be mostly localized.

Despite these disturbances, the presence of remaining forest patches, buffer zones, and undeveloped land outside (25%) the primary construction footprint will continue to support a portion of the bird populations. However, the larger development scale compared to Scenario-1 increases the magnitude of impacts on habitat availability, foraging efficiency, and breeding success.

1.2.1.16 Impacts on Herpetofauna

During the development phase under Scenario-2, extensive vegetation clearance, land development, dredging (~338.08 million m^3), road and railway construction, embankments, industrial plots, and partial township facilities over ~25,350 acres will cause more substantial habitat loss and disturbance for herpetofauna compared to Scenario-3. Reptiles and amphibians that depend on trees, shrubs, grasses, and intertidal habitats, such as the Asian Water Monitor (*Varanus salvator* – Vulnerable), Bengal Monitor (*Varanus bengalensis* – Near Threatened), and Cascade Frog (*Amolops marmoratus* – Vulnerable), will experience higher levels of disturbance due to the larger development footprint.

Excavation, soil filling, and leveling for roads, embankments, and industrial plots will remove ground cover, vegetation, and microhabitats, disrupting breeding, foraging, and sheltering areas. Increased

vehicle movement, machinery operation, and construction noise and vibrations will further disturb reptiles and amphibians, causing temporary displacement and potential stress. Amphibians are particularly sensitive to soil and water contamination from accidental spills of oils, fuels, and construction chemicals, which may accumulate in stormwater channels or nearby khals, affecting larval development and survival.

Disturbance of habitats may lead to higher encounters with humans, domestic animals, and predators, increasing mortality risk. The larger scale of development in Scenario-2 also increases the potential for invasive species establishment, which may compete with native reptiles and amphibians for resources. Dust, exhaust emissions, and sedimentation from dredging and landfilling may affect the physiological health of herpetofauna, particularly amphibians relying on moist skin for respiration.

Compared to Scenario-3 (full development), Scenario-2 has a slightly reduced impact because ~25% of the land remains undeveloped, providing some refuge for herpetofauna. However, relative to Scenario-1, Scenario-2 poses higher risks due to the larger scale of habitat loss, disturbance, and operational disturbance during the development phase.

1.2.1.17 Impacts on Aquatic Mammals

During the development phase under Scenario-2, construction activities over ~25,350 acres, including extensive dredging (~338.08 million m³), jetty construction, port development, pipeline installation for desalination, and partial township facilities, are expected to have significant localized impacts on aquatic mammals in the Sandwip Channel. Key species potentially affected include the Irrawaddy Dolphin (*Orcaella brevirostris* – Endangered) and Indo-Pacific Humpback Dolphin (*Sousa chinensis* – Vulnerable).

Dredging and sediment removal will disturb the seabed, increase turbidity and release contaminants that can degrade water quality. Elevated sediment loads and alters water chemistry may reduce prey visibility and availability, impacting feeding behavior. Construction of jetties, breakwaters, and pipelines, as well as pile driving and blasting in nearshore areas, will generate intense underwater noise, disrupting communication, echolocation, navigation, and foraging. Compared to Scenario-1, the larger scale and longer duration of construction in Scenario-2 increases the risk of stress, temporary displacement, and potential habitat avoidance for dolphins.

Increased vessel traffic for construction, material transport, and maintenance operations may raise the probability of collisions with dolphins. Accidental spills of oil, lubricants, or other chemicals from construction machinery and vessels can introduce toxins into the water, which may affect dolphins directly or indirectly through bioaccumulation in prey. Sediment resuspension and turbidity increases will also affect benthic and pelagic prey species, potentially causing short-term reductions in food availability.

Compared to Scenario-3 (full 100% development), Scenario-2 has a somewhat reduced impact because ~25% of the area remains undeveloped, providing nearby undisturbed channel habitat. However, the larger construction footprint relative to Scenario-1 means that dolphins may experience greater disturbance, temporary displacement, and habitat disturbance.

1.2.1.18 Impacts on Ichthyofauna (Fish)

During the development phase under Scenario-2, extensive land reclamation, infrastructure construction, and dredging over ~25,350 acres are expected to have notable impacts on ichthyofauna in the Sandwip Channel and adjacent riverine and estuarine habitats. The area supports diverse fisheries resources, including 22 species of finfish, 2 species of crab, 6 species of shrimp, and several cultured species in local aquaculture practices. These habitats serve as critical spawning, feeding, and migration grounds.

Large-scale dredging (~338.08 million m³), jetty construction, embankment development, and partial road and railway construction will disturb sediments, alter water depth and flow, and cause habitat modification. Loss of riparian vegetation and partial destruction of estuarine and intertidal areas will

reduce shelter and food availability, potentially affecting fish diversity, abundance, and recruitment. Compared to Scenario-1, the greater footprint of Scenario-2 increases the area of habitat affected and the degree of disturbance.

The absence of a fully operational Sewage Treatment Plant (STP) in Scenario-2 may result in localized discharge of untreated or partially treated wastewater, while construction runoff, oil, lubricants, and chemical spills can temporarily degrade water quality. Elevated turbidity and reduced light penetration from sediment resuspension may impair photosynthesis in aquatic plants, diminish prey availability, and impact feeding behavior, particularly for juvenile and sensitive species. Noise and vibrations from dredging, pile driving, and construction-related vessel traffic can disrupt fish communication, predator-prey interactions, and spawning behavior.

However, as approximately 25% of the NSEZ area remains undeveloped, significant portions of the Sandwip Channel and adjacent aquatic habitats remain functional, providing refuge for fish populations. Temporary displacement localized behavioral changes, and short-term reductions in abundance are expected, but permanent population declines are less likely.

Compared to Scenario-3 (full 100% development), Scenario-2 has slightly lower overall impact severity due to the remaining undeveloped habitats, but the impacts are greater than Scenario-1 due to the larger construction footprint and higher intensity of dredging and infrastructure activities.

1.2.1.19 Impacts on Hilsa Fisheries

Hilsa (*Tenualosa ilisha*) represents the most valuable single fishery in Bangladesh, being largely anadromous and euryhaline, thriving in brackish and marine waters of the Bay of Bengal. The baseline study confirms the presence of hilsa and its spawning and breeding grounds in the Sandwip Channel, particularly near Mayani Point at Mirsharai, Chattogram. Peak spawning occurs over eleven days surrounding the full moon in the Bengali month of Ashwin. No official Hilsa sanctuary exists in the study area, although national regulations restrict activities in designated sanctuaries.

During Scenario-2 development, approximately 25,350 acres (75% of the full NSEZ area) will be subjected to land reclamation, partial dredging (~338.08 million m^3), road, embankment, and jetty construction, along with industrial and port infrastructure development. The larger construction footprint compared to Scenario-1 increases the extent of habitat alteration and disturbance in the Sandwip Channel, including areas critical for Hilsa spawning and migration.

Increased sedimentation and turbidity from dredging, landfilling, and construction runoff may reduce light penetration, smother aquatic vegetation, and degrade water quality, adversely affecting hilsa eggs, larvae, and juvenile survival. The risk of untreated or partially treated wastewater, oil, and lubricant spills entering water bodies is higher than in Scenario-1, potentially impacting hilsa health and reproductive success.

Construction-related underwater noise, pile driving, and increased vessel traffic may disturb Hilsa during their peak spawning periods, temporarily disrupting migration, communication, and spawning behaviors. Relocation or partial obstruction of key access points may further stress the fish population.

The development of ports, industrial zones, and increased access to waterways may attract additional fishing vessels, elevating fishing pressure and the potential for overexploitation, particularly during the spawning season. While some alternative habitats remain outside the NSEZ footprint, the larger area of development under Scenario-2 reduces the availability of undisturbed spawning grounds compared to Scenario-1.

Compared to Scenario-3 (full 100% development), Scenario-2 impacts are slightly less severe but significantly greater than Scenario-1 due to the larger construction footprint, more extensive dredging, and higher potential for pollution and habitat disturbance.

1.2.1.20 Impacts on Plankton and Benthos

Plankton and benthic organisms form the base of aquatic food webs and are essential for nutrient cycling, sediment transport, and overall ecosystem health. Baseline surveys in the Sandwip Channel and downstream areas recorded 19 species of phytoplankton, 14 species of zooplankton, and 16 species of benthos, indicating a diverse and productive aquatic community.

Under Scenario-2, approximately 25,350 acres (75% of the full NSEZ area) will undergo land reclamation, partial dredging (~338.08 million m³), road and embankment construction, and industrial and port infrastructure development. The larger construction footprint compared to Scenario-3 will lead to more extensive disturbance of aquatic habitats, temporarily increasing turbidity, smothering benthic organisms, and reducing light penetration necessary for phytoplankton photosynthesis.

Effluent discharge and construction runoff, including potential oil, lubricant, and cement spills, pose a higher risk of localized water contamination compared to Scenario-1. These pollutants can affect survival, reproduction, and species composition of plankton and benthos in the immediate vicinity of construction and dredging areas. The establishment of partial ports and jetties may also slightly modify water circulation patterns, altering nutrient cycling and oxygen levels locally.

While planktonic organisms are resilient and may recover within weeks to months, benthic communities require 1–3 years for full recovery. Due to the larger area of development and more intensive construction activities compared to Scenario-1, temporary reductions in benthic abundance and shifts in species composition may be more pronounced, although large stretches of undisturbed water and sediment outside the project footprint will continue to support the persistence of these communities.

Compared to Scenario-3 (full 100% development), Scenario-2 impacts are somewhat lower due to partial implementation of infrastructure and dredging but are clearly more significant than Scenario-1, reflecting the larger footprint and increased sedimentation and contamination risk.

1.2.1.21 Impacts of Dredging on Marine Ecosystems

For Scenario-2, development activities will require approximately 112.75 million m³ of dredged material from the Sandwip Channel to support 75% (338.08 million m³) of the EZ footprint. While still a large dredging requirement, the volume is lower than full build-out under Scenario-3 (450.89 million m³) and significantly higher than Scenario-1 (225.33 million m³). Consequently, the scale of impacts on marine ecosystems falls between those two scenarios.

Dredging under Scenario-2 will disturb benthic habitats more extensively than Scenario-1, directly affecting bottom-dwelling organisms such as mollusks, crustaceans, and benthic fish species that form the foundation of marine food webs. Recovery of these communities will require time, and some localized declines in biodiversity are expected, particularly in frequently dredged areas.

Suspended sediments generated during dredging will elevate turbidity and reduce light penetration, affecting photosynthesis in phytoplankton, algae, and aquatic plants. Compared to Scenario-1, turbidity plumes will be broader and persist longer, potentially smothering sensitive habitats such as seagrass beds and intertidal flats. However, because 25% of development is omitted in this scenario, a larger proportion of the Sandwip Channel remains undisturbed compared to Scenario-1, reducing the extent of system-wide impacts.

Pollutants trapped in dredged sediments, including heavy metals and organic contaminants, may be released into the water column, posing risks to fish, invertebrates, and marine mammals. Although these risks are higher than Scenario-1 due to larger dredging volumes, dispersion remains more limited than in full development.

Hydrodynamic changes including alterations in tidal patterns, sediment transport, and localized erosion are expected to be moderate. Some impacts on mangroves, intertidal zones, and fish spawning/nursery grounds are anticipated, though refugia in undisturbed portions of the Sandwip Channel will allow partial ecological continuity.

Overall, dredging impacts under Scenario-2 are greater than those in Scenario-1, but less extensive and severe than Scenario-3, due to the reduced total development area and dredging volume.

1.2.1.22 Ecologically Critical Areas

An Ecologically Critical Area (ECA) is an environmental protection zone in Bangladesh. As per the legal mandate, the Ministry of Environment, Forest, and Climate Change (MOEFCC) till now declared thirteen ECA areas in Bangladesh. According to the literature review, there is no ECA area located inside the EZ master plan area. Therefore, no impacts on ECAs are anticipated due to the development of Scenario – 2 phase of EZ.

1.2.1.23 Protected Areas

According to the Wildlife (Conservation and Security) Act 2012, types of protected areas are national parks, sanctuaries, eco-parks, botanical gardens, community conservation areas, safari parks, Kunjaban, etc. According to the Bangladesh Forest Department's list of protected areas, there is no protected area located within the EZ area. Therefore, no impacts on protected areas are anticipated due to the development of Scenario-2 of EZ.

1.2.1.24 Critical Habitat Assessment

While the NSEZ area does not meet the World Bank ESS6 criteria for Critical Habitat (Criteria a–e), some species presents are still Endangered, Vulnerable, or Near Threatened and remain sensitive to habitat alteration, noise, pollution, and increased human presence. Under Scenario-2, these disturbances will be moderate in intensity and extent due to larger-scale clearing, dredging, and infrastructure construction compared to Scenario-1. However, as full development is not pursued, portions of natural habitat will remain undisturbed, providing some refuges for species and partially mitigating risks associated with habitat disturbance.

1.2.1.25 Impacts due to Land Acquisition, Resettlement, Rehabilitation, and Speculation

For Scenario-2, the total land area considered for development of the EZ is 25,000 acres, representing about three-quarters of the 33,800 acres in the full master plan. To date, BEZA has secured approximately 17,000 acres of land from the DC offices, with further transfers required to reach the 25,000-acre target. As with earlier scenarios, much of this land is reclaimed from the Sandwip Channel. Under Scenario-2, development expands beyond Zone 2A and Zone 2B in Mirsharai, moving more decisively into Sonagazi and Sitakunda for accommodation facilities and heavy industry.

Both physical and economic displacement become more significant at this stage. The number of affected households, fishermen, grazers, and buffalo owners increases compared to Scenario-1, though still remains somewhat lower than at full implementation. The 76 households (135 persons) already displaced illustrate the trend, but further acquisition for roads, rail, and housing will expand resettlement requirements under Scenario-2.

Railway: Around 89 acres will still be required, with approximately 1,200 households and numerous structures affected, similar to the estimates in the full scenario but phased earlier.

Roads: Resettlement along the key corridors (Feni–Sonagazi, Sonagazi–Muhuri, Muhuri, Bamonsundar, Barodarogarhat–Mohanagar, NSEZ Saroni north, south, and main) will be substantial, with impacts higher than Scenario-1 but slightly lower than the scenario 3.

Housing: Worker accommodation demand rises significantly. The NHA township plan for 200–300 acres near the EZ boundary becomes more critical, making acquisition of community land more likely.

The RPF under PRIDE continues to guide land acquisition and resettlement planning. RAPs must be prepared for each corridor and facility area, ensuring timely compensation and transparent consultation. The existing four resettlement sites (RS1–RS4) may not be sufficient; additional resettlement land may be required to accommodate the larger number of PAPs.

The increased development footprint, coupled with the NHA township proposal, drives up land prices further. Speculative buying and inflated expectations among landowner's complicate resettlement financing and planning. Vulnerable groups face even greater risks of exclusion or informal settlement pressures.

1.2.1.26 Community Health, Safety, and Security

In the second scenario, NSEZ expands significantly to approximately 25,350 acres, marking a substantial increase in development intensity. Activities include massive dredging (338 million m³), expanded road networks (NSEZ Sarani North & South, connectivity to Sonagazi-Feni), a 13.4 km railway with bridges, culverts, and a station, multiple jetties (one BEZA, two private), advanced water treatment facilities (100 MLD from Feni reservoir, 250 MLD from Meghna River, plus desalination), two CETPs (100 MLD total), partial township development, expanded power and gas networks, and partial telecommunication and stormwater systems. This large-scale development amplifies risks across Mirsharai and Feni, with broader implications for community health, safety, and security.

The intensified construction and dredging operations generate significant dust, noise, and vibration, increasing respiratory and nuisance-related health impacts for communities in both Mirsharai and Feni. Traffic and accident risks escalate with the expanded road and railway networks, multiple jetties, and heavy equipment movement, posing safety concerns for institutions and residents along access routes. While the establishment of two 50 MLD CETPs reduces long-term risks of industrial wastewater contamination, early operational inefficiencies may still pose hazards. The large-scale influx of migrant workers, coupled with partial township development, heightens the risk of communicable diseases, including HIV/AIDS, malaria, dengue, and respiratory infections.

Township development alleviates some pressure on nearby villages but introduces concentrated risks in worker settlements, such as disease outbreaks, waste generation, and sanitation challenges. The transport and use of hazardous chemicals for expanded industrial activities significantly increase the potential for fires, toxic leaks, and explosions, particularly if safety systems are inadequate.

The larger influx of workers, contractors, and service providers elevates risks of theft, human trafficking, harassment, and violence. Despite the industrial police unit and boundary walls, ensuring security at this scale becomes resource-intensive and complex, stretching local law enforcement capacity.

Resource and livelihood conflicts intensify, with restricted fishing, grazing losses, and displacement affecting larger populations across Mirsharai and Sonagzi. Employment competition between locals and migrants escalates, despite vocational training programs, fueling social tensions. The influx of diverse migrant groups introduces cultural and social friction, further straining community cohesion. Women and marginalized groups face heightened risks of GBV, SEA/SH, and exclusion from economic benefits. Public services, including health, education, water, and sanitation, face severe strain due to the increased EZ population and pressure from nearby communities. While township developments reduce direct impacts on villages, they risk creating segregated worker enclaves, limiting positive host–migrant interactions.

1.2.1.27 Occupational Health, Safety, and Security

At the development stage of scenario 2, with approximately 25,350 acres of the Economic Zone under operation, the scope and complexity of occupational health and safety issues will increase substantially. Large-scale dredging (over 338 million m³), construction of external and internal road networks, the development of railway infrastructure with bridges and culverts, and the establishment of new utilities such as gas pipelines, electricity distribution systems, and telecommunication networks will involve heavy machinery and high-risk operations. Workers will be exposed to greater risks of accidents involving machinery, electrocution, falls from heights, and transportation-related incidents, given the expanded vehicular movement and construction activity across the zone.

The introduction of central effluent treatment plants (2 units), a large water treatment plant (100 MLD from Feni reservoir), and a desalination facility will expose workers to new occupational hazards,

particularly chemical exposure, inhalation of fumes, and risks of burns or explosions in handling treatment processes. Township development at Mirsharai and Feni will bring larger concentrations of workers and residents into the zone, increasing the chances of communicable disease outbreaks if sanitation and waste management remain inadequate. Partial waste facilities, coupled with higher industrial activity, may exacerbate problems of hazardous waste exposure.

The higher number of workers at this stage will also amplify risks of respiratory diseases due to prolonged exposure to dust, exhaust gases, and solvents. Noise and vibration from increased industrial and transport activities will add to the occupational burden. Psychological impacts such as stress, hypertension, and substance abuse are expected to rise, with workers spending long periods away from their families. Moreover, the increased inflow of migrant laborers and interaction with local populations will heighten the risk of sexually transmitted diseases, including HIV/AIDS.

Fire hazards will also become more pronounced, given the storage and use of flammable materials in expanded industrial operations. Emergency preparedness and disaster management systems will be critical, including well-equipped first-aid units, on-site medical care facilities, and rapid evacuation mechanisms.

1.2.1.28 Labor Influx

Under the development scenario 2, approximately 25,350 acres of NSEZ will be developed, and labor requirements will expand significantly. Workforce demands will support additional infrastructure projects including the expansion of internal and external roads, railway transport with 13.4 km track, six bridges, eleven culverts, and a station building at Mirsharai, super dyke construction at Feni, water treatment plants including 100 MLD from Feni reservoir and 250 MLD surface water from the Meghna River, desalination facilities, electricity and gas distribution lines across multiple zones, township development at Mirsharai and Feni, partial waste management facilities, telecommunication network of 15 km fiber cable from Sonagazi to Mirsharai, stormwater network, plantation, and dredging and landfill activities. Existing operational industries and upcoming investors will further drive the need for labor.

The workforce will include unskilled, semi-skilled, skilled, and highly skilled personnel across diverse tasks such as building construction, road and railway works, embankment construction, pipeline installation, dredging, transportation, and industrial facility operations. As construction expands and industrial operations commence, the number of employees residing within NSEZ is expected to increase to 1.05 million, with 0.42 million single employees and 0.63 million employees living with families, generating nearly 1.89 million dependents. The total population in Phase 2 will therefore be approximately 2.94 million people. Follower populations including informal vendors and service providers will also integrate into the surrounding economy.

The larger influx will intensify pressures on housing, healthcare, education, water supply, sanitation, and waste management systems. Informal settlements may grow, with limited access to essential services, heightening public health risks from waterborne, vector-borne, respiratory, and sexually transmitted diseases. Social tensions may arise from cultural, lifestyle, and income differences between host communities and migrant populations. The predominantly male workforce in temporary or semi-permanent settlements may increase gender-based violence and harassment risks. Environmental pressures are expected to increase, including over-extraction of water and raw materials, solid and liquid waste generation, and higher vehicle and pedestrian traffic leading to congestion, noise, air pollution, and road accidents.

The Labor Influx Management Plan under Scenario 2 prioritizes phased township expansion, full operational social services, structured commercial zones, regulated settlements, host-migrant engagement forums, contractor labor oversight, continuous monitoring of GBV/SEA-SH, and grievance redress mechanisms. These interventions aim to stabilize living conditions, ensure equitable access to services, maintain social cohesion, and minimize public health and environmental impacts.

1.2.1.29 Child Labor, and Forced Labor, and Bonded Labor

Under Scenario 2 development, covering approximately 25,350 acres, the scale of labor demand increases substantially. Workforce requirements will support expanded infrastructure including additional internal and external roads, railway construction with 13.4 km track, six bridges, eleven culverts, a station building, super dyke at Feni, two water treatment plants, desalination facilities, electricity and gas networks across zones, township development for worker accommodation, partial waste management facilities, telecommunication networks, stormwater networks, plantation, and dredging and landfill activities. The expanded workforce will also cater to incoming investors and operational industries across Mirsharai and Sonagzi sites.

The larger labor influx in Scenario 2 significantly increases the potential risks of child labor, forced labor, and bonded labor. The intensified hiring pressure may push contractors and subcontractors to rely even more on informal recruitment channels, increasing the likelihood of underage employment and exploitation of vulnerable or undocumented workers. Migrant laborers may be subjected to coercive employment practices, including debt bondage, withheld wages, and restrictions on mobility. Families in poverty may continue to involve children in informal work, and the expansion of temporary and semi-permanent settlements will make monitoring more challenging.

The multilayered nature of construction and service supply chains in the expanded NSEZ further complicates oversight, allowing exploitative practices to remain hidden. Lack of formal grievance mechanisms, weak labor representation, and limited regulatory enforcement can prevent workers from seeking redress. The establishment of township facilities and phased social infrastructure development, if not paired with strict monitoring, may still leave gaps where child labor and forced labor could occur.

1.2.1.30 Gender-Based Violence (GBV), Sexual Exploitation and Abuse (SEA), and Sexual Harassment (SH)

Under Scenario 2 area development (approximately 25,350 acres), labor demand will expand significantly to support additional internal and external roads, railway construction (13.4 km, six bridges, eleven culverts, one station building), super dyke at Feni, two water treatment plants, desalination facilities, electricity and gas networks, township development for workers and investors, partial waste management facilities, telecommunication networks, stormwater networks, plantation, and dredging/landfill works. The expanded workforce will involve both on-site and off-site construction and industrial operations across Mirsharai and Feni.

The larger and more dispersed male workforce further heightens the risks of GBV, SEA, and SH. Temporary and semi-permanent settlements, worker camps, and township accommodations may create environments where inappropriate behavior, harassment, and sexual exploitation can occur if not actively managed. Economic vulnerability among local women and adolescent girls may increase transactional sex and other exploitative practices. Unregulated interactions and gaps in enforcement may also facilitate trafficking or forced involvement in commercial sex work in areas with weak law enforcement.

Preventive measures under Scenario 2 will need to be more robust due to the increased workforce and population density. This includes enhanced Codes of Conduct, widespread behavioral training, expanded safe spaces and survivor support services, comprehensive GRM channels, and intensified community awareness campaigns targeting host populations. Continuous monitoring and liaison with local authorities will be required to ensure adherence to protective measures and adaptive management of emerging risks.

1.2.1.31 Violence Against Children

During development of the NSEZ scenario 2, the labor influx will be substantially larger and more diverse, with semi-skilled and unskilled workers forming a significant proportion of the workforce. The increased demand for auxiliary and subcontracted labor at this stage may create higher risks of child labor, particularly in non-technical or casual jobs such as support services, material handling, and supply chain-related work. With denser settlements forming in and around EZ, children may also face heightened exposure to risks of abuse, neglect, and exploitation. The greater volume of migrant

populations will weaken traditional community monitoring and social cohesion, increasing the vulnerability of children to trafficking, harassment, or exposure to exploitative practices through both physical and digital means. Although law enforcement agencies and project-level management will likely enhance oversight as development advances, the larger population size and the complexity of social interactions will make it more challenging to prevent, detect, and address cases effectively.

1.2.1.32 Impact on Social Infrastructures

Under Scenario 2 of the National Special Economic Zone (NSEZ), approximately 25,350 acres in Mirsharai and Feni undergo extensive development, significantly expanding infrastructure and industrial activity. This phase includes full internal and external road networks (including NSEZ Sarani North & South and connectivity to Sonagazi-Feni), a 13.4-kilometer railway with bridges, culverts, and a station, multiple jetties (one BEZA, two private), two 50 MLD Central Effluent Treatment Plants (CETPs), advanced water treatment facilities (100 MLD from Feni reservoir, 250 MLD from Meghna River, plus desalination), electricity and gas networks, partial township development, telecommunication networks, stormwater networks, and partial waste management facilities. The increased population and industrial activity drive heightened demand for community services, including healthcare, education, housing, sanitation, transport, and other public amenities.

The large-scale development and influx of migrant workers, contractors, and service providers significantly increase the demand for community services in Mirsharai and Sonagazi. The population growth, driven by workers settling in the partial township and surrounding areas, places pressure on healthcare facilities, requiring additional clinics, hospitals, and medical personnel to address both routine and occupational health needs. The risk of communicable diseases, such as respiratory infections or vector-borne diseases like dengue, may rise due to higher population density and construction-related environmental changes, necessitating robust public health measures.

Education services face increased demand as the families of workers and local residents require additional school capacity, teachers, and educational resources. The development of the township and industrial activities heightens the need for housing, with both formal township accommodation and informal settlements in nearby communities experiencing strain. Sanitation services, including water supply and waste management, are challenged by the growing population and industrial waste generation, particularly in the early stages before full waste management systems are operational. Transport services, including public transit and road networks, face increased usage due to worker mobility and industrial logistics, potentially leading to congestion if not adequately managed.

Community services, such as recreational facilities, markets, and social spaces, also experience greater demand as the diverse population seeks access to amenities. The integration of migrant workers into local communities may strain existing infrastructure, particularly in areas with limited prior capacity. However, the phased development of infrastructure, including township planning, hospitals, and educational institutions, helps distribute this demand over time, preventing immediate overload of services.

The influx of a diverse workforce introduces cultural diversity, which can enrich community interactions but also risks creating tensions if service access is perceived as unequal. Vulnerable groups, including women and low-income households, may face challenges accessing strained services like healthcare or education, particularly if resources are prioritized for industrial workers. The pressure on sanitation and waste management systems could lead to public health risks, such as water contamination or inadequate waste disposal, if not addressed promptly. However, the planned development of hospitals, schools, and township facilities mitigates these risks by enhancing service capacity and accessibility.

The NSEZ is implementing a continuous process of mitigation measures to address the increased demand for community services and prevent service overload, congestion, and public health risks.

1.2.1.33 Impacts on Fishermen's Livelihood and Fishery Activity

In the development scenario 2, the NSEZ expands to approximately 25,350 acres, intensifying the scale and scope of development activities across Mirsharai, Sitakunda, and Sonagazi. This phase includes extensive dredging of 338.08 million cubic meters, expanded internal and external road networks (including NSEZ Sarani North & South and connectivity to Sonagazi-Feni), a 13.4-kilometer railway with bridges, culverts, and a station, multiple jetties (one BEZA, two private), advanced water treatment facilities (100 MLD from Feni reservoir, 250 MLD from Meghna River, plus desalination), two 50 MLD CETPs, partial township development, and expanded power, gas, telecommunication, and stormwater systems. The increased intensity of construction and industrial activity amplifies the disruption to fishermen and fishery-based livelihoods, with broader and more severe impacts on the social and economic fabric of affected communities.

The expanded super-dyke, additional sluice gates, and partial railway networks further restrict access to traditional fishing grounds and khals, severely limiting the ability of fishermen to maintain their livelihoods. Fish landing stations and boat parking facilities are relocated even farther from communities, increasing travel distances to four or more kilometers in some cases. This significantly raises operational costs, travel time, and vulnerability during cyclones and storms, as fishermen face greater risks navigating to distant shelters. The intensified marine traffic from industrial and construction vessels in the Sandwip Channel further depletes fish stocks and causes frequent damage to fishing nets, placing additional economic pressure on fishermen and reducing their ability to sustain their households.

Artisanal fishing households, which rely heavily on traditional fishing techniques, face acute challenges adapting to these changes. Women engaged in post-harvest activities encounter heightened difficulties due to the increased distance to landing sites and local markets, coupled with persistent inadequacies in sanitation and storage facilities. These factors reduce their productivity and income, exacerbating economic vulnerabilities. The broader fishery-dependent workforce, including boat owners, vendors, and mechanics, faces similar challenges, as the decline in fish availability disrupts the entire value chain, affecting local markets and related livelihoods.

The large-scale development under Scenario 2 intensifies resource competition and livelihood displacement, threatening the social and cultural fabric of fishing communities. The increased distance to landing stations and cyclone shelters heightens safety risks, particularly during severe weather events, which are frequent in this coastal region. The economic pressures from reduced fish stocks, damaged nets, and higher operational costs push many fishing households toward financial instability. Socially, the influx of migrant workers and the expansion of industrial activities introduce cultural and social friction, further marginalizing local fishing communities. Women and marginalized groups face elevated risks of exclusion from economic opportunities and increased gender-based vulnerabilities, as their roles in the fishery sector are further constrained.

To mitigate these severe disruptions, the Social and Skills Development Program and Enterprise Skills Agency interventions will be significantly scaled up. Short-term measures include establishing temporary sea access points and boat parking facilities to provide immediate relief. Medium- and long-term strategies focus on vocational training, aquaculture diversification, entrepreneurship support, and integration of fishermen into SEZ industries. These programs aim to equip fishing communities with the skills and resources needed to transition to alternative livelihoods, such as aquaculture or industrial employment. However, the magnitude of disruption under this scenario poses significant challenges to rapid adaptation, and the reliance on traditional fishing techniques limits the community's capacity to shift to new income sources quickly. Ensuring sustainable employment, income security, and the preservation of cultural practices will require comprehensive, long-term interventions tailored to the needs of fishing communities.

1.2.1.34 Impacts on Livestock Population and Dependent Community

In the stage of development scenario 2, the NSEZ expands to approximately 25,350 acres, intensifying development activities across Mirsharai, Sitakunda, and Sonagazi. This phase includes extensive dredging of 338.08 million cubic meters, expanded internal and external road networks (including NSEZ

Sarani North & South and connectivity to Sonagazi-Feni), a 13.4-kilometer railway with bridges, culverts, and a station, multiple jetties (one BEZA, two private), advanced water treatment facilities (100 MLD from Feni reservoir, 250 MLD from Meghna River, plus desalination), two 50 MLD CETPs, partial township development, and expanded power, gas, telecommunication, and stormwater systems. The increased scale of construction and industrial activity significantly exacerbates impacts on livestock-dependent communities, with broader and more severe consequences for their livelihoods.

The expanded infrastructure, including the super-dyke, railway lines, and additional jetties, drastically reduces grazing lands within the EZ and adjacent areas, leaving minimal viable pasture for buffaloes, cows, sheep, and goats. Livestock owners face increased pressure to sell animals or relocate them to temporary grazing areas along the seaside or char regions, which are often subject to regulatory restrictions by the forest department. The livestock population is expected to decline further, intensifying income losses for buffalo owners, grazing boys, and participants in dairy and livestock-related value chains. The local dairy value chain faces significant disruption, with reduced milk production affecting vendors, chilling facilities, and market linkages, further straining the economic stability of these communities.

Women and youth, critical to dairy processing, small livestock care face heightened constraints due to the near-total loss of traditional grazing lands and limited access to resources. The increased distance to grazing areas and regulatory restrictions exacerbate operational challenges, forcing many households to abandon livestock rearing altogether. The broader livestock-dependent workforce, including vendors and processors, experiences significant income losses as the supply of milk and meat, impacting local markets and related businesses.

The extensive reduction in grazing lands and livestock numbers threatens the economic foundation of livestock-dependent communities, pushing many households toward financial instability. The disruption of traditional livestock practices undermines cultural and social structures, as livestock rearing is deeply embedded in the identity of these communities. The loss of employment opportunities for grazing boys and other youth further exacerbates economic vulnerabilities, particularly for households with limited access to alternative income sources. Women face increased risks of exclusion from economic opportunities, as their roles in dairy processing and small livestock management are severely constrained. The influx of migrant workers and the expansion of industrial activities introduce cultural and social friction, further marginalizing local communities.

The NSEZ is implementing a continuous process of mitigation measures to address these severe disruptions. Short-term interventions include expanding fodder supply programs and allocating temporary grazing areas to sustain remaining livestock populations. Medium- and long-term strategies involve investing in dairy value chains with collection points, chilling facilities, and market linkages, as well as promoting poultry and small livestock enterprises to diversify household income. Skill development programs, vocational training, and integration into SEZ industries provide alternative income sources for affected households. These ongoing efforts aim to safeguard livelihoods and enhance economic security, though the magnitude of disruption poses significant challenges to rapid adaptation.

1.2.1.35 Tourism

In development scenario 2, the NSEZ expands to approximately 25,350 acres, intensifying development activities across Mirsharai, Sitakunda, and Sonagazi. This phase includes extensive dredging of 338.08 million cubic meters, expanded internal and external road networks (including NSEZ Sarani North & South and connectivity to Sonagazi-Feni), a 13.4-kilometer railway with bridges, culverts, and a station, multiple jetties (one BEZA, two private), advanced water treatment facilities (100 MLD from Feni reservoir, 250 MLD from Meghna River, plus desalination), two 50 MLD CETPs, partial township development, and expanded power, gas, telecommunication, and stormwater systems. The impacts on tourism remain generally limited but are slightly more pronounced than in Scenario 1 due to the larger scale of development and increased workforce influx.

As in Scenario 1, key tourist destinations such as Mahamaya Lake, Khoiyachara Waterfalls, Napittachora Waterfall, Sitakunda Eco Park, Botanical Garden, Sohosrodhara Waterfall, Jharjhari Waterfalls, Bhatiari Lake, Komoldoho Trail, and the Muhuri Project remain outside the core EZ boundary and are not directly affected by construction. The expanded scale of construction, including dredging, railway development, and township establishment, increases noise, dust, and vehicular traffic, which may further degrade the aesthetic and environmental quality of nearby tourist locations. The larger workforce influx exacerbates visitor pressure on natural and recreational sites, potentially leading to congestion, soil erosion, sedimentation in water bodies, and disturbance to wildlife habitats.

The intensified development under Scenario 2 amplifies both the challenges and opportunities for tourism. Improved infrastructure enhances access to tourist sites, fostering economic opportunities for local businesses, including hospitality, food services, and tour operations. The larger workforce influx may drive demand for recreational activities, benefiting local economies. However, the increased environmental stress from construction, waste, and resource competition poses risks to the quality of tourist experiences, particularly at sites sensitive to ecological disturbances.

1.2.1.36 Cultural Heritage

In development scenario 2, the NSEZ expands to approximately 25,350 acres, intensifying development activities across Mirsharai, Sitakunda, and Sonagazi. This phase includes extensive dredging of 338.08 million cubic meters, expanded internal and external road networks (including NSEZ Sarani North & South and connectivity to Sonagazi-Feni), a 13.4-kilometer railway with bridges, culverts, and a station, multiple jetties (one BEZA, two private), advanced water treatment facilities (100 MLD from Feni reservoir, 250 MLD from Meghna River, plus desalination), two 50 MLD Central Effluent Treatment Plants (CETPs), partial township development, and expanded power, gas, telecommunication, and stormwater systems. The impact on cultural heritage remains limited but slightly more pronounced than in Scenario 1 due to the increased scale of construction activities.

As in Scenario 1, no documented tangible or intangible cultural heritage sites have been identified within the expanded EZ master plan boundary based on baseline surveys and stakeholder consultations. However, the larger scope of construction activities, including deep excavation, extensive dredging, and large-scale land development, increases the likelihood of encountering previously unknown or buried archaeological or cultural resources. Activities such as railway construction and township establishment, which involve significant earth-moving, pose a higher risk of disturbing subsurface heritage deposits compared to the development scenario 1. While the probability of such discoveries remains low, the expanded footprint and intensity of construction activities amplify the potential for chance finds, particularly in areas with unstudied historical or prehistoric significance.

Mishandling of chance finds could lead to tensions with local stakeholders, while proper documentation and preservation could enhance cultural awareness and provide opportunities for community engagement, such as through local museums or educational programs. The increased scale of development also heightens the need for coordination with local authorities and communities to ensure culturally sensitive handling of any discoveries.

1.2.1.37 UNESCO World Heritage Sites

As per the UNESCO cultural heritage listing, there are two cultural heritage sites in Bangladesh i.e., Historic Mosque City of Bagerhat and Ruins of the Buddhist Vihara at Paharpur, and one natural heritage site i.e., the Sundarbans. No heritage sites available in the EZ master plan area as well as the study region. Therefore, no impacts on UNESCO heritage sites are anticipated by the development of EZ.

1.2.1.38 Impacts on Community Dynamics

In development scenario 2, the NSEZ expands to approximately 25,350 acres, intensifying development activities across Mirsharai, Sitakunda, and Sonagazi. This phase includes extensive dredging of 338.08 million cubic meters, expanded internal and external road networks (including NSEZ Sarani North &

South and connectivity to Sonagazi-Feni), a 13.4-kilometer railway with bridges, culverts, and a station, multiple jetties (one BEZA, two private), advanced water treatment facilities (100 MLD from Feni reservoir, 250 MLD from Meghna River, plus desalination), two 50 MLD Central Effluent Treatment Plants (CETPs), partial township development, and expanded power, gas, telecommunication, and stormwater systems. The larger workforce influx amplifies impacts on community dynamics, though the effects remain generally limited with proper management.

The significant increase in the number of workers from various regions leads to greater cultural interactions and integration with host communities. The expanded workforce, engaged in construction, industrial operations, and township development, introduces a broader range of cultural influences, including diverse languages, traditions, and lifestyles. These interactions are more pronounced than in Scenario 1, as the larger worker population interacts more frequently with locals in markets, public spaces, and service sectors. The composition of the local population may shift noticeably, with increased diversity altering community dynamics in Mirsharai, Sitakunda, and Sonagazi.

Local market demands evolve further, with businesses adapting to the preferences of a larger and more diverse workforce. Informal networks expand to include new social connections between locals and migrant workers, fostering cultural exchange but also requiring adjustments to accommodate diverse community needs. The development of a partial township may concentrate worker populations in specific areas, reducing direct pressure on local communities but creating new dynamics within these enclaves.

The larger workforce influx heightens the potential for social tensions, particularly if cultural differences lead to misunderstandings or if resources like housing, water, and healthcare become strained. The demand for rental accommodations and social services may create competition between locals and migrant workers, potentially leading to friction. Women and vulnerable groups may face increased challenges if social norms shift or if access to community resources becomes more competitive, though these impacts are expected to be manageable with proper interventions.

Community awareness initiatives are expanded to educate both groups about cultural norms, reducing the risk of conflicts arising from misunderstandings. The NSEZ collaborates with local authorities to manage resource demands, ensuring that public services like housing, water, sanitation, and healthcare remain accessible to all. Additionally, vocational training and job placement programs through the Social and Skills Development Program (SSDP) support locals in accessing SEZ-related employment, reducing competition and fostering economic integration. These ongoing efforts aim to minimize social tensions and maximize the benefits of cultural and economic exchange.

1.2.1.39 Changes of Landscape - Visual Impact

The second phase development activities will alter the landscape of the EZ site having an area of 8,450 acres (total area will be 25,350 acres including first phase development of 16,900 acres). These impacts will remain during the operational phase.

1.2.1.40 Impacts due to Disasters

Natural hazards anticipated at the EZ site are cyclones, earthquakes, tsunamis, and floods/flash floods. As per the seismic zone map, the EZ site and study region fall into a severe seismic intensity zone (zone 3) with coefficients of 0.28. Bangladesh has experienced several earthquakes in the past, and there is a possibility that earthquakes will occur in and around the EZ. If an earthquake occurs during the construction phase, the damage would be extended to some extent, such as the collapse of buildings and injury from falling objects.

Another natural hazard associated with the EZ site is cyclones. The site is located in the high-risk zone for cyclones and its associated disasters like storm surges. As per the tsunamigenic zones map of Bangladesh, the EZ site falls within zone-I, which is reportedly the most vulnerable belt. Though the Indian subcontinent is in a seismically active region, tsunamis along the coastline of India and Bangladesh have been rare, but not unprecedented.

All the interventions will be developed along the shoreline of the Bay of Bengal thus are highly vulnerable to coastal floods caused by tidal surges. According to the UDMP of Mirsharai and Sitakunda, both upazilas are flood-prone areas, specifically vulnerable to flash floods. At the Feni site, a super dyke will be constructed during 2nd phase development to protect the site from tidal surges and flooding.

1.2.1.41 Climate Change and Greenhouse Gas Emissions

Development activities will lead to emissions emanating from fuel-powered equipment, i.e., vehicle engines, vessels, construction equipment, etc. The exhaust will contain pollutants notably Carbon Dioxide (CO_2), Nitrogen Oxides (NOx), Sulphur Dioxides (SO_2), Carbon Monoxide (CO), Hydrocarbons, and Particulate Matter (PM). These greenhouse gases (GHGs) are known to interfere with temperature regimes and cause climate change effects. CO_2 is the main GHG gas that contributes maximum to the warming of the atmosphere, and increased CO_2 concentration is one of the major drivers of climate change. It is noteworthy to mention that the quantity of emissions during the development phase will depend on the vehicles/vessels/equipment type, amount, and condition (e.g., level of maintenance).

To minimize GHG emissions during the development of the EZ, mitigation measures shall be taken by the investors and contractors, such as management of the operation time of construction machinery, avoidance of excessive loading operations, and education of construction workers/drivers about the idling stop practice for construction machinery and vehicles.

1.2.2 Impacts During Operation Phase

The operational activities during the second phase will involve factory establishment and operation (approximately 132 nos. have been allocated land and others), operation of other facilities, solid waste generation and disposal, operation of power plant, operation of WTP and CETPs, township operation, etc. In addition, the first phase operation activities will be continued parallel to the second phase operation activities.

1.2.2.1 Impacts on Air Quality

During the operation of the EZ, there will be an increase in the movement of traffic, and hence, emissions from the moving vehicles will also increase. The exhaust from the DG set in different industries, diesel-operated small boats, vessels, etc. will enhance a pollution load during operation.

Increased traffic on the access road has the potential to cause an impact on the air quality experienced by the residents along the access roads, specifically an increase in pollutants such as NOx and particulate matter. Concentrations of primary pollutants generated by road traffic decrease exponentially with increasing distance from the road. This means that by 50m to 100m from the road center the concentrations of carbon monoxide, oxides of nitrogen, particulates, and non-methane hydrocarbons (benzene and related compounds) are considerably less than half the levels at the central median.

With the increase in the number of ships and boats, their operation and movement of cargo to and from will also increase. These activities will increase the pollution load in the atmosphere. The sources of air pollutants from jetty operations will include combustion emissions from ships propulsion and auxiliary engines and boilers, mainly consisting of SO_2, NO_X, CO_2 and CO, fine particulate matter, and VOC, followed by combustion source emissions from vehicles, port equipment and land-based engines and boilers contributing similar pollutants. VOC may also be emitted for fuel storage and transfer.

Furthermore, another air pollutant that needs to be considered for the economic zone is dioxin which will be generated from waste incinerators. Dioxin is known as a persistent environmental pollutant and accumulates in the food chain mainly in the fatty tissue of animals. Dioxin is known as a highly toxic substance and can cause reproductive and developmental problems, damage the immune system, interfere with hormones, and cause cancer. It is obvious that dioxin formation occurred at temperatures above 450°C and was reduced significantly at temperatures above 850°C. The reaction occurring in an incinerator is extremely complex, and there are many factors in addition to combustion temperature influencing dioxin formation. Selection of manufacturing processes and incinerators with low dioxin

emissions are recommended to reduce the formation of dioxin. In addition, stack emissions standards for municipal solid waste incinerator has been provided in Air Pollution (Control) Rules 2022 and this should be followed during the operation of the incinerator plant.

Methane gas, one of the greenhouse gas groups, generated from landfill sites and leachate treatment by anaerobic process is also concerned. Gas flaring must be provided to cope with this methane gas for the reduction of emitted greenhouse gas quantity.

During the operation, air pollution is generated from various sources, in the production process, and from the stacks. Air pollutants of concern and their major sources from the activities expected to take place in the economic zone include:

- Particulate matter (PM_{10}) will be generated from combustion processing, which includes fuel combustion in manufacturing, and vehicle exhaust.
- Sulfur dioxide (SO_2) will be generated from the combustion of fossil fuels, which contain sulfur, in boilers and power plants.
- Nitrogen oxide (NOx) is a result of the reaction between oxygen and nitrogen in the air in the combustion process.
- Volatile Organic Compounds (VOCs) will be generated from electronic manufacturing industries.
- Dioxin will be generated from waste incinerators.

Potential impacts from the above air pollutants are mostly focused on human health, particularly to those living in the vicinity of the sources, in this case around the economic zone.

1.2.2.2 Impacts from Noise

During the operation, vehicle movements in the access roads for staff mobilization, materials/product transportation in and out of the economic zone, and the operation of industries will be the major sources of noise pollution from EZ. Noise will be generated due to industrial activities (operation of heavy-duty machinery like boilers, compressors, pumps, hydraulic systems, various industrial operations, etc.) involved in raw material/product handling and transportation and the same will be felt upon work personnel and nearby settlements.

Noise will also be generated from jetty and terminal operational activities such as vessel loading/unloading, container handling, and access road/rail traffic that will result from container traffic arriving and departing through the jetty business day. Water is an efficient medium for sound propagation, particularly low-frequency sound, and therefore marine life over a wide area could be potentially affected. The day-to-day terminal activities such as vessel loading/unloading, container handling, etc. will cause additional underwater noise emissions.

Noise sources in the operation phase will vary depending on the production processes of each facility/industry in the economic zone. Control of noise at the source will be the most effective approach to control the impact on the receptors outside the boundary of the facility/industry. Equipment that generates a high level of noise is usually installed in enclosed buildings. The noise level in the fence line of each facility/industry needs to be routinely monitored so that the ambient noise level does not exceed the standards applicable for industrial areas stipulated in Noise Pollution (Control) Rules, 2006. Effects from noise on the receptors outside the initial phase of the industrial estate area are negligible. Nevertheless, it is necessary for each factory to provide earplugs and/or earmuffs for employees or workers who work in places that have noise levels exceeding 80 dB(A).

1.2.2.3 Impacts on Surface Water

During the operation of the 2nd phase, the economic zone will extract 100 MLD surface water from the Feni reservoir. A water treatment plant and associated transmission and distribution line will be established.

Raw sewage can impact surface water quality by promoting the growth of algae and delivering pathogens that may be harmful to human and ecological receptors if not properly managed. Sewage is generally characterized as having a high concentration of suspended solids and dissolved solids, biochemical oxygen demand, chemical oxygen demand, nutrients (nitrogen, ammonia), and fecal coliform counts. Organic substances are decomposed in water, and the decomposition of organic matter will reduce the oxygen content dissolved in water.

1.2.2.4 Impacts on Groundwater

During the operation of the 2nd phase, the economic zone will extract groundwater for industrial operation as like as 1st phase development and operation. According to the MUDP, the projected population in the urban and rural setups in Mirsharai Upazila is 33,960 and 4,52,757 respectively in 2037. The water requirements estimated for these setups are about 4.10 MLD and 27.20 MLD, respectively. The average per capita water requirements are considered 120 LPD and 60 LPD for the urban and rural setups, respectively, following the guidelines provided in the BNBC. Thus, the total water requirement for Mirsharai Upazila in 2037 is about 31.30 MLD, excluding the water demand of the EZ. Considering all sources of water, the total capacity for water supply appears to be 19.20 MLD. Thus, the future water balance scenario appears to be negative, and Mirsharai Upazila may have a water deficit of 31.30 - 19.20 = 12.10 MLD in 2037.

Accidental spillage or leaks of chemicals, hydrocarbons (oil, fuel, or other substances), and leachate from the landfill site could percolate into the subsurface and potentially contaminate the groundwater. Any leachate in the groundwater would have adverse impacts on hydrology.

According to the master plan of the EZ, four central wastewater treatment plants have been considered and operated to treat wastewater from industries. For the 2nd phase operation two CETPs will be installed having the capacity of 100 MLD (50+50 MLD). It is planned that initial screening and treatment will be done by individual industries and sent to the CETPs for further treatment. Wastewater effluent shall be well within the standard, and discharged to the river, no untreated wastewater is allowed to seep into the groundwater source.

The project activity that might impact groundwater quality is the waste management facilities where sanitary landfills and secure landfill sites will be located. A groundwater monitoring program will be required particularly for the waste management facilities.

Good design and construction practices of industries and manufacturing facilities can prevent contamination of groundwater by using impervious material for drainage systems and tanks. However, it is recommended that a systematic groundwater monitoring program should be established to monitor overall contaminants that may be released into groundwater due to project activities. Possible groundwater pollution sources and pollutants in EZ and its surrounding area during the operation are given in Table-1.

Table-1: Groundwater Pollution Sources and Pollutants

Pollution Sources	Potential Pollutants
Domestic activities (leakage from sewage systems, sewage water drains, septic tanks)	Nitrate, ammonia, phosphate, heavy metals, organic micro compounds, bacteria, etc.
Agricultural activities (excessive use of fertilizers and pesticides, irrigation with wastewater)	Nitrate, phosphate, pesticides, bacteria (from wastewater irrigation), etc.
Industrial activities - chemical industry	Aromatic hydrocarbons, chlorinated hydrocarbons, Heavy metals (Zn, Cd, Cu, etc.)
Industrial activities - textile industry	Aromatic hydrocarbons, Heavy metals (Zn, Cd, Cu, etc.), Acids, Mineral oils

Pollution Sources	Potential Pollutants
Industrial activities - metal and machinery	Aromatic hydrocarbons, Heavy metals (Zn, Cd, Cu, etc.), Acids, Mineral oils
Industrial activities - food production	Ammonia, vegetable oil products, Nonchemical hydrocarbons
Industrial activities - construction industry	Mineral oils
Industrial activities - small-scale service (gas stations and garage)	Aromatic hydrocarbons, Mineral oils

1.2.2.5 Impacts on Topography and Soil

Topography will be mainly change during the development phase and during operation it is expected individual industries or factories may adjust the elevation and level of their land plot on a limited scale. Potential impacts on the soil environment are envisaged due to hazardous and non-hazardous waste generated due to the operation of various industries in EZ. Poor management of hazardous waste from the operations is a potential risk of soil contamination. The waste disposal facility is another area where potential soil contamination may occur.

1.2.2.6 Impacts of Sediment

The operation of industries in EZ will produce various types of waste. If not properly handled, the waste can contaminate water and sediment quality in internal khals and Sandwip Channel. All industrial wastewater from each industry will be screened and sent to CETPs. If any industry generates high pollution concentrated wastewater/hazardous waste, they will establish their own ETP and ensure the treatment before sending wastewater to the CETPs. Wastewater from the industrial industry will be collected and transferred to the central treatment plant, designed with appropriate treatment techniques.

The wastewater from industries will be pretreated to meet the requirements according to the national regulatory requirements (Schedule-3 and Schedule-4 of ECR 2023). The pretreated wastewater will then be combined and transferred to the CETPs of EZ. The treated wastewater is then transferred through a drainage system and discharged into the Sandwip Channel.

Solid waste that will be generated at the jetty facility should be collected and managed properly. Waste disposal from ships/vessels may impact sediment quality if proper management is not done.

1.2.2.7 Impact due to Changes in Land Use

Potential negative impacts on land use are predicted to affect the surrounding area of EZ. One of the major concerns is the unplanned land use in EZ's surrounding areas as a result of the increasing demand for social infrastructures by the influx of a large number of workers. As the industries in EZ will start operation, there will be a need for services other than those day-to-day services that can be provided within the township zone. Naturally, it can be predicted that the EZ surrounding area, with a certain level of infrastructure and social services, will rapidly grow to accommodate the requirements of project personnel such as residences for the supervisors or higher officials who prefer not to stay within the industrial estate, business clients, and guests who visit the economic zone shortly for specific purposes, or other workers who perform services to the project personnel but are not allowed to stay in the township zone.

UDD already prepared the Mirsharai Upazila Development Plan (MUDP) in 2020 which will help to reduce unemployment and poverty problems and socio-economic development by creating employment opportunities by protecting agricultural land and building an industrial and tourism-based city[17]. The National Housing Authority (NHA) is also working in the area to select a suitable site and develop a township for the workers and officials. At present, there is no specific authority to exercise

[17] https://www.mudp.gov.bd/about.php

the land use planning practice in the whole total EZ area, therefore, participants during the stakeholder consultation raised their concerns and proposed to establish a "Development Authority" for the EZ surrounding area.

1.2.2.8 Impact due to Solid Waste Generation

During the operation of 2nd phase parallel to 1st phase activities, it is likely to generate a substantial volume of solid waste which can be broadly categorized as municipal waste, hazardous waste, and non-hazardous waste. Further, the generated solid waste generated may include biodegradable, recyclable, reusable, and inert compounds from municipal and nonindustrial occupants and industrial occupants. Solid waste will be generated from the canteen, office, workers facilities, medical, maintenance workshop, etc. According to the Master Plan, total 508,791 tons/year of solid waste will be generated including 184,233 tons/year of industrial solid waste and 324,558 tons/year of municipal solid waste from the EZ by the year 2030.

Apart from those listed, e-waste from both domestic and industrial segments is also expected to be generated in EZ. If the solid waste generated is not properly managed and disposed of in an unauthorized manner, it will impact the air quality, soil quality, and groundwater quality.

Wastes originating at the jetty may include inert solid waste from administrative offices, as well as hazardous or potentially hazardous waste associated with vehicle and equipment maintenance operations (e.g., used lubricating oils and engine degreasing solvents). Wastes originating from ships may include oily sludge, inert materials such as food packaging, and food waste. These wastes will generate odor and health impacts and ground and surface water contamination, if not managed properly.

1.2.2.9 Impacts from Liquid Waste Generation

EZ is anticipated to generate various forms of wastewater. As per discussion with BEZA, two CETPs have been proposed having a total capacity of 100 MLD (50+50 MLD) and 30 acres of land area have been allocated. Improper management of wastewater might be a major health hazard if proper measures are not put in place.

The source of wastewater generation from EZ operational activities is industrial process wastewater/ effluent, domestic wastewater/sewage, equipment cleaning, floor washings, etc.

1.2.2.10 Impacts on Drainage

During the operation, surface water flow would be the same as the flow at the end of the development phase because the drainage system and structures on the surface during this phase would undergo no change since they will be completed in the previous phase. According to the EZ master plan, storm water drains shall be provided on either side of the proposed road network of the area to collect the storm runoff generated from the catchment and get it discharged to the drainage channel for ultimate disposal to the Sandwip Channel. Indicative command area (catchment area) for each of the existing drainage channels passing through EZ with locations of the pumping stations, proposed at the location close to its outfall to the sea.

Different road networks are developing in EZ and its surrounding area without considering proper drainage or water-passing provisions. In such cases, there is a possibility of drainage congestion or flooding in the surrounding area of EZ. Moreover, erratic rainfall will make more worsen conditions in the drainage system in the whole area mainly during the rainy season (April-September). The prolonged local flooding may affect directly and indirectly the living conditions of people and workers, cause poor environmental sanitation, and pose potential sources of communicable diseases.

For the area immediately outside of the EZ, not only land use should be controlled, but also other infrastructure that will enable setting up structures and services, such as local roads, electricity, gas, water supply, telephone, internet line, and drainage should be well planned and controlled. The strategic locating or prohibiting of these basic infrastructures will induce and encourage early settlers and

services outside the designated township zone into the area planned by the organization to provide temporary services in the early stage of development.

1.2.2.11 Impacts of Traffic

Traffic volume on the improved roads is predicted to increase significantly during the operation of EZ 2nd phase activities as this time the 1st phase operation will continue, specifically during the morning and afternoon peaks. During the 2nd phase operation, it is estimated that, traffic volume for Borotakia to NSEZ will increase from 3,997 PCUs/day to approximately 8,954 PCUs/day and NSEZ to Borotakia will increase from 3,848 PCUs/day to approximately 8,620 PCUs/day by 2030. Improvement of regional road networks may prompt high-speed driving, which is likely to cause accidents for pedestrians unless adequate road safety measures are adopted. In addition to the risk of accidents, increased traffic will lead to inconvenience to the local public, and road users, and increase the potential for nuisance in the region.

During the operation, a huge number of workers will be moved on the access road at a time, therefore, there will be a risk of traffic congestion on access roads as well as the Dhaka-Chattogram Highway. Traffic congestion will not only waste precious time and fuel of commuters but also cause air and noise pollution along with causing stress and anxiety leading to impatience and accidents.

The increased traffic volumes will increase the potential of incidents on the internal road as well as access roads within the study region, specifically at intersections and passing through busy (market, schools, etc.) areas, resulting in serious injuries or even fatalities.

Existing road networks in the region are not adequate to support additional traffic volume due to the operation of industries in EZ. There is an urgent demand for the upgradation and expansion of the provision of additional transport systems with an increase in the capacity of roads to scoop up the upcoming requirements of transportation and communication.

1.2.2.12 Loss of Ecosystem Services

Ecosystem services are the benefits provided by functioning natural systems, including provisioning services such as food, water, and fodder; regulating services like climate moderation, flood control, and water purification; supporting services such as habitat provision and nutrient cycling; and cultural services including aesthetic, recreational, and heritage values. During the operation phase of NSEZ under Scenario-2, these services will continue to be provided by remaining wetlands, vegetation patches, and water bodies, though the larger extent of development compared to Scenario-1 increases pressure on natural systems.

Provisioning Services – agricultural land and fisheries resources may experience moderate loss due to increased clearing and dredging. Localized pressure on aquatic resources, including fish populations, is likely from expanded jetty operation, wastewater discharge, and increased traffic in the Sandwip Channel. Groundwater extraction (greater than in Scenario-1 but still below full development levels) supports industrial and domestic needs, but risks of localized aquifer stress are higher compared to Scenario-1. Reduced availability of grazing land and fuelwood sources is expected due to larger conversion of natural and semi-natural habitats.

Regulating Services – conversion of land for industrial plots and associated infrastructure moderately reduces flood buffering and cyclone resilience in affected areas. Increased industrial activities raise risks of effluent discharge into water bodies, particularly in the absence of fully functional STP and CETP systems. Air pollution from higher levels of industrial and vehicular emissions compared to Scenario-3 will further strain regulating services like air purification and climate moderation. Soil fertility and stabilization services are reduced in converted lands but remain functional in surrounding undeveloped landscapes.

Supporting and Cultural Services – expanded operational areas lead to more pronounced habitat disturbance, affecting species movement and long-term ecological balance. Cultural and recreational values are moderately reduced due to loss of open landscapes and increased industrial presence.

However, undeveloped portions of the NSEZ still maintain scenic value, biodiversity, and ecological functions, partially mitigating impacts.

1.2.2.13 Impacts on Terrestrial and Mangrove Flora

During the operational phase of the NSEZ under Scenario-2, a larger extent of land will be operational compared to Scenario-1, though still not at the scale of full development. Most of the land conversion within this operational footprint will already have occurred during the development phase. Nevertheless, terrestrial and mangrove habitats in preserved zones and adjacent areas will continue to provide ecological functions while being subjected to higher levels of operational pressures than in Scenario-1.

Terrestrial vegetation in preserved green belts, roadside plantings, and buffer zones will likely experience stress from increased soil compaction, vehicular emissions, and deposition of airborne pollutants such as dust, heavy metals, and particulate matter associated with more intensive industrial activities. These stressors can reduce plant vitality, photosynthesis, and regeneration capacity, potentially weakening the long-term health of preserved green areas.

Mangrove habitats within designated conservation areas are expected to remain intact; however, they are at risk of indirect impacts from operational activities. Higher industrial activity compared to Scenario-1 may increase the likelihood of air and water pollution, altered hydrological patterns due to stormwater discharge, and localized salinity changes. These conditions could impair mangrove growth, resilience, and ecological functioning if operational safeguards are not rigorously maintained.

Greater transport and human activity associated with an expanded operational footprint including larger-scale road use, jetty operation, and industrial traffic can accelerate the spread of invasive plant species. Without active control measures, invasive flora may displace native plant species, reduce biodiversity, and diminish habitat quality in both preserved and buffer areas.

Remaining habitats such as secondary vegetation, mangrove patches, and plantation areas will continue to support some native wildlife, including birds, reptiles, insects, and small mammals. However, disturbances from elevated levels of noise, light, and human activity during operations may further restrict habitat use for disturbance-sensitive species. Wildlife dependent on dense vegetative cover may gradually decline in abundance or shift ranges, with impacts likely more pronounced than in Scenario-1 but still less severe than Scenario-1.

1.2.2.14 Impacts on Terrestrial Mammals

During the operation phase of Scenario-2, the partially developed EZ will continue to exert pressures on terrestrial mammals through long-term habitat alteration, disturbance, and human–wildlife interactions. While ~25% of the area remains undeveloped, the majority of land conversion into industrial facilities, transport infrastructure, and township areas will result in sustained impacts on mammal populations.

The presence of industrial infrastructure and associated human activity will contribute to the disturbance of mammal habitats. This can restrict dispersal routes, reduce access to food resources, and hinder seasonal movement, particularly for larger-ranging species. Herbivores are likely to experience diminished foraging opportunities due to reduced vegetation cover, while carnivores such as Jungle Cat (*Felis chaus*) and Fishing Cat (*Prionailurus viverrinus*) may face declining prey availability in the modified landscape.

Operational activities, including vehicle traffic, industrial processes, and regular maintenance work, will create persistent noise and vibration, which can disturb sensitive species and affect breeding success. Artificial lighting from facilities, streetlights, and roads may disrupt nocturnal species by interfering with their natural foraging patterns, predator-prey interactions, and navigation.

Transport networks within the EZ will present ongoing risks of roadkill and direct mortality, particularly for species attempting to cross between disturbance patches. Isolated populations may experience reduced gene flow, limiting their adaptability to environmental change. Additionally, accidental spills of

oil, lubricants, and hazardous materials, combined with emissions from industrial operations, can degrade habitat quality and negatively affect mammal health and reproductive success.

As human activity increases in and around the operational EZ, the probability of human–wildlife encounters also rise. This can lead to conflict situations, crops or property damage in nearby communities, and occasional injuries or fatalities for both mammals and people. However, the presence of undeveloped areas provides partial refuge and reduces the severity of these conflicts compared to Scenario-3.

Overall, while the operation of Scenario-2 does not exert as severe an impact as full development (Scenario-3), it is expected to generate higher pressures on terrestrial mammals than Scenario-1 due to the larger development footprint.

1.2.2.15 Impacts on Birds/Avifauna

During the operation phase of Scenario-2, approximately 25% of the land area will remain undeveloped, including preserved green spaces and vegetation patches that provide partial shelter, roosting, and breeding habitat for resident and migratory birds. The nearby Sandwip Channel and its mudflats will continue to serve as critical foraging grounds for waterbirds. However, the larger development footprint compared to Scenario-1, with expanded industrial zones, transport infrastructure, and township facilities, will exert higher operational pressures on avifauna.

Industrial operations, traffic, and human activity will contribute to continuous noise and disturbance, which may disrupt breeding, foraging, and communication among sensitive bird species. Artificial lighting from factories, warehouses, and road networks is expected to affect nocturnal and migratory birds more significantly than in Scenario-1. Disorientation, altered navigation, and increased risk of collisions with illuminated structures may occur, particularly during peak migration periods.

Although preserved green areas provide some refuge, disturbance of these habitats within an industrialized matrix can limit nesting opportunities for forest and shrubland species. Waterbirds relying on the Sandwip Channel and adjacent mudflats may be indirectly impacted by industrial runoff, pollution, or accidental spills, which can degrade invertebrate and fish populations that form a key part of their diet. Air pollution from industrial emissions may also affect insect abundance, reducing food availability for insectivorous birds.

Human-avifauna interactions are expected to increase near industrial plots, roads, and residential townships. Birds may be attracted to food waste or urban vegetation, potentially leading to conflicts with humans and greater exposure to roadkill or collisions. The partial disturbance of habitats may also facilitate the establishment of invasive bird species (e.g., House Crow, Common Myna), which could outcompete native species for food and nesting sites, further stressing resident populations.

Compared to Scenario-3, impacts are slightly lower due to the retention of some undeveloped land, but the larger development footprint and higher operational activity relative to Scenario-1 increases risks of habitat disturbance, collision mortality, and pollution-related effects.

1.2.2.16 Impacts on Herpetofauna

During the operation phase under Scenario-2, reptiles and amphibians will be exposed to moderate pressures due to the extensive but not full-scale development of industrial, transport, and township infrastructure. While ~25% of the land remains undeveloped, the disturbance of green patches within an industrialized matrix will reduce habitat continuity for herpetofauna.

Vehicular movement, operational noise, and artificial lighting are expected to disturb amphibians and reptiles, altering their breeding, foraging, and sheltering behavior. Amphibians with permeable skin remain highly vulnerable to polluted stormwater and effluents, while reptiles may face displacement from preserved areas due to encroachment and human disturbance. Some snakes and lizards may be drawn into operational zones in search of food or refuge, raising the risk of human–wildlife conflict and direct mortality.

Pollution from effluents, spills of oils and lubricants, and air and soil contamination may degrade habitats, particularly wetlands and stormwater channels that serve as amphibian breeding grounds. The nearby Sandwip Channel and charlands, which support species such as the Asian Water Monitor (*Varanus salvator*) and Dog-faced Water Snake (*Cerberus rynchops*), may be impacted by water pollution and prey reduction.

Compared to Scenario-3, preserved patches provide partial refuge, but greater operational activity than Scenario-1 increases disturbance, habitat disturbance, and conflict risk.

1.2.2.17 Impacts on Aquatic Mammals

Operational activities under Scenario-2 are expected to moderately affect aquatic mammals, particularly Irrawaddy Dolphins (Orcaella brevirostris) and Indo-Pacific Humpback Dolphins (Sousa chinensis) inhabiting the Sandwip Channel. Expanded vessel traffic from industrial and port operations increases collision risk and chronic underwater noise levels, which may interfere with echolocation, communication, and navigation.

Industrial effluents, untreated or partially treated wastewater, and accidental spills of oils or lubricants may contaminate dolphin habitats, reduce prey availability, and bioaccumulate in the food chain. While ~25% of land remains undeveloped, the operational footprint under Scenario-2 is substantial enough to elevate pollution risks compared to Scenario-1.

Maintenance dredging to keep jetties and channels functional may disrupt benthic habitats and reduce fish availability, indirectly impacting dolphin feeding grounds. Increased human activity, including small-scale tourism associated with operational facilities, could exacerbate noise and disturbance. Chronic stress from sustained vessel noise and habitat degradation may reduce reproductive success and calf survival.

Relative to Scenario-3, impacts can be less severe but still significant due to the expanded operational scope beyond Scenario-1.

1.2.2.18 Impacts on Ichthyofauna (Fish)

During Scenario-2 operations, fish populations in the Sandwip Channel and nearby waterbodies are likely to experience moderate impacts from pollution, habitat degradation, and increased vessel activity. Expanded industrial operations without complete treatment facilities may result in the discharge of pollutants, including heavy metals, organic compounds, and toxic residues, which can impair fish reproduction, growth, and survival.

Stormwater runoff from industrial and township areas may introduce fertilizers, pesticides, and sediments, reducing water quality. Oil and lubricant spills during jetty and port operations may further degrade aquatic habitats, affecting spawning and nursery grounds.

Maintenance dredging may disturb benthic habitats, reduce oxygen availability, and displace fish from feeding areas. Vessel traffic can elevate turbidity and noise, altering fish behavior and migration routes. Over time, pollutants may bioaccumulate in fish tissues, affecting both fish health and human consumers.

Compared to Scenario-3, the retention of undeveloped land reduces the full extent of stress on water quality. However, impacts are greater than Scenario-1 due to a larger operational footprint, higher vessel movement, and greater risk of effluent discharge.

1.2.2.19 Impacts on Hilsa Fisheries

The operation phase of Scenario-2 is expected to exert moderate pressures on Hilsa populations in the Sandwip Channel, particularly in spawning grounds near Mayani Point. Expanded industrial and port operations increase risks of untreated or partially treated effluent discharge, carrying pollutants such as heavy metals and toxins that degrade water quality and impair spawning success.

Partial habitat loss from dredging and jetty operations may disturbance migration routes, while stormwater runoff from industrial and residential areas may further deteriorate spawning habitats. Noise from vessel traffic, combined with artificial lighting from port and township infrastructure, can disrupt Hilsa communication, feeding, and migratory behavior.

Fishing pressure may increase with enhanced access to waterways, raising the risk of incidental capture and overexploitation. Pollution and habitat degradation may also reduce prey availability, compounding stress on Hilsa populations.

Compared to Scenario-3, some habitats remain available due to undeveloped land, but the higher scale of development relative to Scenario-1 makes Scenario-2 a greater threat to Hilsa fisheries.

1.2.2.20 Impacts on Plankton and Benthos

Planktonic and benthic communities in the Sandwip Channel will be moderately affected under Scenario-2 operations due to ongoing dredging, industrial discharges, and increased vessel activity. Expanded but not full-scale dredging will disturb benthic habitats, resuspend sediments, and alter nutrient dynamics, leading to localized declines in benthic invertebrates.

Effluent discharge from partially developed industrial and residential areas may contain heavy metals, organic pollutants, and excess nutrients. This could trigger algal blooms, reduce oxygen levels, and alter planktonic community structure. Amphibious benthic organisms are particularly vulnerable to sediment contamination and hypoxic conditions.

Ship traffic and maintenance dredging may cause chronic physical disturbances, further stressing plankton and benthos. While the retained undeveloped areas help maintain some ecological resilience, the operational footprint under Scenario-2 expands pressures beyond those expected in Scenario-1.

1.2.2.21 Impacts due to Land Acquisition, Resettlement, Rehabilitation, and Speculation

This impact will happen during the development phase only.

1.2.2.22 Community Health, Safety, and Security

As the NSEZ advances to scenario 2 development, covering approximately 25,350 acres, the intensity and diversity of operations will expand significantly. The number of functioning industries will grow, supported by large-scale infrastructure such as a railway line, expanded road networks, multiple jetties, and two centralized effluent treatment plants. While the establishment of CETPs and water treatment facilities at this stage will provide an institutional mechanism to control some industrial pollution, the sheer scale of industrial activity—including emissions of SO_2, NO_2, PM_{10}, and volatile organic compounds—will still contribute to a deterioration of local air quality. This could aggravate respiratory illnesses such as asthma, bronchitis, and other pulmonary conditions among residents.

The operation of large facilities, combined with expanded transportation networks for goods and raw materials, will increase heavy traffic volumes both within and around EZ. The addition of a railway system is expected to reduce some road traffic, but accidents, occupational hazards, and risks of injury from collisions will remain significant given the scale of logistics operations. Communities along transport corridors will experience greater exposure to noise, vibration, and road safety concerns.

Another defining feature of the scenario 2 operational stage will be township development at Mirsharai and Sonagazi, which will host large workers and investor populations. While this development will reduce the need for informal worker settlements, it will also intensify pressure on public services and utilities in the surrounding areas. The risk of disease outbreaks will remain elevated, particularly with greater labor mobility, higher population density, and the arrival of foreign workers. Sexually transmitted diseases, HIV/AIDS, and other communicable illnesses may spread more widely if preventive measures are not strictly implemented. Additionally, improper management of sewage and solid waste from both industries and residential settlements could degrade sanitation, impacting both environmental and community health.

Security considerations will also become more pronounced at this stage, as the concentration of people, goods, and high-value infrastructure could attract social tensions or petty crime in surrounding communities. Continuous collaboration between EZ management, local authorities, and law enforcement will therefore be essential to maintain community safety.

1.2.2.23 Occupational Health, Safety, and Security

In Scenario 2, when three-quarters of the NSEZ reaches operational capacity, the magnitude and complexity of occupational health and safety risks increase substantially. The expansion of large-scale steel, petrochemical, and power generation industries introduces the potential for catastrophic incidents such as major fires, explosions, and toxic chemical releases. Workers in these sectors face heightened exposure to extreme heat, molten metal, and moving machinery, with confined space risks becoming more frequent as production volumes rise. The possibility of large-scale accidents resulting in multiple fatalities becomes a critical concern, especially in steel mills and petrochemical plants.

The chemical-intensive industries, including paints, plastics, and petrochemicals, pose increasingly severe risks due to the higher volumes of flammable and toxic substances handled daily. Inadequate containment measures or accidental releases can lead to large-scale fires, explosions, or toxic gas emissions, with adverse effects not only on workers but also on surrounding communities. Textile industries continue to expose workers to airborne fibers, repetitive strain, and chemical dyes, but with larger workforces and higher output, the cumulative risks to respiratory and musculoskeletal health become more pronounced. In plastics and electronics, risks associated with toxic fumes, thermal burns, and lead exposure increase with intensified production. Food processing facilities, which often operate under high-speed, labor-intensive conditions, also amplify risks of injuries, burns, and foodborne illness outbreaks as workforce density grows.

Scenario 2 also aggravates cross-cutting occupational risks. Poor sanitation and overcrowded worker housing intensify vulnerability to communicable diseases, while long working hours and high workloads heighten psycho-social stress. Workers may experience chronic fatigue, anxiety, depression, and higher rates of interpersonal conflicts and substance abuse. The presence of foreign laborers adds another dimension, as differences in language, cultural practices, and safety awareness may create gaps in training and adherence to OHS protocols.

With the expansion of operations in Scenario 2, the cumulative impact of industrial emissions, chemical use, poor ergonomics, and weak enforcement of safety measures makes occupational health and safety challenges more severe and complex than in Scenario 1. The scale of potential accidents, combined with the long-term health effects of chronic exposure to industrial pollutants, elevates the risks from being moderate to substantially more significant.

1.2.2.24 Labor Influx

Under Scenario 2, the NSEZ expands to approximately 25,350 acres, with extensive infrastructure to support intensified industrial operations, including full internal and external road networks (NSEZ Sarani North & South and connectivity to Sonagazi-Feni), a 13.4-kilometer railway with bridges, culverts, and a station, multiple jetties (one BEZA, two private), two 50 MLD Central Effluent Treatment Plants (CETPs), advanced water treatment facilities (100 MLD from Feni reservoir, 250 MLD from Meghna River, plus desalination), electricity and gas networks, partial township development, telecommunication networks, stormwater networks, and partial waste management facilities. The high labor influx during the operation phase significantly amplifies impacts on local communities and infrastructure, posing substantial challenges to social cohesion and service capacity.

The operation phase under Scenario 2 sees a rapid and large-scale migration of workers, their families, and secondary service providers to support the expanded industrial activities. This influx intensifies demand for housing, healthcare, education, water supply, and sanitation services, quickly overwhelming local infrastructure in Mirsharai and Feni. Informal settlements and unregulated commercial activities, such as food carts, stalls, and small businesses, proliferate as workers and service providers seek affordable accommodation and economic opportunities. These settlements often

lack adequate sanitation, water, or waste management facilities, leading to overcrowding, waste accumulation, and heightened risks of communicable diseases, such as respiratory or waterborne illnesses.

Contractors employing large numbers of laborers for facility management, logistics, or security services house workers in temporary camps or rented accommodations with poor hygiene and limited support facilities, exacerbating public health concerns. Real estate pressures intensify as speculative land acquisition inflates property values, excluding local populations, particularly low-income households, from housing markets. This land speculation fuels economic inequalities and disrupts community access to affordable housing.

The diverse workforce introduces cultural frictions and integration challenges, particularly as external vendors with greater resources compete with local businesses, risking the marginalization of local vendors and service providers. Transient workers and those displaced by disasters may settle in unsafe, temporary camps, increasing vulnerabilities and straining community relations. These dynamics could lead to labor disputes, social unrest, or tensions if not carefully managed, particularly if locals perceive external workers as competitors for jobs or resources.

The high labor influx drives significant economic activity by increasing demand for goods and services, benefiting sectors like retail, transport, and hospitality. Jobs in facility management, logistics, and security provide employment opportunities, but the rapid population growth overwhelms public services, leading to shortages in housing, healthcare, and education. These shortages disproportionately affect vulnerable groups, such as women, children, and low-income households, who may struggle to access strained services. The proliferation of informal settlements and unregulated commercial activities heightens public health risks, including disease outbreaks, due to inadequate sanitation and waste management.

Competition for resources, such as housing and water, and the marginalization of local vendors by external competitors could deepen inequalities and fuel resentment. The presence of temporary workers in poorly equipped camps increases vulnerabilities, particularly for disaster-displaced individuals, and may strain community cohesion, potentially leading to social unrest or labor disputes if unaddressed.

1.2.2.25 Child Labor, and Forced Labor, and Bonded Labor

The operation phase of the National Special Economic Zone (NSEZ) is projected to generate approximately 1.4 million employment opportunities by 2040, primarily for unskilled and semi-skilled laborers recruited from local and regional areas, including Mirsharai, Sitakunda, Sonagazi, and parts of Chattogram and Feni districts. The labor-intensive sectors, such as packaging, light manufacturing, food services, and facility management, create significant employment demand but also pose risks of child labor, forced labor, and bonded labor. These risks are driven by socio-economic challenges, such as poverty and low literacy rates, and the potential for informal recruitment practices.

Under Scenario 2, the NSEZ expands to approximately 25,350 acres, with extensive infrastructure to support intensified industrial operations, including full internal and external road networks, a 13.4-kilometer railway with bridges, culverts, and a station, multiple jetties, two 50 MLD CETPs, advanced water treatment facilities (100 MLD from Feni reservoir, 250 MLD from Meghna River, plus desalination), electricity and gas networks, partial township development, telecommunication networks, stormwater networks, and partial waste management facilities. The high labor influx during the operation phase significantly amplifies risks of child labor, forced labor, and bonded labor, posing substantial challenges to regulatory oversight and enforcement.

Forced and bonded labor undermines workers' rights, fostering exploitative work environments that can lead to labor disputes, social unrest, or community tensions. Vulnerable groups, including children, women, and migrant workers, face heightened risks of exploitation and marginalization, particularly in informal settlements or temporary camps.

1.2.1.26 Gender-Based Violence (GBV), Sexual Exploitation and Abuse (SEA), and Sexual Harassment (SH)

During the operation In Scenario 2, the NSEZ expands to 25,350 acres, with extensive infrastructure including full road networks (NSEZ Sarani North & South, connectivity to Sonagazi-Feni), a 13.4-kilometer railway, multiple jetties (one BEZA, two private), two 50 MLD Central Effluent Treatment Plants (CETPs), water treatment facilities (100 MLD from Feni reservoir, 250 MLD from Meghna River, plus desalination), electricity and gas networks, partial township development, telecommunication networks (15 km optical fiber cable), and partial waste and stormwater systems.

The high influx of workers and families into Mirsharai, Sonagazi, and Feni amplifies GBV and SEA/SH risks due to increased population density and social disruption. The larger workforce, particularly in labor-intensive sectors, heightens the potential for sexual harassment and exploitation in workplaces, informal settlements, and public spaces. Women and girls in expanded informal settlements or low-skill jobs, such as manufacturing or food services, face greater vulnerability to abuse or exploitation. Competition over resources and cultural differences between locals and newcomers may escalate tensions, contributing to psychological or emotional abuse. The larger scale challenges oversight, increasing the risk of unreported GBV incidents.

the heightened GBV and SEA/SH risks further undermine women's safety and community cohesion, with victims facing increased stigma and mental health challenges. Economically, these issues limit women's workforce participation, reducing household incomes and economic resilience, particularly for low-income families. The larger influx creates more job opportunities, but without robust protections, women may face unsafe work environments. Social tensions from resource competition may exacerbate GBV-related conflicts, straining community trust.

1.2.2.27 Violence Against Children

During the operation of NSEZ, in scenario 2, the large-scale presence of workers and associated economic activity substantially increases the risk of children becoming involved in operational or informal economic activities. This involvement may lead to higher school absenteeism and potential exposure to accidents or minor injuries. The demand for goods and services from the growing workforce can also incentivize households to engage children in work to supplement family income, thereby exacerbating school dropout rates. The rapid influx of workers makes regulatory oversight more challenging, requiring strengthened monitoring mechanisms, community awareness programs, and strict enforcement of child protection policies. Even with mitigation measures in place, the probability of children being involved in unsafe or exploitative activities is higher compared to Scenario 1

1.2.2.28 Impact on Social Infrastructures

Under Scenario 2, the NSEZ operates across approximately 25,350 acres, with extensive infrastructure including full road networks (NSEZ Sarani North & South, connectivity to Sonagazi-Feni), a 13.4-kilometer railway with bridges, culverts, and a station, multiple jetties (one BEZA, two private), two 50 MLD Central Effluent Treatment Plants (CETPs), water treatment facilities (100 MLD from Feni reservoir, 250 MLD from Meghna River, plus desalination), electricity and gas networks, partial township development, telecommunication networks (15 km optical fiber cable), stormwater networks, and partial waste management facilities. The high population influx during the operation phase significantly intensifies pressure on social infrastructures, posing greater challenges to service delivery and social cohesion.

The high influx of workers, families, and service providers amplifies demand for social infrastructures in Mirsharai, Sonagazi, and Feni. Housing faces severe pressure, with informal settlements proliferating in areas like Magadia and Ichakhali, driven by affordability and accessibility. These unregulated developments lead to slumification, land-use conflicts, disrupted drainage patterns, and heightened waterlogging risks during monsoons. Education infrastructure is overwhelmed by the influx of school-age children, with shortages of classrooms, teachers, and inclusive services. The absence of technical

colleges and universities limits educational and career opportunities, forcing families to relocate or face constraints.

Healthcare facilities struggle with increased disease risks due to overcrowding, inadequate sanitation, and limited clean water access, necessitating modern hospitals and specialized services like maternal, child, and mental health care. Transportation systems face significant congestion and safety hazards due to increased worker mobility and commercial activity, with existing roads and public transit unable to cope. Sanitation and waste management are severely strained by residential and industrial waste, with informal settlements lacking basic sanitation, increasing risks of environmental pollution and disease outbreaks. Commercial facilities, including hat-bazars, are overcrowded, with unregulated vendors posing food safety and public order challenges. Religious and social institutions face overcrowding, risking exclusion and tensions among diverse cultural and religious groups.

The lack of a local urban development authority, with the pending implementation of the Mirsharai Development Plan, exacerbates fragmented service delivery, amplifying risks of resource competition and social conflict. The failure to incorporate universal design principles risks excluding vulnerable populations, such as persons with disabilities, from accessing essential services.

informal settlements and inadequate infrastructure deepen social divisions, with newcomers occupying marginal, hazard-prone lands, leading to spatial inequality and social stratification. Vulnerable groups, including persons with disabilities, older adults, children, and low-income families, face exclusion from non-inclusive services, exacerbating inequality. Competition over housing, jobs, water, and other resources risks discrimination, social tensions, and potential conflicts, including increased crime or exploitation of undocumented laborers. Public health risks, such as disease outbreaks, threaten community well-being, while the lack of higher education limits economic mobility for residents and workers' families.

1.2.2.29 Impacts on Fishermen's Livelihood and Fishery Activity

In Scenario 2, the NSEZ expands to 25,350 acres, with extensive infrastructure including full road networks (NSEZ Sarani North & South, connectivity to Sonagazi-Feni), a 13.4-kilometer railway, multiple jetties (one BEZA, two private), two 50 MLD Central Effluent Treatment Plants (CETPs), water treatment facilities (100 MLD from Feni reservoir, 250 MLD from Meghna River, plus desalination), electricity and gas networks, partial township development, telecommunication networks (15 km optical fiber cable), and partial waste and stormwater systems. The high influx intensifies impacts on fishermen's livelihoods and fishery activities.

The operation of multiple jetties and expanded shipping activities significantly increases safety hazards, with larger vessels and frequent transit creating stronger bow waves and washes that threaten small fishing boats. Expanded exclusion zones around jetties and shipping channels severely restrict access to fishing grounds in Mirsharai, Sonagazi, and Feni, while coastline modifications (e.g., super-dyke at Feni, khal maintenance, and breakwaters) disrupt fish habitats, further reducing fishery productivity. Offshore facilities and anchored vessels outside the project footprint expand the affected area, increasing risks of damage to fishing equipment like nets and traps. Related activities, such as boat repair, fish marketing, and transportation, face greater disruptions due to reduced catches and restricted access. The lack of sanitation, resting facilities, and safe boat parking in new fishing locations, combined with cyclone vulnerabilities, heightens challenges for fishermen.

Economically, significant reductions in fish catches lead to greater income losses, impacting fishermen and related businesses like fish markets and net repair. Socially, the loss of fishing livelihoods undermines community identity, with increased risks to women and youth in fish processing due to inadequate facilities. The high influx creates more job opportunities in the NSEZ, but without targeted support, fishermen may struggle to transition, exacerbating economic hardship. Social tensions may arise if local communities perceive restricted access as favoring industrial priorities over traditional livelihoods.

1.2.2.30 Impacts on Livestock Population and Dependent Community

In Scenario 2, the NSEZ expands to 25,350 acres, with extensive infrastructure including full road networks (NSEZ Sarani North & South, connectivity to Sonagazi-Feni), a 13.4-kilometer railway, multiple jetties (one BEZA, two private), two 50 MLD Central Effluent Treatment Plants (CETPs), water treatment facilities (100 MLD from Feni reservoir, 250 MLD from Meghna River, plus desalination), electricity and gas networks, partial township development, telecommunication networks (15 km optical fiber cable), and partial waste and stormwater systems.

The expanded operation phase intensifies the loss of grazing lands due to increased land acquisition and the construction of boundary fencing across a larger area in Mirsharai, Sonagazi, and Feni. The complete restriction of open-access grazing lands, combined with the development of industrial infrastructure and township facilities, severely limits livestock grazing, particularly for buffalo. This loss reduces livestock productivity and threatens the livelihoods of communities reliant on animal husbandry for food, nutrition, and income, exacerbating economic challenges in poverty-prone areas.

Economically, the significant reduction in grazing lands leads to greater income losses for livestock-dependent households, impacting dairy and meat sales and related activities. Socially, the disruption of livestock rearing undermines community identity and food security, particularly for women and vulnerable households involved in animal husbandry. The increased scale of industrial activity creates more job opportunities, but without targeted support, transitioning to alternative livelihoods remains challenging, potentially deepening economic hardship. Social tensions may arise if communities perceive industrial development as prioritizing external interests over local needs.

1.2.2.31 Tourism

During the operation of the EZ, the increase in population attributed to the number of workers to be engaged in the EZ will translate to more visitors to the EZ's surrounding tourist spots. This will create extra pressure on the existing infrastructures and local resources, i.e., energy, food, fuel, road, accommodation, water resources, health facilities, waste management, etc. Tourist activity can cause the same forms of pollution as any other industry, i.e., air emissions, noise, solid waste and littering, releases of sewage, oil, and chemicals, and even architectural/visual pollution. Water, specifically groundwater, is one of the most critical natural resources in the region. The use of water for hotels, swimming pools, and personal use of water by tourists can result in water shortages and degradation of water supplies, as well as generate a greater volume of wastewater. More solid waste will be generated from the tourist facilities, and there will be a possibility of impact on the environment if adequate measures are not taken. In addition, tourist activity can put enormous stress on local land use and can lead to soil erosion, increased pollution, natural habitat loss, and more pressure on wildlife.

1.2.2.32 Cultural Heritage

No impact is expected during the operation phase.

1.2.2.33 UNESCO World Heritage Sites

No impact is expected during the operation phase.

1.2.2.34 Impacts on Community Dynamics

The high influx significantly intensifies the assimilation of cultural practices, as a larger population of workers, families, and service providers introduces diverse festivals, social norms, and traditions across Mirsharai, Sonagazi, and Feni. This increased diversity risks greater social friction, as competition over resources like housing, water, and jobs escalates. Cultural differences may lead to community conflicts or disharmony, particularly in areas with strong local identities. The lack of integration among outsiders, combined with limited empathy for local customs, heightens the risk of increased crimes, such as theft or vandalism, as social disconnection grows.

Economically, the larger influx drives greater demand for goods and services, boosting local economies but intensifying resource competition, which may marginalize vulnerable groups like women and low-income households. Socially, cultural exchange enriches communities but risks significant tensions if

differences are not addressed, potentially leading to social stratification or conflicts. The increased crime risk further strains community trust, particularly in areas with high outsider populations.

1.2.2.35 Changes of Landscape - Visual Impact

The landscape of the 2nd phase area (approximately 25,350 acres) will be changed during the development phase, and it will continue during the operation phase along with the operation of 1st phase. Therefore, no changes are expected during the operation phase due to the operational activities.

1.2.2.36 Impacts due to Disasters

If an earthquake occurs during the operation phase, the damage would be extended in EZ including industries/buildings of individual industries and infrastructure such as roads, railways, gas pipelines, power plant, electricity transmission lines, telecommunication lines, etc. which will be constructed.

All the interventions will be developed along the shoreline of the Bay of Bengal thus are highly vulnerable to coastal floods caused by tidal surges. According to the Upazila Disaster Management Plan of Mirsharai and Sitakunda, both upazilas are flood-prone areas specifically vulnerable to flash floods. According to the consultation with BEZA, the whole EZ site will be filled with an elevation of 6.5 m. The finished level of both the off-shore and on-shore structures should be above the high flood level of the sea and rivers/khals to prevent flood hazards. At the Feni site, an embankment/super dyke will be developed along the Sandwip Channel thus the site is not prone to flooding.

1.2.2.37 Climate Change and Greenhouse Gas Emissions

Increasing greenhouse gases (GHGs) due to the operation of industries will result in global warming and climate change. Its consequences are devastation for the environment, such as the rising temperature, sea level change, impacts on the ecosystem, etc. The activities and sectors associated with EZ, which include transportation, industry, commercial, and residential, will emit greenhouse gases into the atmosphere. One of the most significant of these gases is carbon dioxide (CO_2), which will be generated when fossil fuels, such as oil and natural gas, are burned (e.g., in industry, electricity generation, and automobiles) and changes in land use (i.e., deforestation). In the long run, the accumulation of CO_2 and other GHGs in the atmosphere can cause global climate change.

Transportation will be one of the major sources of GHGs in the region. GHGs from transportation will be carbon dioxide (CO_2), Carbon monoxide (CO), Non-Methane (CH_4), Organic compounds (VOCs), Oxides of nitrate (NOx), Sulphur dioxide (SO_2), and Hydrocarbons. The total amount of GHGs will depend on the population and transportation activities, types of vehicles/vessels, choices of fuel, and condition of vehicles (e.g., level of maintenance). The operation of equipment and machinery will lead to GHG emissions.

The operation of industry within the EZ, including cement, iron/steel, chemicals, fertilizer, minerals, paints, or similar, will emit GHGs. The type of energy input or fuel used in the industries is an important factor that will contribute to the amount of GHG emissions. It is recommended to keep a record of resource utilization to analyze greenhouse gas emissions in each industry and report to the EZ authority.

Greenhouse Gases (GHGs) Estimation

The total amount of GHG emission potential is calculated following the scenario where the EZ is implemented in partial operation in the year 2025. For calculation, all factories are considered running 16 hours daily throughout 300 days in a year.

The total electrical energy to be consumed is estimated keeping the maximum demand in mind, whereas for natural gas consumption total gas demand per day (m^3/day) values are used. The GHG estimation is demonstrated in Table-1.

Table-1: GHG Estimation for EZ Operation

Consumption Type	Demand**	Operation Time Considered	Yearly Demand	Emission Factor	GHG Emission (million tons CO_2 e)
Electricity	1895.56 MW	300 days, 16 hours/day	2484288.00 MW-h	0.648 tons CO_2 eq/ MW-h	1.609
Natural Gas	3592560.31 m^3/day		1,077,768,095.10 m^3	1.885 kg CO2 eq/ m3	2.031
Total GHG Emission Estimated for 2030					3.640

** Electricity and Natural Gas demand values are taken from Master Plan

Note: Emission Factors used in GHG Calculation

1. Natural Gas: EF = 1.885 kg- CO_2 eq /m^3 [GHG Protocol]

To minimize GHG emissions, mitigation measures shall be taken by the investors and contractors, such as management of the operation time of construction machinery, avoidance of excessive loading operations, and education of construction workers/drivers about the idling stop practice for machinery and vehicles. In order to reduce GHG emissions, the usage of solar light and the usage of LED in the EZ area is planned. In addition, energy-saving equipment and fuels that emit less GHG will be recommended to be installed in all industries for their operations as much as possible.

Besides, the utilization of commuter buses and/or industrial electric vehicles for workers to reduce traffic GHG emissions shall be initiated by the industries. Gas-based fuels tend to emit lower amounts of GHGs than liquid fuels and solid fuels. Thus, clean fuel alternatives or low-emission GHG fuels and technologies that will be established in the EZ shall be promoted. In order to reduce GHG as part of the carbon footprint incentive program, energy conservation, recovery of heat, or power-efficient consumption shall be implemented. Therefore, this issue is recommended in GHG mitigation measures or as an alternative option for future development of the EZ.

The operation of industrial facilities within EZ may contribute to greenhouse gas emissions and exacerbate climate change impacts on the Sandwip Channel ecosystem. Changes in temperature, precipitation patterns, and ocean acidification associated with climate change could further stress planktonic and benthic organisms, compounding existing threats to their survival and reproductive success.

The EZ itself may be vulnerable to changes in the environment due to climate change. The EZ is located on the coastline of Bangladesh, which is highly vulnerable to cyclone disasters and their associated tidal surges. The frequency of Cyclones has already increased in the Bay of Bengal.

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