Quarterly Monitoring Report
Ground Water and Marine Water Analysis

For

NAVI MUMBAI INTERNATIONAL AIRPORT (NMIA)

Sponsor:

City and Industrial Development Corporation of Maharashtra Ltd (CIDCO)

Period:

January – March 2019

PREPARED BY

ADITYA ENVIRONMENTAL SERVICES PVT.LTD.
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1. INTRODUCTION

Mumbai Metropolitan Region (MMR) comprises of areas in and around Mumbai city and includes parts of Mumbai, Thane and Raigad Districts. Mumbai is known as the commercial capital of India and MMR is an industrial and technologically advanced region, which has experienced rapid growth in income and employment. The increasing trend in trading, business and financial services, demands highest order of infrastructure. There is need to enhance the capacity of airport as the existing airport in Mumbai experiencing tremendous pressure for meeting the air traffic demands of this vibrant region. Realizing the need of second airport for Mumbai, the Government of Maharashtra granted approval and appointed City & industrial Development Corporation of Maharashtra Limited (CIDCO) as Nodal agency for implementation.

The site for the airport was selected near Panvel in Raigad district of Maharashtra state with central coordinates 18°59'33.00"N and 73°4'18.00"E. Environmental Impact Assessment (EIA) study was conducted by Centre for Environmental Science and Engineering (CESE), Indian Institute of Technology (IIT) Mumbai and updated report submitted in April 2011. Environmental Clearance was granted by Ministry of Environment and Forests vide F. No. 10-53/2009- IA.III dt 22.11.2010 and extension of validity granted vide F.No. 10-53/2009-IA.III dt 20.12.17 upto 21.11.2020.

Pre-development works for the site has expected to started in May 2017 and as compliance to the Environmental clearance, CIDCO appointed Aditya Environmental Services Pvt. Ltd. (AESPL) to conduct Compliance Environmental Monitoring for the New Mumbai International Airport (NMIA) vide (1) Tender No. CIDCO / T&C / NIMA / EC-22-11-2010/7.I.vii/xiii/xxx/010/251 dated. 16.02.2012 & its Work Order no. CIDCO / T&C / CGM (T & A)/ STE (S-I& A)/2015/867 dated 28.05.2015 for period of January – May 2018 & vide (2) Tender No. C. A. No. 01 / CIDCO/ T&C/ CGM (T&A) / STE (S& A) / 2017-18 & its Work Order No. CIDCO / T&C / CGM (T & A)/ STE (S-I& A)/2018/1383 dated 07.06.2018 from month of June 2018 onwards.

The sampling locations fixed by CIDCO for compliance monitoring every quarter as per Tender (1) as given in Chapter II for period of January 2018 – March 2018. The assignment comprises monitoring of following parameters in and around the surrounding project area:

- Ground/surface water
- Marine water and sediments for biological and physicochemical parameters.

The sampling locations fixed by CIDCO for compliance monitoring once in month for ambient Air Quality and Noise level monitoring; and once in each season (Post, pre & during monsoon) for ground water and marine/Surface water quality as per Tender (2) are as given in Chapter II for month of March 2018. The assignment comprises monitoring of following parameters in and around the surrounding project area:

- Ground/surface water
- Marine water for biological and physicochemical parameters.

2. SCOPE OF MONITORING WORK

2.1 Scope of Monitoring Work as per CIDCO Tender:

Scope of monitoring work as per CIDCO tender are as given below:

Table 2-1: Scope of Environmental Monitoring Work as per CIDCO Tender (1)

Sr. No.	Parameters – as per Annexure B	Location	Frequency	Samples / Year
1.	**Ground Water Quality Parameters:** pH, Temperature, Turbidity, Alkalinity, Salinity, Total Nitrogen, Total Phosphorous, DO, BOD, COD, O&G, Residual Chlorine, Total Hardness, Chloride, TDS, Na, Fluorides (as F), NO_3, Mn, K, Fe, SO_4, Phenol, Hexa Chromium, Cu, Cd, As, Hg, Pb, Zn, Fecal Coliform (MF count/ml), Coliform Colonies, Phytoplankton, Total Heterotrophic Bacteria (spc /mL) & Chlorophyll.	10	5 Location per Month @ 1 Sample per location = 5 samples per month	60
2.	**Marine/Surface Water Quality: Physico Chemical parameters:** PH, Floating materials, Turbidity, Temperature, Salinity (ppt), TSS, TDS, TOC, DO, BOD, O&G, SO_4, NO_2, NO_3, NH_3-N, Inorganic PO_4, Ca, Mg, Fe, Cr, Cu, As, Cd, Hg, Pb, Zn.	13	For 3 seasons No. of samples 26 samples per season 26 x 3 =78 samples per year	78
3.	**Marine/Surface Water Quality: Biological parameters:** Seasonal sampling & testing (SPC) of: Phytoplankton, Zooplankton, Macrofauna, Meiofauna, Microbiology, Benthos, Diversity Indices & Coliform colonies (MPN)	3 (2 at Gadhi river entrance & 1 at Ulwe River)	For 3 seasons. No. of Samples - 3x3 **= 9** per year	9

Table 2-2: Scope of Environmental Monitoring Work as per CIDCO Tender (2)

Sr. No.	Parameters – as per Annexure B	Location	Frequency	Samples / Year
4.	**Ground Water Quality (35):** **Physical Parameters - pH**, Temperature, Turbidity, EC, Salinity, TSS, TDS. **Chemical Parameters:** DO, BOD, COD, Magnesium, Hardness, Alkalinity, Chloride, Sulphate, Fluoride, Sodium, Potassium, Phenol, Total Phosphorous, Total Nitrogen, Sodium Absorption Ratio (SAR), Nitrite-N, Nitrate-N, Calcium. **Heavy Metals**: Fe, Zn, Mg, Mn, Cd, Cr, Hg. **Bacteriological Parameters**; Coliform Count. Total Heterotrophic Bacteria. SPC/100ML.	10	10 Stations per season (Post, Pre- & During Monsoon)	30
5.	**Marine/Surface Water Quality parameters (35):** **Physico Chemical parameters:** PH, Temperature, Turbidity, EC, Salinity (ppt), TSS, TDS. **Chemical Parameters:** Nitrate-N, Nitrite N, Phosphate-P, Silicate, DO, BOD, COD, O&G, Magnesium, Hardness, Alkalinity, Chloride, Sulphate, Fluoride, Sodium, Potassium, Phenol, Total phosphorus, Total Nitrogen. **Heavy Metals:** Fe, Zn, Mg, Mn, Cd, Cr, Hg **Bacteriological parameters:** Coliform Count. Marine Biology: Phytoplankton & Zooplankton	13	13 stations per season (Post, Pre- & During Monsoon)	39

2.2 Locations of Monitoring:

Sampling Locations have been specified by CIDCO in its Tender. The monitoring was carried out at the same locations as fixed by CIDCO. Details of monitoring stations for Ambient Air Quality, Ambient Noise, Soil, Ground Water, Marine Water- physicochemical & biological and Sediment, and along with location maps showing station locations are as given below:

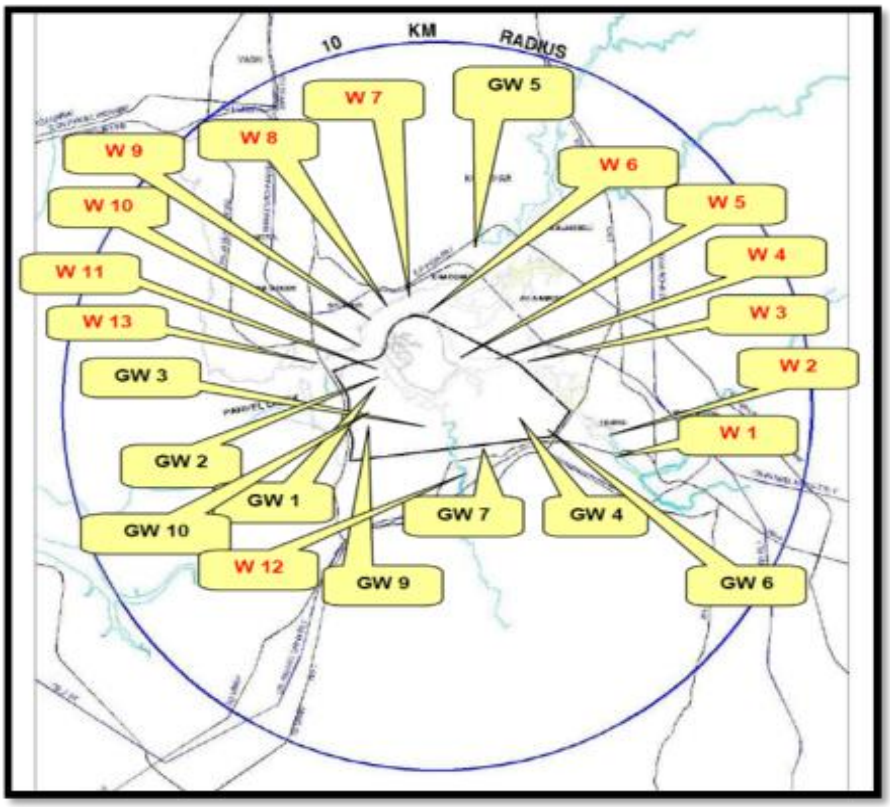
Table 2-3: Details of Ground Water Quality Monitoring Stations as per CIDCO Tender (1) & (2)

Station Code	Stations Name
GW1	Open well at Kombadbhuje
GW2	A well near pond at Ganeshpuri
GW3	Open well at Vaghivalivada
GW4	Open well at Koli
GW5	Open well at Kopar
GW6	Open well at Chinchpada
GW7	A well near pond at Pargaon
GW8	A well near pond at Vaghivali
GW9	Open well at Ulwe
GW10	A well near pond at Targhar

Table 2-4: Details of Marine Water Quality Monitoring Stations as per CIDCO Tender (1) & (2)

Station Code	Station details / Location
W1	Extreme end of Gadhi River (upstream side)
W2	Near Pargaon village (200m from W1) in Gadhi River
W3	Near Jui Village (300m from W2) in Gadhi River
W4	Near Kopar Khadi (300m from W3) in Gadhi River
W5	Near Vaghivali village (500m from W4) in Gadhi River
W6	Vaghivali creek junction (300m from W5) in Gadhi River
W7	Near Kharghar Rly Station (300m) in Gadhi River
W8	Near Belpada (300m from W7) in Gadhi River
W9	Near Konkan Bhavan (300m from W8) in Gadhi River
W10	Near Divala village (300m from W10) in Gadhi River
W11	At Junction of Ulwe and Gadhi Rivers in Panvel Creek
W12	In Ulwe River
W13	Near Rathi bander in Panvel Creek

Figure 2.1: Surface Marine, Ground Water & Sediment Monitoring Stations as per CIDCO Tender (1) & (2)



2.3 Period/Time of Sampling:

The sampling survey was carried out as per following schedule during January to March 2018 as per scope of work as per CIDCO tender (1) & (2)

Table 2-4: Period/Time of Sampling for this Survey

Month	Parameter	Sampling Stations	Dates of Sampling	Time Period
January 2018	Ground Water	GW1, GW2, GW8, GW9 & GW10	31.01.18	Grab sample
February 2018	Ground Water	GW3, GW4, GW5, GW6 & GW7	27.02.18	Grab sample
March 2018	Ground Water	GW1, GW2, GW8, GW9 & GW10	29.03.18	Grab sample
	Marine Water	W1, W2, W3, W4, W5, W6, W7, W8, W9, W10, W11, W12 & W13	30-31.03.18	Grab sample

As per the Tender (1) Conditions Marine & surface water physico- chemical sampling was required to be done for 3 stations per quarter @ 2 samples per station – 13 stations to be accommodated in one of the quarter- total 78 samples as also Marine Biological/sediment Analysis was required to be done at 9 locations per year. This would have meant to cover totally different 3 locations every quarter – which would not have given any meaningful interpretation. AESPL therefore approached CIDCO vide its email dt 10.10.2015 requesting for covering all 13 sample locations in each quarter at two samples per location- i.e. 26 samples totally. Thus over 3 quarters, total 78 samples will be covered. CIDCO has vide its email dt 05.11.2015 clarified that they are acceptable to revised work plan. Hence, AESPL team collected samples at 13 locations from 30-31 March 2018 during pre-monsoon.

2.4 Constraints in completing Environmental Baseline Monitoring as per CIDCO Tender (1):

- Sediment samples at location W2 could not be collected due to rocky substratum during marine survey in March 2018.

3. METHODOLOGY ADOPTED FOR ENVIRONMENTAL MONITORING

3.1 GROUND WATER SAMPLING

3.1.1 Reconnaissance Survey:

The villages in study area use ground water from open/bore well and use it for drinking and other domestic purposes. Ground water gets contaminated due to bad sanitary habits such as washing of utensils, cattle and bathing and location of septic tanks in/near the open wells.

3.1.2 Methodology of Sampling:

Ground water sample is collected by using containers and the sampling container is rinsed before using it for storing water samples. Ground water samples are stored in two separate containers for Physicochemical & Microbiological analysis and preservatives added as recommended by Standard Methods APHA, stored in cold storage box and transferred to the laboratory for the further analysis.


Ground Water Sampling in Progress

3.2 MARINE WATER, SEDIMENTS & PLANKTON SAMPLING EQUIPMENTS

3.2.1 Reconnaissance Survey:

The study area represents complex hydrodynamic system. The Ulwe river flows down through the mountains (to the south) in the centre of project site and joins the Panvel creek. The Gadhi river flows from the East to the West. The Ulwe river will be diverted/retrained as part of the project and the Gadhi river will be partly retrained towards the northern part of the site. The river Gadhi receives sewage from Panvel town and nearby areas. Both the rivers drain into the Panvel creek which drains into the Arabian sea to the west. The Panvel creek also receives effluents from CETP at MIDC Taloja and sewage from NMMC STPs in Nerul.

3.2.2 Methodology of Sampling:

3.2.2.1 Niskin Bottle - Marine Water Sampler

This Water Sampler is used to collect samples at various water depths and can operate at any depth on a cable or line with a messenger.

Niskin Sampler

3.2.2.2 Plankton Net - Biological Samples

This plankton net operates a cable or lined by hand or behind a boat, it can be towed vertically or horizontally. Nets comes in varieties of size (Mesh no. 00 equal an aperture of 0.30 inches).

Plankton Net

3.2.2.3 Grab Sampler - For Marine Sediments

Sediment grab operate at any depth on a cable or line by free fall (without a messenger). It is extremely heavy and can take samples of hardest rocky ocean bottoms.

Grab Sampler

3.2.2.4 Selection of Stations, Preservation and Transportation of Samples as per Tender (1) for Month of March 2018

Marine samples were collected from sampling locations in Gadhi River, Ulwe River and Panvel Creek at the locations indicated by CIDCO – in all 26 samples were collected from 13 sampling locations for physicochemical samples (Stations 1 to 10 are located in Gadhi River & Station 11 & 13 are in Panvel Creek while station 12 in Ulwe River), while 3 samples were collected 1 from Ulwe river and 2 at entrance of Gadhi rivers for biological samples. A good amount of mangrove vegetation was noted on either side of stream from station 4 to 6. Sampling locations were approached by boat (wherever possible) and collection done irrespective of tide. Depending of water depth at sampling location during sampling, both (surface and bottom) samples were collected. The samples were preserved and taken to laboratory using vehicle on same day.

Labelling the water samples

Collection of surface water sample

Zooplankton Sampling in progress

Collection of zooplankton Sample

Bottom marine water sampling

Collection of benthos sample

Sampling in process

3.3 Laboratory Credentials

Sampling and analysis were done by laboratory of Aditya Environmental Services Pvt Ltd located at Plot P-1, MIDC Commercial plots, Mohopada, Tal Panvel, Dist. Raigad.

- Our Environmental Laboratory is recognized by Ministry of Environment & Forest (MoEFCC), Govt. of India under Environment (Protection) Act, 1986.
- Laboratory is also certified ISO 9001:2015 and OHSAS 18001:2007.
- Laboratory is accredited under ISO/IEC 17025:2005 (TC-7085) for water, wastewater and soil parameters
- Environmental sampling conducted by our experienced, qualified environmental staff & Analysis and reporting by approved Government Analyst.
- Instruments used for sampling are from reputed manufacturer & are regularly calibrated.
- Chemicals used are Analytical Reagent grade and from reputed manufacturer.
- Analytical Instrumentation used in the laboratory is regularly calibrated.
- We have regular program of Preventive & Annual Maintenance for all critical equipment.
- Ground Water, Soil Analysis - using APHA, BIS, ASTM & CPCB standards Methods for water Analysis.
- Standard Methods Adopted in the laboratory are those prescribed by APHA, BIS, ASTM & CPCB for water, waste & marine water analysis using methods as per NIO (National Institute of Oceanography) Manual.
- We have CRMs (Certified Reference Material) for heavy metals from reputed manufacturers for heavy metals and Standard sea water which we use for analysis.
- We are regularly participating in Proficiency testing with reputed Organizations like Central Pollution Control Board (CPCB), Goa State Pollution Control Board and others as also Intra laboratory QC testing to check performance of our chemists.
- Overall approach & methodology is with Annexure IA Scope of the work & the Best practices as per prevailing norms of Central Pollution Board /Ministry of Environment & Forest etc. /Internationally adopted practices.

4. COMPILATION OF DATA & INFERENCE

4.1 GROUND WATER QUALITY ANALYSIS REPORT

4.4.1 GW Analysis Data

The physicochemical analysis of ground water study showed considerable variation and is compiled and presented below:

Table 4-1: Ground water analysis at various stations during January 2018 – March 2018

Sr. No.	Sampling Locations	GW 1	GW 2	GW 8	GW 9	GW 10	GW 3	GW 4	GW 5	GW 6	GW 7	GW 1	GW 2	GW 8	GW 9	GW 10
	Sampling month	Jan 18					Feb 18					March 18				
1	pH	7.01	6.76	6.78	6.53	7.22	6.49	7.42	6.96	7.12	6.92	7.11	6.82	6.78	6.58	7.28
2	Temperature, ° C	28.1	28.4	28.2	27.6	28.6	27.6	28.1	28.4	28.0	27.5	28.1	28.2	27.9	28.1	28.1
3	Turbidity, NTU	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4	Alkalinity, mg/L	92	60	68	48	58	48	62	58	72	84	88	58	70	50	60
5	Salinity, ppt	1.6	1.8	2.5	2.0	1.8	2.0	2.3	1.8	1.4	1.4	1.8	1.9	2.0	2.0	2.0
6	TKN, mg/L	ND	ND	ND	ND	ND	ND	1.12	ND	ND	ND	ND	1.96	ND	ND	ND
7	Total P, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
8	DO, mg/L	6.4	6.4	6.2	6.5	6.6	6.4	6.3	6.2	6.1	6.1	6.6	6.5	6.5	6.5	6.4
9	BOD, mg/L	32	20	24	18	12	18	16	14	8	22	24	22	28	20	12
10	COD, mg/L	80	60	70	60	40	60	60	40	20	60	60	70	80	60	40
11	Oil & Grease, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12	Residual Free Chlorine, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
13	Hardness ($CaCO_3$), mg/L	112	54	78	68	54	74	70	54	64	92	108	58	74	74	58
14	Chlorides (Cl), mg/L	86	40	63	36	40	48	52	59	42	78	92	40	60	40	42
15	TDS, mg/L	140	60	110	100	140	120	140	100	60	100	150	80	120	120	130
16	Na, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
17	Fluoride (F), mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
18	Nitrate, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
19	Mn, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
20	K, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
21	Iron (Fe), mg/L	0.02	0.11	0.10	0.12	0.11	0.20	0.20	0.11	0.16	0.06	0.06	0.14	0.15	0.16	0.10
22	Sulphate, mg/L	20	14	32	32	40	40	62	18	30	38	26	28	30	38	36
23	Phenol, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
24	Hexavalent Chromium, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
25	Cu, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
26	Cd, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
27	As, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
28	Hg, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
29	Pb, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Sr. No.	Sampling Locations	GW 1	GW 2	GW 8	GW 9	GW 10	GW 3	GW 4	GW 5	GW 6	GW 7	GW 1	GW 2	GW 8	GW 9	GW 10
	Sampling month	Jan 18					Feb 18					March 18				
30	Zn, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
31	Fecal Coliform	≥1600	≥1600	≥1600	≥1600	≥1600	≥1600	≥1600	≥1600	≥1600	≥1600	≥1600	≥1600	240	≥1600	≥1600
32	Coliform Colonies	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present	Present
33	Phytoplankton (no x 10^3/L)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
34	Total Heterotrophic Bacteria, spc/ml	124	86	120	109	107	128	109	117	121	159	117	102	97	109	92
35	Chlorophyll (mg/m^3)	0.003	0.001	0.003	0.003	0.002	0.004	0.001	0.005	0.007	0.006	BDL	BDL	0.01	BDL	BDL

GW1: Open Well at Kombadbhuje; GW2: Well near pond at Ganeshpuri; GW3: Open well at Vaghivalivada; GW4: Open Well at Koli;
GW5: Open well at Kopar; GW6: Open well at Chinchpada; GW7: A well Near Pargaon; GW8: Well near Vaghivali; GW9: Open well at Ulwe; GW10: Well near pond at Targhar

4.1.2 GW Analysis Inference:

The ground water quality showed considerable variation. Some ground water parameters were within desirable limit, some between desirable and permissible limit and few exceeded the permissible limit. The ground water did not fully comply the quality requirements as per IS 10500 revised in 2012 for purpose of drinking water.

The quality of collected ground water was not suitable for drinking purpose due to the presence of Fecal coliform, E. coli colonies & heterotrophic bacteria at all locations i.e. Koli, Kopar, Pargaon, Chinchpada, Vaghivalivada, Ulwe, Ganeshpuri, Vaghivali, Targhar & Kombadbhuje. Proper treatment of ground water required before consumption.

4.2.1 Analytical Data - Physicochemical Parameters during Premonsoon

Table 4-2: Marine water physicochemical analysis of various stations of project area during March 2018

Sr.No.	Parameter	W 1	W 2	W 3	W 4	W 5	W 6		W 7		W 8		W9		W10		W11		W12	W13	
		S	S	S	S	S	S	B	S	B	S	B	S	B	S	B	S	B	S	S	B
1.	pH	6.48	7.23	7.14	6.95	6.76	6.62	6.72	7.12	7.19	7.19	7.04	6.92	6.98	6.85	6.89	7.12	7.14	7.16	7.20	7.21
2.	Floating Matter	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
3.	Turbidity, NTU	2.4	3.4	2.0	2.4	1.9	4.3	4.5	3.1	4.3	4.0	4.2	4.4	4.5	2.5	3.2	3.2	3.6	4.2	3.8	3.9
4.	Temperature,˚C	32.0	31.0	32.0	31.0	32.0	31.5	30.5	31.0	31.5	30.0	29.0	31.0	30.5	30.5	30.0	31.0	31.0	32.0	32.0	31.0
5.	Salinity, ppt	13.6	14.0	13.9	13.1	13.3	20.0	20.4	20.1	20.9	20.9	20.2	21.3	21.5	22.3	22.6	23.1	23.4	5.6	23.5	23.6
6.	TSS, mg/L	124	132	120	136	122	140	158	136	146	146	153	184	214	128	136	142	152	184	156	162
7.	TDS, mg/L	1250	1240	960	2210	2040	2840	2190	3120	2530	2530	2620	2130	2190	2230	2410	1850	2180	3120	3140	3180
8.	TOC, mg/L	1.2	1.4	1.3	1.7	1.3	1.2	1.6	1.8	2.4	2.1	1.4	1.3	1.6	1.5	1.4	1.4	2.2	2.3	1.7	1.9
9.	DO, mg/L	5.5	5.8	6.2	6.0	6.1	6.1	5.9	5.8	6.1	6.1	6.3	6.5	6.4	5.9	5.8	5.9	6.0	6.1	5.6	5.9
10.	BOD, mg/L	20	28	22	14	10	22	28	26	20	20	24	28	26	20	24	20	24	26	22	24
11.	O&G, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12.	Sulphate, mg/L	82.4	96.3	88.4	28	18	48	62	72	54	82	52	64	70	45	58	24	24	36	46	49
13.	Nitrite, mg/L	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
14.	Nitrate, mg/L	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
15.	TAN, mg/L	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
16.	Inorganic PO_4, mg/L	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
17.	Ca, mg/L	98	132	332	214	80	136	120	96	88	75	78	52	56	42	56	62	68	36	58	62
18.	Mg, mg/L	24.3	33.4	58.6	33.6	14.3	20.4	24.3	11.2	22.6	24.6	32.1	12	18	23	12	10	12	18	11	13
19.	Fe, mg/L	0.12	0.12	0.10	0.10	0.08	0.14	0.10	0.11	0.08	0.08	0.09	0.09	0.10	0.10	0.12	0.10	0.12	0.11	0.14	0.13
20.	Cr, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
21.	Cu, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
22.	As, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
23.	Cd, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
24.	Hg, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
25.	Pb, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
26.	Zn, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

4.2.2 Inference - Physicochemical Parameters during Premonsoon:

The pH value ranged from 6.48 to 7.23 at surface and 6.72 to 7.21 at bottom suggest slight acidic to basic nature of water. Salinity was low due to influx of fresh water and collection during pre-monsoon. The total suspended solids were found due to accumulation of discharge from surrounding villages in the Panvel Creek and Ulwe river respectively.

The Total dissolved solids were noted high which suggest the high concentration of dissolved salts and deteriorated quality of water. Total organic carbon was noted low which suggest there were no accumulation of organic matter in water body.

Dissolved Oxygen level more than 5 mg/l is within normal limit suggest good amount of dissolved oxygen in the water body to support living organism. BOD value suggests the presence of biodegradable organic wastes present in water body which comes as domestic waste, discharge of sewage from surrounding areas and effluents from CETP at MIDC Taloja and sewage from NMMC STPs in Nerul.

The Sulphate value were found in low concentration which represents anthropogenic contamination. The concentration of Calcium, Manganese and Iron were low due natural origin.

4.3 MARINE WATER QUALITY ANALYSIS REPORT (BIOLOGICAL PARAMETERS)

4.3.1 Analytical Data - Biological Parameters during Premonsoon:

As per Tender (1)

Biological parameters viz. Phytoplankton, Zooplankton, Benthos and Microbiology were analyzed, and compiled data is presented below:

Table 4-3: Marine water biological analysis of various stations of project area during March 2018

Parameter	W 2	W 11		W12
	S	S	B	S
Phytoplankton				
Population(nox10³/L)	64	36.8	28.8	301.6
Total Genera	15	14	10	18
Major Genera	*Scenedesmus, Thalassiosira, Navicula, Nitzschia*	*Nitzschia, Thalassiosira, Leptocylindrus, Skeletonema*	*Thalassiosira, Skeletonema, Nitzschia, Navicula*	*Pleurosigma, Thalassiosira, Leptocylindrus, Scenedesmus*
Diversity Index	2.09	2.19	1.68	2.19
Zooplankton				
Population (no x 10³/100m³)	9	62		4
Total Group	6	5		7
Major Groups	Copepoda Decapoda larvae Polychaetes	Copepoda, Gastropods Lamellibranch Foraminiferans		Copepoda, Gastropods Foraminiferans Lamellibranch
Biomass (ml/100m³)	7.58	20.73		3.79
Diversity Index	0.46	0.04		0.90
Benthos				
Population (no x 10²/ m²)	Sample could Not be collected due hard substratum	83		250
Total Group		3		1
Major group		Polychaete, Amphipod		Polychaete, amphipods
Biomass (gm/ m²)		0.33		1.27
Diversity Index		0.00		1.00
Microbiology				
Coliform/100 ml	*P	*P	*P	*P
E. coli	*P	*P	*P	*P

4.6.2 Inferences - Biological Parameters during pre-monsoon:

4.6.2.1 Phytoplankton

In March 2018, Phytoplankton population density ranges from 36.8-301.6 x 10^3/l at surface of stations 2, 11 and 12; population was noted 28.8 x 10^3/l at bottom of Station 11. Highest phytoplankton population at surface water of station 12 may be due to influx of domestic water from surrounding villages;

total generic groups ranges from 14-18 nos. at surface water of stations W2, W11 and W12. Maximum generic diversity 18 no. is observed at surface water of Station 12 during March 2018.
Thalassiosira, *Navicula*, *Skeletonema and Nitzschia*, are most common ones, followed by rest of observed genera like *Leptocylindrus*, *Scenedesmus*, *Pleurosigma*.
The other fresh water phytoplankton genera found are *Scenedesmus*, *Oscillatoria* in Gadhi River (Station 2). *Nitzschia*, *Thalassiosira* and *Navicula* are common Genera noted in all stations 2, 11 and 12 mostly present in surface water. Graphical representations of phytoplankton population and total genera is represented in Figure 4.2.

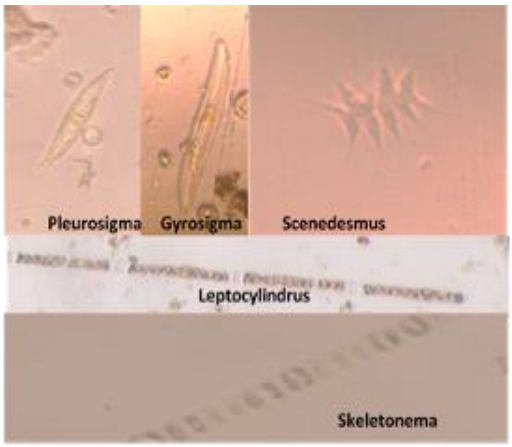


Figure 4.1: Phytoplankton found in samples for March 2018

The above graph represents the population of phytoplankton is more at station 12; and less at station 11, which represents there is discharge of sewage and domestic waste. The phytoplankton trend with respect to total number of genera is almost same throughout all stations. Some of the major genera seen were photographed and shown in figure 4.1.

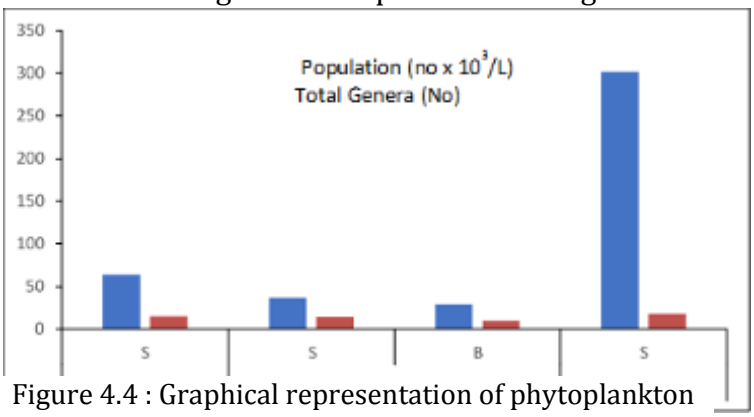


Figure 4.4 : Graphical representation of phytoplankton population and total genera *for March 2018*

Figure 4.5: Phytoplankton found in samples for March 2018Figure 4.6 : Graphical representation of phytoplankton population and total genera *for March 2018*

4.6.2.2 Zooplankton

In March 2018, the zooplankton biomass ranged from 3.79 to 20.73 ml/100 m^3 with population density of 4 to 62 no x 10^3/100m^3 while having good faunal group ranging from 5-7 nos. The zooplankton was noted with good population and group diversity. Copepods, decapods larvae, & polychaetes were common groups observed as, figures 4.3 represents zooplankton standing stock graphically.

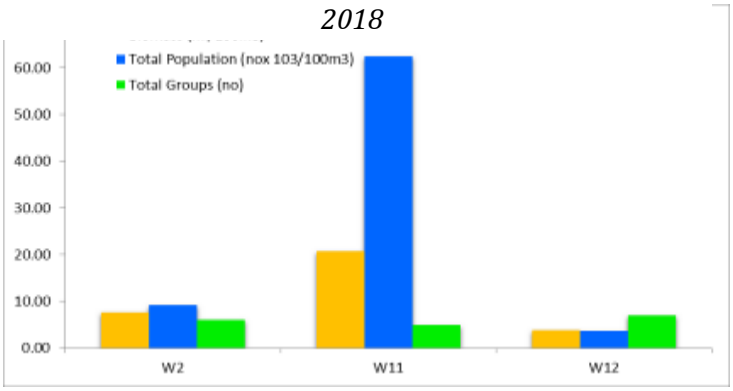


Figure 4.7: Graphical representations of Zooplankton Biomass, Population and total group for March 2018

The above graph represents that average standing stock reported from all stations; Station 12 shows lowest population and biomass when compared to station 12 & 11.

Figure 4.10: Zooplankton found in samples for March 2018

4.6.2.3 Benthos

Macro-benthic biomass noted 0.00 to 1.27 gm/m^2 with population 83 to 250 x $10^2/m^2$ and Polychaete being only faunal group found at station 11 and 12 respectively.

Benthic sample couldn't be collected at station 2 because of hard bottom. The benthos observed was poor in terms of biomass of Benthos, population & diversity as well.

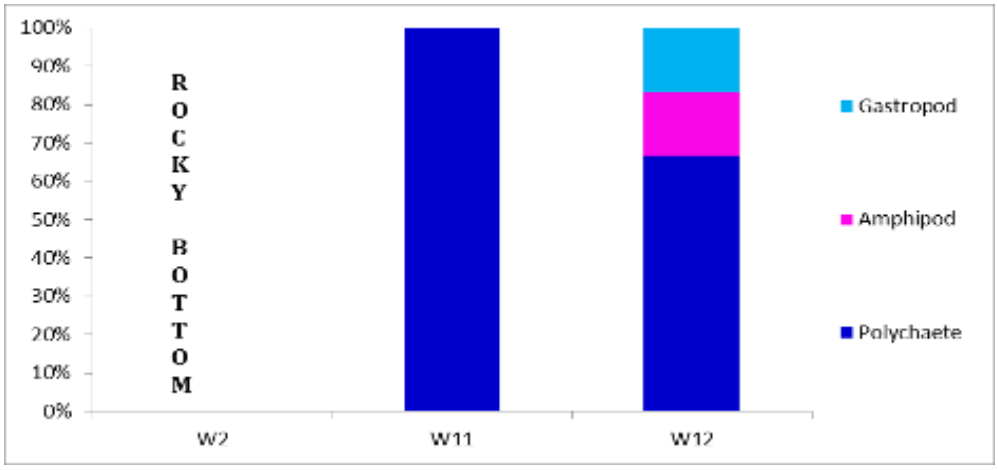


Figure 4.11: Graphical representation of benthic population for March 2018

The benthic organisms found at sampling area shown in Figure 4.6 and Figure 4.5 represents the graphical representations of population of benthic organisms' groups in percentage.

The graphs represent the Polychaete as major stable benthic component.

Figure 4.14: *Benthic organism found in samples for March 2018*

4.6.2.4 Microbiology

Coliform and E. Coli microbes were present at all stations in surface and bottom levels. No specific trend was observed.

5. CHAPTER V: CONCLUSION & RECOMMENDATION

Based on the study of activities planned during pre-development works and on the basis of the environmental baseline monitoring results, certain issues have been identified and steps proposed to mitigate the environmental impacts as suggested below:

5.1 Ground Water:

5.1.1 Observations from Data:

Ground Water quality is poor and fails to meet IS 10500:2012 norms at number of locations. The area of the site is low lying and partially inundated during high tide. Ground water occurrence is high and mostly open dug wells are seen in the area.

5.1.2 NMIA Pre - Development Activities and impacts anticipated on Ground Water Quality:

Construction activities at NMIA during pre-development works include:

- demolition of hill which will generate of material like murum and rock which will be utilized within site and balance will be taken to fill up nearby areas
- Site level is currently low and will be increased to +6 to +7m above existing GL by using excavated material.
- The area of the site is partially inundated during high tide. This area will be filled up to make available land for airport development

The ground water quality will get affected by above activities.

5.1.3 Further Study Suggested:

- As per clause (vii) under specific conditions of the Environmental clearance granted for the NMIA project by MOEFCC, "systematic and periodic monitoring mechanism need to be put in place by CIDCO to assess the impact on sub surface flow /impact on aquifers as well as surface water bodies in different seasons. Necessary additional environmental protection measures to be adopted to address the impact of proposed development in coastal sub surface flow as well as impact on aquifers".

The above study needs to be undertaken by a Functional Area Expert specializing in Hydrology/Geo- hydrology urgently in view of the fact that pre-development activities have started.

5.1.4 Mitigation Measures for Rehabilitated Settlements:

CIDCO needs to make adequate and clean piped water supply available for people to be accommodated in Rehabilitated settlements.

5.2 Marine Water:

5.2.1 Observations from Data:

Marine Water quality is moderate, may be due to hindrances.

5.2.2 NMIA Pre- Development Activities and impacts anticipated on Marine Water Quality:

Construction activities at NMIA during pre-development works include:

- demolition of hill which will generate of material like murum and rock which will be utilized within site and balance will be taken to fill up nearby areas.
- Site level is currently low and will be increased to +6 to +7m above existing GL by using excavated material.
- The area of the site is partially inundated during high tide. This area will be filled up to make available land for airport development

The marine water quality may get affected by activities such as land filling, diversion of courses of Ulwe and training of Gadhi rivers.

5.2.3 Further Study Suggested:

The re-coursing of Ulwe river and training of Gadhi river with provision of special channel to the North of the site in the proposed Master plan needs detailed studies so far as its impacts on marine water quality and drainage on the entire area is considered. The Environmental clearance has several clauses pertaining to this as below:

(1) The proposed re-coursing of tidally influenced water body outlets from Ulwe river has a large cross-sectional area at the middle with the river/creek on either end remaining unchanged with its natural course. The whole system should function as it was functioning earlier without airport project. Surface runoff should not be let into the channel just because the area of cross section is large. The whole airport area will be reclaimed, and the level raised to 7m whereas the existing level all around the airport will continue to be low in its natural state. There will be flow all around due to surface runoff. This additional quantity must be collected by appropriate drainage system and let into Gadhi River and not into the recoursing channel. The recourse channel may be able to take it but not the river or creek on either side of the channel. This aspect shall be examined by CIDCO in details to avoid the flooding of the low-lying areas besides inducting other hydrological and environmental studies.

(2) The entire system shall be studied as one composite system with appropriate boundary conditions to reflect the worst conditions – minimum 100 years to be specified and compliance ensured such as -flooding, surface runoff not only from the airport but also from surrounding areas as well, normal flow, tidal flow due to tidal surge having a long return period, possible obstructions to flow, tributaries joining the main river etc. so as to take appropriate protection and remedial measures. Due to construction of recourse Channels and also due to tail end of the Gadhi & Ulwe Rivers into Panvel Creek, there is a need to prepare a Comprehensive Master Plan for Surface drainage and Flood protection, keeping in view the proposed developments. CIDCO shall submit the above Master Plan to the Ministry.

(3) On the northern part of the airport there is a secondary channel of the Gadhi River which will be filled up for the airport runway construction. This will be replaced by a

shorter channel along the northern boundary of the airport. The channel shall be designed appropriately through overall modeling study so that the channel provides tidal water to the mangrove park and moderate tidal flows under worst environmental conditions. Need for widening and deepening of Gadhi River may also be studied simultaneously, if required. The revised widths and depths of recourse channels shall be determined with modified drainage and worst rainfall/tide conditions including appropriate factor of safety.

The above studies need to be undertaken on priority in view of the fact that pre-development activities have started.

5.2.4 Mitigation Measures for protection of Marine Water Quality:

Mitigation measures taken up at NMIA during pre-development works are as follows:

- landfilling is done in areas inundated during high tide, taking care that there is no disposal of debris in inter tidal area, nor any water way is obstructed
- for excavated areas and freshly filled up areas, proper garland drains leading to settlement basins followed by filter bunds are provided so that rainwater does not carryover the loose excavated material into marine areas.
- polyelectrolytes are used to help settle loose suspended material in the settlement basins.