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:

April – June 2018

PREPARED BY

ADITYA ENVIRONMENTAL SERVICES PVT.LTD.
MOEFCC Recognized Laboratory under EP Act 1986
Accredited under ISO 9001: 2008 & OHSAS 18001: 2007 by ICQS
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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 April 2018 – June 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 for ground water and marine/Surface water quality as per Tender (2) are as given in Chapter II for month of April 2018 & May 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

.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
	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
	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
	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 - p**H, Temperature, Turbidity, EC, Salinity, TSS, TDS. **Chemical Parameters:** DO, BOD, COD, Magnesium, Hardness, Alkalinity, Chloride, Sulphate, Fluoride, Sodium, Potassium, Phenol, Total Phosphorous,	10	10 Stations per season (Post, Pre- & During Monsoon)	30

	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.			
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 Ground Water, Marine Water- physicochemical & biological and Sediment, and along with location maps showing station locations are as given below:

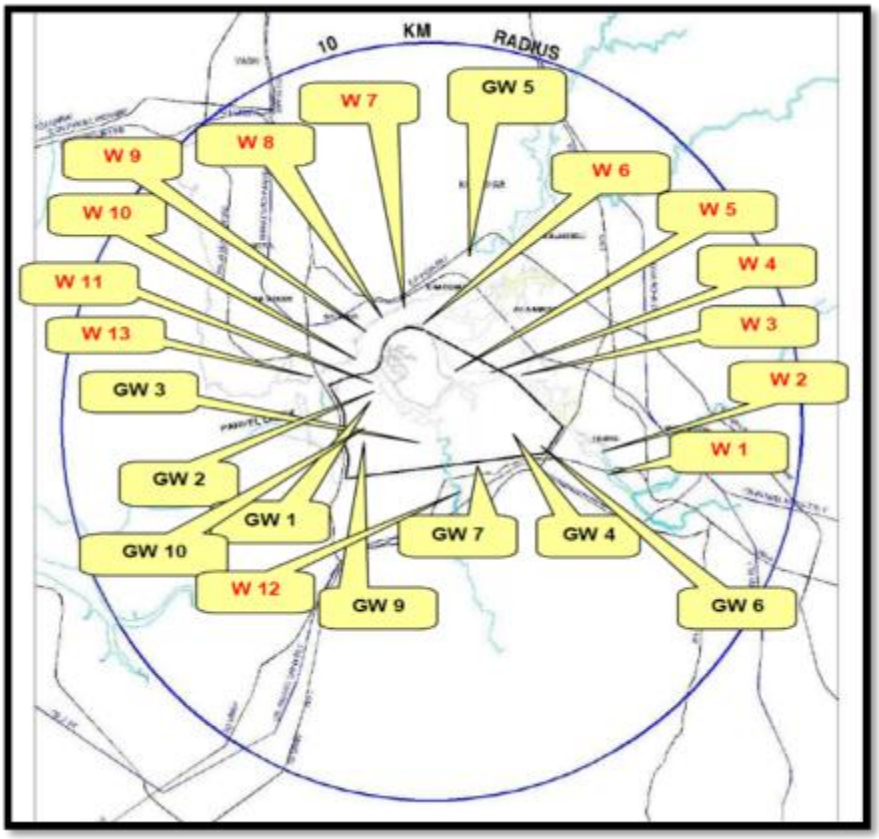
Table 2-3: Details of Ground Water Quality Monitoring Stations as per CIDCO Tender (1) & (2)

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: Map of Surface Marine, Ground Water & Sediment Monitoring Stations as per CIDCO Tender



2.3 Period/Time of Sampling (April – June 2018):

The sampling survey was carried out as per following schedule during April – June 2018. Ground Water samples collected for premonsoon season (April & May 2018)

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 shall collect samples at 13 locations as per sessions. ***For current report marine sample analysis is not carried out. Ground Water Analysis is carried out and sampling sites, methods and analysis report for same is as given below:***

Table 2-3: Period/Time of Sampling for this Survey

Month	Parameter	Sampling Stations	Dates of Sampling	Time Period
April 2018	Ground Water	GW3, GW4, GW5, GW6 & GW7	24.04.18	Grab sample
May 2018	Ground Water	GW1, GW2, GW8, GW9 & GW10	23.05.18	Grab sample

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 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 of various stations of project area during April to Jun 2018

Sr. No.	Sampling Locations	GW 3	GW 4	GW 5	GW 6	GW 7	GW 1	GW 2	GW 8	GW 9	GW 10
	Sampling month	April 18					May 18				
1	pH	7.41	7.22	7.63	7.54	7.09	7.49	7.55	7.58	7.33	8.10
2	Temperature, ° C	28.3	28.6	28.4	28.5	28.8	28.6	28.8	28.7	28.2	28.5
3	Turbidity, NTU	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4	Alkalinity, mg/L	68	58	76	84	82	198	212	236	204	202
5	Salinity, ppt	1.5	1.4	2.2	1.8	2.0	2.4	2.6	2.4	1.6	1.8
6	TKN, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
7	Total P, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
8	DO, mg/L	5.3	6.5	6.0	6.4	5.8	6.2	5.6	5.4	5.2	5.6
9	BOD, mg/L	28	18	22	20	16	24	18	16	6	12
10	COD, mg/L	75	56	64	56	43	58	68	42	24	65
11	Oil & Grease, mg/L	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
13	Hardness ($CaCO_3$), mg/L	84	82	68	92	76	180	222	210	198	184
14	Chlorides (Cl), mg/L	30	42	52	32	28	54	72	52	81	53
15	TDS, mg/L	80	80	90	90	70	100	110	80	140	90
16	Na, mg/L	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
18	Nitrate, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
19	Mn, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
20	K, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
21	Iron (Fe), mg/L	0.03	0.03	0.08	0.05	0.04	0.6	0.8	0.6	0.5	0.6
22	Sulphate, mg/L	16	12	ND	38	36	30	11	11	29	30
23	Phenol, mg/L	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
25	Cu, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
26	Cd, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
27	As, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
28	Hg, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
29	Pb, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
30	Zn, mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
31	Fecal Coliform	≥1600	≥1600	≥1600	≥1600	≥1600	≥1600	≥1600	≥1600	≥1600	≥1600
32	Coliform Colonies	Present									
33	Phytoplankton (no x 10^3/L)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
34	Total Heterotrophic Bacteria, spc/ml	120	72	110	107	102	111	128	98	142	152
35	Chlorophyll (mg/m^3)	0.02	0.06	0.04	0.02	0.02	0.03	0.01	0.02	0.01	0.05

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.

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 are identified, and steps taken to mitigate the environmental impacts. These mitigation measures need to be under constant watch through continuous vigilance, auditing and monitoring of air quality:

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.