

**Environmental Monitoring for the Navi Mumbai International
Airport Proposed
by
City & Industrial Development Corporation of Maharashtra Ltd.**



ENVIRONMENTAL COMPLIANCE MONITORING REPORT

FOR

(August to December 2015)

PREPARED BY



ADITYA ENVIRONMENTAL SERVICES PVT.LTD.

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Section I : Introduction

Mumbai metropolitan Region (MMR) is industrial and technological advanced region, which experience growth in income and employment. The increasing trend in trading, business and financial services, demands a highest order of infrastructure. This needs immediate attention to enhance the capacity of airport as the existing airport in Mumbai experiencing tremendous pressure for meeting the traffic demands. Realizing the need of second airport for Mumbai the civil Aviation granted approval & Govt. of Maharashtra also granted approval and appointed City & industrial Development Corporation of Maharashtra Limited (CIDCO) as Nodal agency for implementation.

The proposed area is situated in Panvel taluka of Raigad district of Maharashtra state with latitude of 18° 59' 00.33" N and longitude of 73° 04' 18.00" E.

CIDCO appointed Aditya Environmental Services Pvt. Ltd. (AESPL) to conduct Compliance Environmental Monitoring for the New Mumbai International Airport (NMIA). Refer to Tender No. CIDCO / T&C / NIMA / EC-22-11-2010/7.I.vii/xiii/xxx/010/251 dated. 16.02.2012, Ambient air monitoring, Ambient noise level monitoring, Soil, ground/surface water, marine water and sediments for biological and physicochemical parameters considered for study by AESPL in the surrounding region of project area.

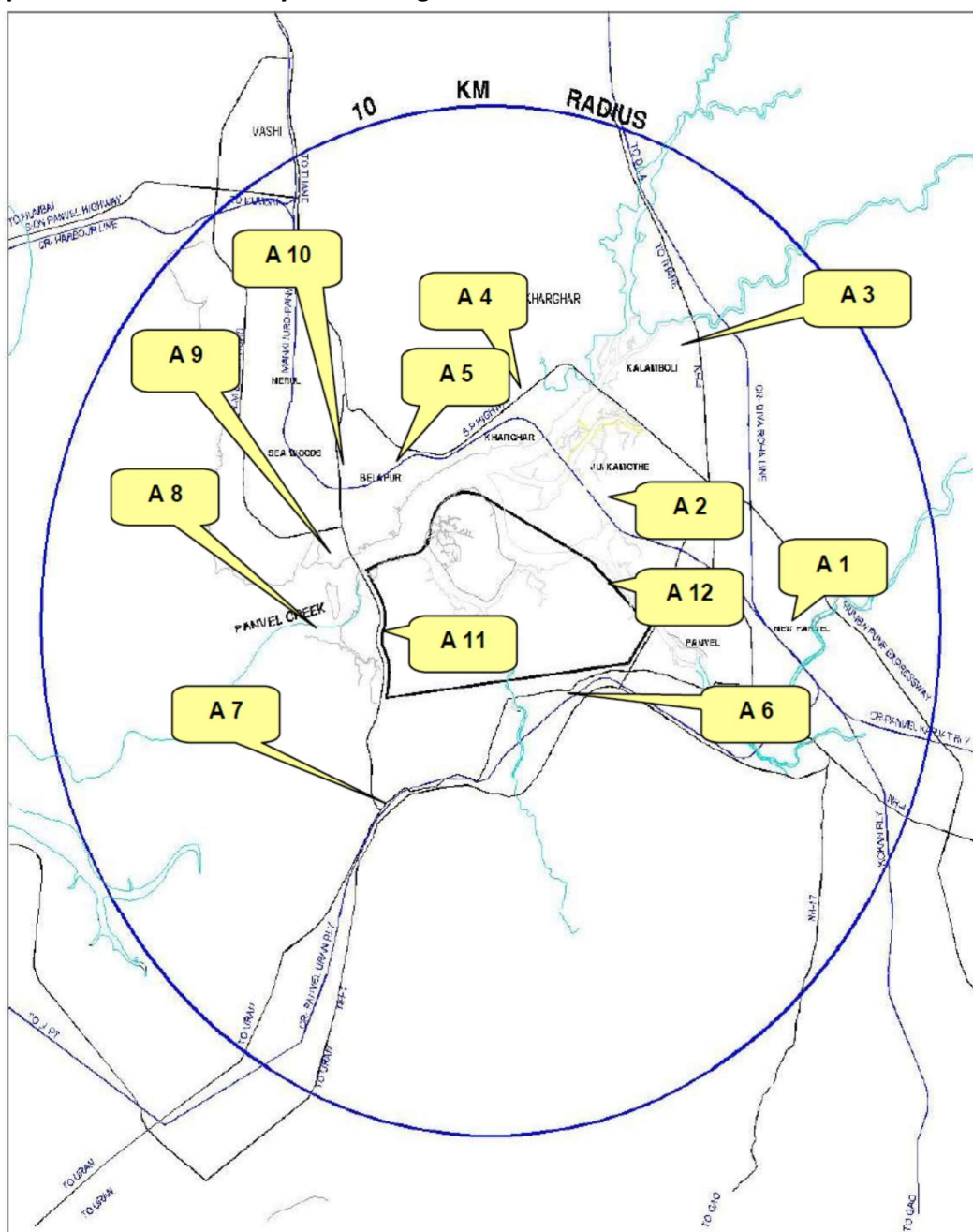
After receiving confirmation from Proponent, reconnaissance visit with CIDCO officials were conducted, after that Environmental Monitoring activities at given locations were started from August 2015. Accordingly, report is prepared for period of August 2015 to December 2015.

Ambient Air Quality Monitoring Stations

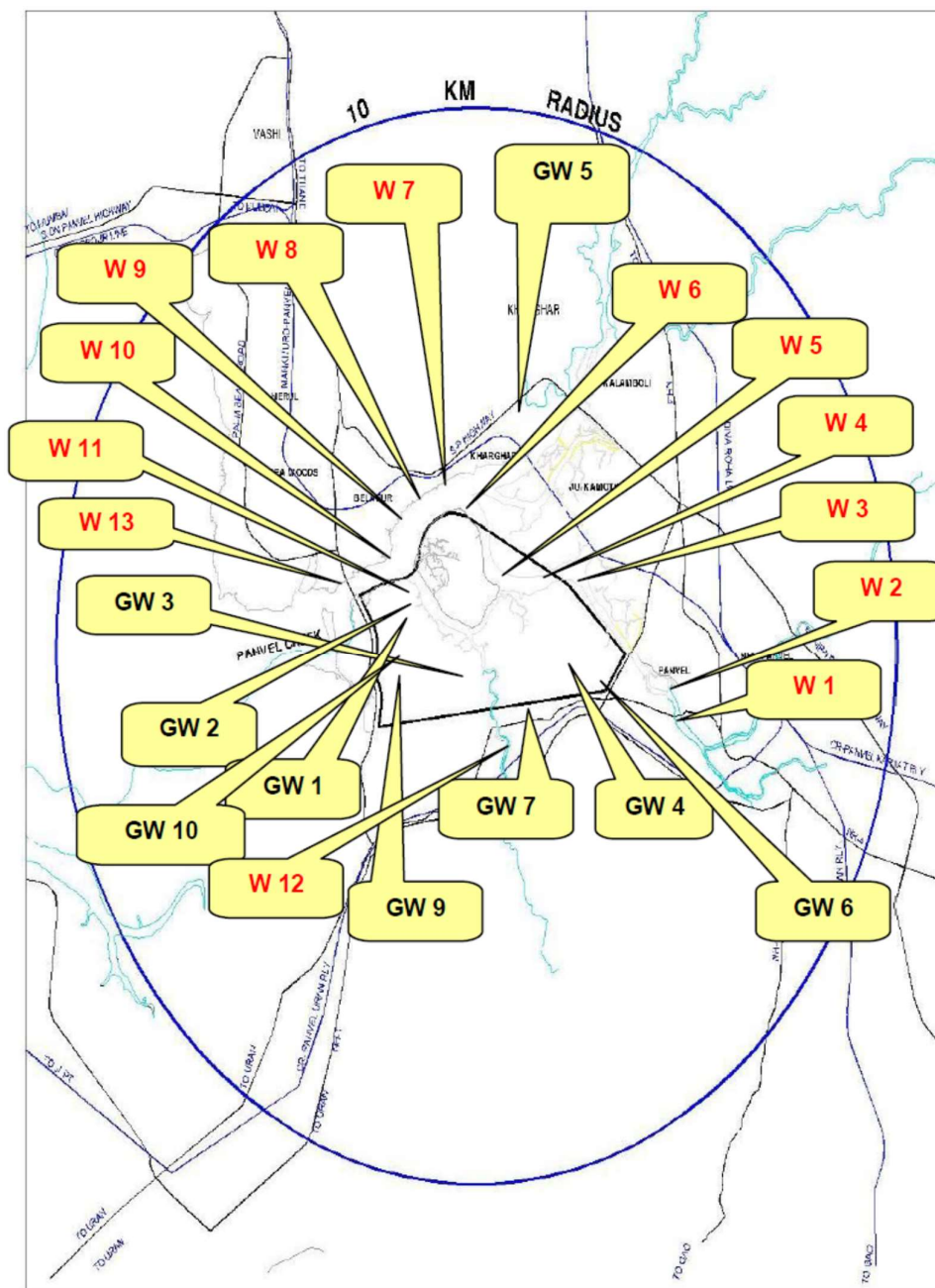
Sr. No.	Station Code	Station	Remarks
1.	PCO	Panvel CIDCO Office	Location of meteorological station and in residential zone
2.	KRS	Khandeshwar Railway Station	Commercial activity center
3.	KCO	Kalamboli CIDCO Office	Receptor oriented as it is in residential zone
4.	KNO	Kharghar Nodal Office	Receptor oriented as it is in residential zone
5.	BCB	Belapur CIDCO Bhavan	Major commercial activity center, heavy traffic movement
6.	PHS	Pargaon High School	Rural and mixed area
7.	GWT	Gavanphata Water Tank	Near to main traffic junction and hence heavy traffic movement

Sr. No.	Station Code	Station	Remarks
8.	ACL	Ambuja Cement Ltd	Industrial activity center
9.	KGH	Kille Gaothan Guest House	Receptor oriented as it is in residential zone
10.	PGH	Panchsheel Guest House	Receptor oriented as it is in residential zone
11.	To be named	Airport Entry – West	High vehicular movement at the entry / exit at the west side, near Aamra Marg
12.	To be named	Airport Entry – East	High vehicular movement at the entry / exit at the east side, near NH4B

Map of Ambient Air Quality Monitoring Stations



Map of Water Quality Monitoring Stations



Marine Water Quality Monitoring Stations

Sr. No.	Station Code	Location
1.	W1	Extreme end of Gadhi River (upstream side)
2.	W2	Near Pargaon village (200m from W1) in Gadhi River
3.	W3	Near Jui Village (300m from W2) in Gadhi River
4.	W4	Near Koppar Khadi (300m from W3) in Gadhi River
5.	W5	Near Vaghivali village (500m from W4) in Gadhi River
6.	W6	Vaghivali creek junction (300m from W5) in Gadhi River

Sr. No.	Station Code	Location
7.	W7	Near Kharghar Rly Station (300m) in Gadhi River
8.	W8	Near Belpada (300m from W7) in Gadhi River
9.	W9	Near Konkan Bhavan (300m from W8) in Gadhi River
10.	W10	Near Divala village (300m from W10) in Gadhi River
11.	W11	At Junction of Ulwe and Gadhi Rivers in Panvel Creek
12.	W12	In Ulwe River
13.	W13	Near Rathi bander in Panvel Creek

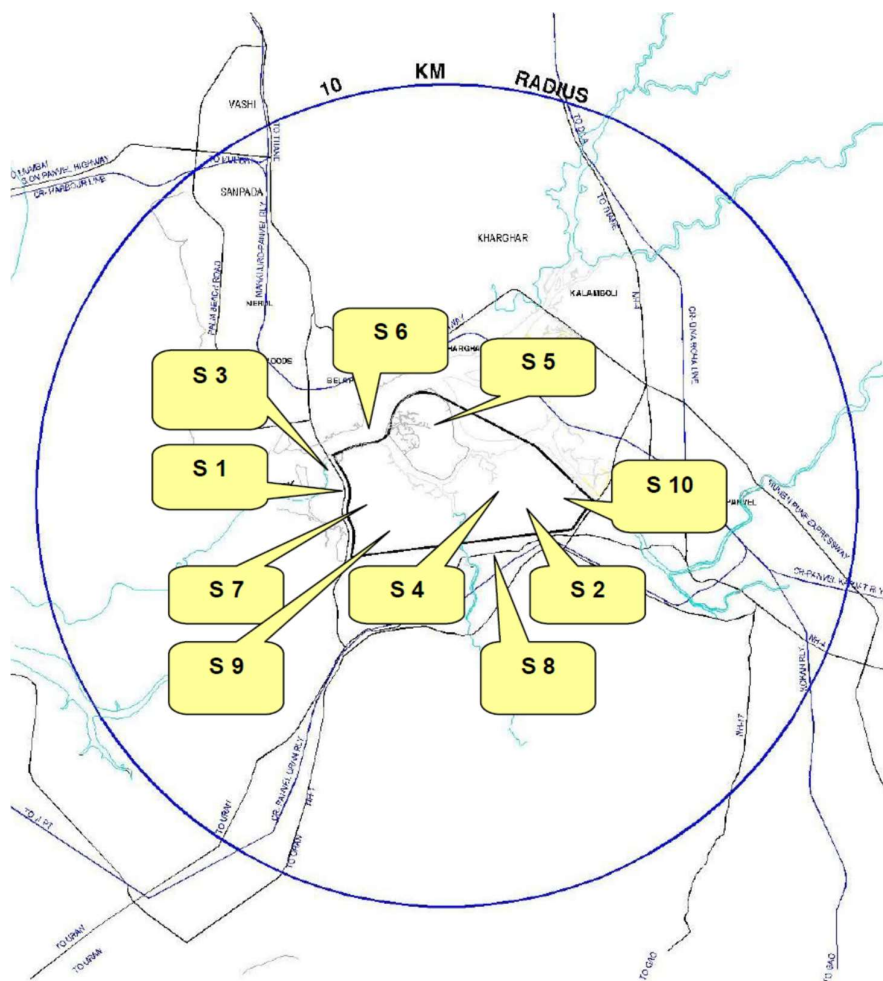
Ground Water Quality Monitoring Stations

Sr. No.	Station Code	Location
1.	GW1	Open well at Kombadbhuje
2.	GW2	A well near pond at Ganeshpuri
3.	GW3	Open well at Vaghivlivada
4.	GW4	Open well at Koli
5.	GW5	Open well at Kopar
6.	GW6	Open well at Chinchpada
7.	GW7	A well near pond at Pargaon
8.	GW8	A well near pond at Vaghivali
9.	GW9	Open well at Ulwe
10.	GW10	A well near pond at Targhar

Soil Quality Monitoring Stations

Sr. No.	Station Code	Location
1.	S1	Targhar
2.	S2	Kopar
3.	S3	Kombadbhuje
4.	S4	Koli
5.	S5	Vaghivali
6.	S6	Ganeshpuri
7.	S7	Ulve
8.	S8	Pargaon
9.	S9	Vaghivlivada
10.	S10	Chinchpada

Map of Soil Quality Monitoring Stations



Noise Level Monitoring Stations

Sr. No.	Station Name	Category of area
N1	Ambuja Cement Limited	Industrial area
N2	CIDCO Bhavan, CBD Belapur	Commercial area
N3	Palaspa Junction	Commercial area
N4	Teen Tank Gavanphata	Commercial area
N5	Panvel CIDCO Office	Residential Area (Mixed category)
N6	Kharghar Nodal Office	Residential Area
N7	Panchsheel Guest House	Residential Area
N8	Pargaon School	Sensitive area (Mixed category)
N9	MES School	Sensitive area (Mixed category)
N10	MGM Hospital, Kalamboli	Sensitive area (Mixed category)
N11	Swapna Nagri	Residential Area (Mixed category)
N12	Karnala Bird Sanctuary	Sensitive area

Section II : Scope Of Work As Per Tender

Sr. No.	Parameters – as per Annexure B	Location	Frequency	Samples / Year
1.	Ambient Air Quality: PM 2.5, PM 10, SO ₂ , NOX, CO, Lead, Ammonia, Hydrocarbon (nMHC).	12.00	2 Stations per Month, @ one sample per station	24.00
2.	Marine/Surface Water Quality: Physico Chemical parameters: PH, Floating materials, Turbidity, Temperature, Salinity (ppt, %0), 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.	13.00	For 3 seasons No. of samples 26 samples per season 26 x 3 =78 samples per year	78.00
3.	Marine/Surface Water Quality: Biological parameters: Seasonal sampling & testing (SPC) of: Phytoplankton, Zooplankton, Macrofauna, Meiofauna, Microbiology, Benthos, Diversity Indices & Coliform colonies (MPN)	3.0 - 2 at Gadhi river entrances, & 1 at Ulwe river	For 3 seasons. No. of Samples - 3x3 = 9 per year	9.00
4.	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.	10.00	5 Location per Month @ 1 Sample per location = 5 samples per month	60.00
5.	Soil: Parameters: pH, Texture class, Organic carbon, Electrical Conductivity, Available Nitrogen, Available Phosphorus, Available Potassium, Sulphate, Chloride, Calcium, Magnesium, Iron, Manganese, Copper, Mercury, Cadmium, Arsenic, Lead, Zinc, Aluminum, Nickel, Cobalt, Chromium, Sodium & Potassium.	10.00	1 Sample at each station per 6 monthly periods. 10 x 1 x2 =20 samples per year	20.00
6.	Noise: Parameters: Leq Noise level - Day time & Night time separately.	12.00	Same as per Air Quality	24.00

Section III : Methodology

Sampling, analytical methods adopted for Ambient Air, Noise, Water Analysis:

Sr. No.	Parameter	Method of Sampling	Method of Analysis	Reference
1.	PM ₁₀	RSPM Sampler	Gravimetric analysis	CPCB Guidelines Manual 2011
2.	PM _{2.5}	PM _{2.5} Sampler	Gravimetric analysis	CPCB Guidelines Manual 2011
3.	SO ₂	Absorption in TCM	West & Gaeke Method	CPCB Guidelines Manual 2011
4.	NO _x	Absorption in NaOH	Jacob – Hochheiser (Sodium Arsenic)	CPCB Guidelines Manual 2011
5.	CO	Sampling in Tedler bags / CO Meter	GC with Methaniser	CPCB Guidelines Manual 2011
6.	Lead	Sampling using EPM 2000 equivalent Filter paper	AAS Method	CPCB Guidelines Manual 2011
7.	NH ₃	Absorption in sulfuric acid	Indophenol Method	CPCB Guidelines Manual 2011
8.	nMHC	Collection Activated Carbon	Gas Chromatography	APHA
9.	Noise level (Maxi, Mini. & Av.) Leq dB(A)	Using Integrated Noise Level Meter		EPA Method
10.	Ground, Marine Water, Soil Analysis	Using APHA, BIS, ASTM & CPCB standards Methods for water Analysis		

- Environmental sampling conducted by experienced, qualified environmental staff & Analysis and reporting by approved Govt. Analyst.
- Instrument used for sampling are from reputed manufacturer & are regularly calibrated.
- Chemicals used will be Analytical Reagent grade and from reputed manufacturer.
- Analytical Instrumentation used in the laboratory is regularly calibrated.
- We have regular program of Preventive Maintenance & Annual Maintenance Contracts for all critical equipment's.
- Our Environmental Laboratory is recognized by Ministry of Environment & Forest (MoEFCC), Govt. of India under Environment (Protection) Act, 1986.
- Standard Methods Adopted in the laboratory are those prescribed by APHA, BIS, ASTM & CPCB for water, waste & marine water analysis.
- Overall approach & methodology will be in tune with Annexure IA Scope of the work & the Best practices as per prevailing norms of CPCB/MoEF etc /Internationally adopted practices.

Section IV & V : Compilation of Data & Inference

Ambient Air Quality Monitoring Report

Ambient Air quality was monitored with relevant parameters as per NAAQS standards published by CPCB in November 2009 considering that the present project is for development of International Airport for Navi Mumbai area.

Table no. 1: Ambient air quality monitoring of various stations of project area during August to December 2015

Sampling Locations	Panvel CIDCO office	Kalmboli CIDCO Office	Kharghar CIDCO Office	CBD CIDCO Office	Near Khandeshwar Rly. Stn.	Kalmboli CIDCO Office	Ambuja Cement Ltd.	Pansil G.H., Nerul	Gavanppa da Water Tank	CBD Guest House	Limit #	Unit
Sampling Date	28.08.2015		28.09.2015		30.10.2015		27.11.2015		30.12.2015			
PM _{2.5}	12.0	42.5	45.8	32.1	49.6	50.4	50.4	44.6	52.3	48.2	60.0	µg/m ³
PM ₁₀	60.8	63.3	70.4	57.1	64.6	66.3	59.6	49.6	62.1	64.6	100.0	µg/m ³
SO ₂	12.7	13.7	9.1	8.5	10.4	11.2	11.4	10.3	12.1	11.0	80.0	µg/m ³
NO _x	20.3	18.3	13.5	19.8	13.6	17.3	12.0	11.1	12.1	11.8	80.0	µg/m ³
CO	0.3	0.3	0.3	0.3	0.2	0.3	0.2	0.2	0.2	0.2	4.0	mg/ m ³
Lead	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	µg/m ³
NH ₃	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	400.0	µg/m ³
NMHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.24	ppm

ND – Not detected.

The concentration of Particulate Matter – 10 micron (PM₁₀) / Respirable particulate matter was observed above 50 µg/m³ at all sampling locations in this period. The level of Particulate Matter - 2.5 micron (PM_{2.5}) was also higher side except Panvel CIDCO Office location. Amongst gaseous pollutant, Nitrogen Oxide level was higher than others probably due to high vehicular load in the region. Concentration of lead, Ammonia and NMHC was not detected during the survey period. Over all air pollutants level was observed below NAAQS standards.

Ambient Noise Level Monitoring Report

Ambient Noise level was monitored over 24 hours' duration for Day and Night time as per Schedule - II of Environmental Protection Act 1986.

Table no. 2: Ambient noise level monitoring of various stations of project area.

Sr. No.	Sampling Location	Sampling Date	Date Time (Leq)			Night Time (Leq)			Limiting Standard (Leq) as per EPA Schedule II.	
			Max	Min	Avg	Max	Min	Avg	Day Time dB(A)	Night Time dB(A)
1.	Panvel CIDCO Office	28.08.2015	77.5	52.5	66.4	70.4	47.5	55.8	75	70
2.	Kalmboli CIDCO Office		96.1	66.3	74.3	83.7	61.4	67.6	75	70
3.	Kharghar CIDCO Office	28.09.2015	93.5	56.6	73.2	82.4	54.5	65.8	75	70
4.	CBD CIDCO Office		75.9	55.9	61.0	67.9	54.6	58.8	75	70
5.	MES School	30.10.2015	80.6	49.0	61.4	75.1	44.9	56.0	75	70
6.	Paragaon High school		80.7	64.3	70.5	79.5	66.7	68.9	75	70
7.	Ambuja Cement Ltd.	27.11.2015	74.5	49.6	55.5	61.3	41.1	47.6	75	70
8.	Pansil Guest House, Nerul		72.7	53.3	62.1	79.7	44.1	59.6	75	70
9.	Gavanpada Water Tank	30.12.2015	94.1	51.6	67.9	82.5	59.1	67.9	75	70
10.	CIDCO Guest House		73.5	43.6	54.3	80.7	45.1	52.4	75	70

At day time the average noise level was observed in the range of 55-74.3 dB(A) & Night time 47-68 dB(A) at all locations during sampling period. The noise level for day / night time was observed high at Kalmboli CIDCO office area due to transportation of commercial vehicles. It is that observed sound level are below EPA Standards at all locations.

Soil Quality Monitoring Report

Soil samples collected from proposed project locations & analyzed for physicochemical characteristics by standard IS methods. The concentration of useful nutrients like of Organic Carbon, Nitrogen, Phosphorous, Potassium was observed favorable for plantation.

Table no. 3: Soil analysis of various stations of project area during August to December 2015

Sr. No	Locations	Koli	Kopar	Kombadbhuje	Ulwe	Paragaon	Chinchpada	Vaghivali	Vaghiwaliwada	Ganeshpuri	Targhar	Unit
	Sampling Date	28.8.2015		28.09.2015		30.10.2015		27.11.2015		30.12.2015		
1.	pH	6.7	6.9	6.12	6.38	6.76	7.12	7.24	6.54	6.82	7.24	--
2.	TOC	2.02	6.4	18.8	17.3	2.1	1.8	2.8	2.4	2.4	1.1	%
3.	TKN	21	22	110	70.5	12.8	8.1	28	28	2.8	2.8	mg/kg
4.	Conductivity	140.3	140.3	132.3	130.2	130.2	124.1	133.1	124.2	132	121.1	µS/cm
5.	Ca	112	136	264	176	124	125	242	112	96	114	mg/kg
6.	Mg	24	28.8	43	110	20	26	48	48	18	62	mg/kg
7.	Sulphate	52	78.6	260	240	62	74	254	149	62	44	mg/kg
8.	Chlorides	29	57.8	67	39	51	60	62	72	59	72	mg/kg
9.	Na	60.5	2431	25	154	31.2	24	21	14	24	18	mg/kg
10.	K	294	390	210	261	126	39	52	26	104	24	mg/kg
11.	Phosphates	2.1	3.91	1.2	2.4	NIL	1.6	1.1	NIL	NIL	0.8	mg/kg
12.	Iron	NIL	1.12	4.4	4.2	NIL	NIL	2.1	1.8	NIL	NIL	mg/kg
13.	Lead	NIL	119	38	15	NIL	NIL	NIL	NIL	NIL	NIL	mg/kg
14.	Copper	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	mg/kg
15.	Nickel	NIL	3	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	mg/kg
16.	Zinc	NIL	3	2	1	NIL	NIL	NIL	NIL	NIL	NIL	mg/kg
17.	Chromium	21	17	21	NIL	NIL	NIL	NIL	NIL	NIL	NIL	mg/kg

Sr. No	Locations	Koli	Kopar	Kombadbhuje	Ulwe	Paragaon	Chinchpada	Vaghivali	Vaghiwaliwada	Ganeshpuri	Targhar	Unit
	Sampling Date	28.8.2015		28.09.2015		30.10.2015		27.11.2015		30.12.2015		
18.	Mercury	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	mg/kg
19.	Manganese	1	9	1	NIL	NIL	NIL	NIL	NIL	NIL	NIL	mg/kg
20.	Aluminum	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	mg/kg
21.	Cobalt	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	mg/kg
22.	Cadmium	5	NIL	4	1	3	NIL	NIL	NIL	NIL	NIL	mg/kg
23.	Arsenic	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	mg/kg

There was marginal high level of heavy metals observed (at Koli, Kopar Kombadbhuje & Ulwe) This may be due to previous landfilling activity by CIDCO but not to other locations. Over all soil quality was observed fertile in nature and suitable to grow local plants varieties at all locations.

Ground Water Quality Analysis

The physicochemical analysis of ground water study 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 standard requirements as per IS 10500 revised in 2012 for purpose of drinking water.

Table no. 4: Ground water analysis of various stations of project area during august to December 2015

Sr. No.	Sampling Locations	Koli			Kopar			Paragaon			Chinchpada			Vaghiwaliwada			Ulwe		Ganeshpuri		Vaghivali		Targhar		Kombadbhuje	
	Sampling Date	Aug	Oct	Dec	Aug	Oct	Dec	Aug	Oct	Dec	Aug	Oct	Dec	Aug	Oct	Dec	Sep	Nov	Sept	Nov	Sept	Nov	Set	Nov	Sep	Nov
1	pH	5.26	6.94	6.69	7.12	7.57	6.69	7.01	6.61	7.42	7.11	6.34	7.42	7.32	7.29	7.42	6.3	6.62	6.62	6.94	7.37	7.37	7.05	7.65	7.02	10.3
2	Temperature, °C	28	28	28	28	28	28	28	28	28	29	29	28	28	28	28	28	28	28	28	29	26	29	28	28	28
3	Turbidity, NTU	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
4	Alkalinity, mg/L	46	58	60	440	78	60	114	38	34	144	80	34	126	58	58	178	178	160	160	108	112	158	152	166	186
5	Salinity, ppt	4.28	1.7	5.56	1.5	1.9	5.56	1.9	1.9	2.6	1.1	1.5	2.6	1.3	1.9	2.1	1.1	1.5	0.64	0.85	1.3	2.14	0.8	1.3	0.42	2.35
6	TKN, mg/L	154	159	168	NIL	NIL	168	134	13	NIL	NIL	NIL	NIL	126	104	98	2.8	3.4	2.8	3.1	2.8	89.6	11.8	12.3	7.2	7.6

Sr. No.	Sampling Locations	Koli			Kopar			Paragaon			Chinchpada			Vaghiwaliwada			Ulwe		Ganeshpuri		Vaghivali		Targhar		Kombadbhuje	
		Aug	Oct	Dec	Aug	Oct	Dec	Aug	Oct	Dec	Aug	Oct	Dec	Aug	Oct	Dec	Sep	Nov	Sept	Nov	Sept	Nov	Set	Nov	Sep	Nov
7	Total P, mg/L	1.41	3.6	2.8	2.06	2.8	2.8	4.3	4.6	1.3	3.4	3.7	1.3	2.9	6.4	3.2	2.8	3.5	5.3	6.6	5.9	2.3	3.5	4.8	3.2	5.4
8	DO, mg/L	3.2	5.7	3.9	2.5	4.2	3.9	2.7	5.6	4.8	3.3	4.7	4.8	3.6	5.3	5.6	5.3	5.3	4.9	5	5	5.2	5	5.2	4.7	4.9
9	BOD, mg/L	16	10	24	18	18	24	10	10	28	4	14	28	32	16	18	10	12	10	8	8	28	12	28	10	8
10	COD, mg/L	56	38	60	56	67	60	37	38	70	19	48	70	112	58	60	48	48	29	29	28	57	29	76	29	30
11	Oil & Grease, mg/L	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
12	Residual Free Chlorine, mg/L	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
13	Hardness (as CaCO ₃), mg/L	230	250	248	330	318	248	156	186	188	346	324	188	164	180	174	140	122	172	178	180	208	180	196	240	246
14	Chlorides (as Cl), mg/L	11	43	43	93	109	43	33	52	52	79	91	52	24	38	42	38	28	45	47	311	264	46	292	57	66
15	TDS, mg/L	80	70	90	180	180	90	110	90	120	170	170	120	70	80	110	140	80	110	120	420	460	120	360	130	180

Nitrate was found high at Kopar (12.9 mg/l) in the month of August and October ; at Pargaon and Chinchpada (11.2 mg/l) during December 2015; at Targhar (10.9 mg/l) during September 2015 there is evidence that more than 10 mg/l of Nitrate is lethal, may cause Methamoglobinemia (“blue baby syndrome”).

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

Marine Water Quality Analysis:

Physicochemical Parameters:

Marine samples were collected from pre-decided sampling locations in Gadhi River, Ulwe River and Panvel Creek. 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 analyzed for Biological and Physicochemical parameters.

Figure 1 depicts sampling location map. Stations 1 to 10 are located in Gadhi River & Station 11 & 13 are in Panvel Creek while station 12 in Ulwe River. A good amount of mangrove vegetation was noted on either side of stream from station 4 to 6.

Table no. 5: Marine water physicochemical analysis of various stations of project area during November 2015

Sr. No.	Parameter	W 1	W 2	W 3	W 4	W 5		W 6		W 7		W 8	
		S	S	S	S	S	B	S	B	S	B	S	B
1.	pH	6.90	6.98	7.02	6.80	7.01	6.78	7.01	7.17	7.00	7.06	7.03	6.79
2.	Floating Matter	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
3.	Turbidity, NTU	NIL	NIL	NIL	NIL	NIL	NIL	NIL	13.9	11.7	13.9	NIL	NIL
4.	Temperature, ° C	28.1	28.0	28.0	28.0	28.0	28.0	28.0	27.2	27.8	28.2	28.0	28.1
5.	Salinity, ppt	2.66	3.42	9.88	10.8	11.1	12.2	12.1	13.2	13.3	13.4	12.4	13.2
6.	TSS, mg/L	116	123	23655	288	376	267	243	305	302	303	262	334
7.	TDS, mg/L	6130	10915	222	28520	26475	31355	30740	32540	29210	33855	32355	33700
8.	TOC, mg/L	1.5	1.4	1.2	1.4	2.0	2.2	2.1	2.2	2.3	2.4	1.7	NIL
9.	DO, mg/L	4.9	5.0	5.2	5.0	5.0	4.9	5.4	5.3	4.5	5.2	5.2	4.9
10.	BOD, mg/L	24	38	26	18	10	14	10	6	14	16	22	20
11.	O&G, mg/L	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
12.	Sulphate, mg/L	16.3	9.0	27.0	12.0	13.1	18.9	21.8	20	30	30.7	32	22

Sr. No.	Parameter	W 1	W 2	W 3	W 4	W 5		W 6		W 7		W 8	
		S	S	S	S	S	B	S	B	S	B	S	B
13.	Nitrite, mg/L	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
14.	Nitrate, mg/L	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
15.	TAN, mg/L	16.8	13.7	10.0	28.0	1.9	3.92	11.7	11.4	6.72	7.5	4.2	11.2
16.	Inorganic PO ₄ , mg/L	2.8	2.8	NIL	NIL	7.1	2.2	1.3	NIL	NIL	1.5	1.7	NIL
17.	Ca, mg/L	100	256	832	408	376	520	488	424	592	472	456	480
18.	Mg, mg/L	202	412	609	484	936	1108	1032	1147	1204	1209	1075	1094

Table no. 5: Marine water physicochemical analysis of various stations of project area during November 2015 continued....

Sr. No.	Parameter	W 9		W 10		W 11		W 12		W 13	
		S	B	S	B	S	B	S	B	S	B
1.	pH	6.94	6.98	6.96	6.87	6.87	7.02	7.10	6.99	6.96	6.94
2.	Floating Matter	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
3.	Turbidity, NTU	3.2	17.1	7.5	24.6	6.4	19.2	NIL	6.4	12.8	3.2
4.	Temperature, ° C	27.7	28.2	27.9	28.3	28.1	27.5	28.3	28.3	28.1	27.7
5.	Salinity, ppt	13.3	13.3	12.2	13.2	12.3	12.5	6.1	10.0	10.1	13.3
6.	TSS, mg/L	329	271	419	277	304	281	191	377	276	329
7.	TDS, mg/L	31390	34180	31810	5180	32025	31300	19385	31885	31855	31390
8.	TOC, mg/L	2.5	2.6	2.1	2.2	1.6	1.7	4.4	NIL	NIL	2.5
9.	DO, mg/L	5.0	5.1	5.0	5.2	5.2	4.9	5.4	5.5	5.0	5.0
10.	BOD, mg/L	18	18	14	18	24	32	24	18	14	18
11.	O&G, mg/L	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
12.	Sulphate, mg/L	16.0	10.9	14.0	19.5	35.0	32.0	30.0	32.0	20.4	16.0
13.	Nitrite, mg/L	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
14.	Nitrate, mg/L	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL

Sr. No.	Parameter	W 9		W 10		W 11		W 12		W 13	
		S	B	S	B	S	B	S	B	S	B
15.	TAN, mg/L	7.8	4.2	14.5	6.7	7.5	8.4	4.7	7.3	12.3	7.8
16.	Inorganic PO ₄ , mg/L	6.7	4.7	3.1	NIL	NIL	4.3	4.4	NIL	NIL	6.7
17.	Ca, mg/L	376	568	536	592	496	488	424	400	448	376
18.	Mg, mg/L	1281	1137	1089	1114	1056	1176	734	1195	1224	1281

The results of analysis shown in the Table no. 5 the observations were noted as below:

The pH value ranged from 6.80 to 7.03 at surface and 6.78 to 7.17 at bottom suggest the acidic to basic nature of water. Salinity was low due to influx of fresh water. The high total suspended solids were found at surface of water at station 3 due to accumulation of discharge from surrounding villages in the Gadhi river. 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. DO within normal limit suggest good amount of dissolved oxygen in the water body to support living organism. BOD value suggest the presence of biodegradable organic wastes present in water body which comes as domestic waste and discharge of sewage from surrounding areas. The Sulphate value were found in low concentration which represents anthropogenic contamination. Total ammonical nitrogen were low in water body. Inorganic phosphate was found in low concentration. The concentration of Calcium & Manganese was high due natural origin. but concentration of Iron was low.

Biological Parameters:

Biological parameters viz. Phytoplankton, Zooplankton, Benthos and Microbiology were analyzed.

Table no. 6: Marine water biological analysis of various stations of project area during November 2015

Sample Details	Parameter	W 1	W 2	W 3	W 4	W 5		W 6	
		S	S	S	S	S	B	S	B
Phytoplankton	Population (no x 10 ³ /L)	197.6	158.4	146.4	132.8	178.4	65.6	44.8	20.8
	Total Genera	21	16	13	15	11	12	14	10
	Major Genera	<i>Scenedesmus, Thalassiosira, Leptocylindrus, Navicula</i>	<i>Nitzschia, Scenedesmus, Thalassiosira, Leptocylindrus</i>	<i>Thalassiosira, Leptocylindrus, Navicula, Skeletonema</i>	<i>Thalassiosira, Leptocylindrus, Chaetoceros, Skeletonema</i>	<i>Thalassiosira, Leptocylindrus, Navicula, Skeletonema</i>	<i>Nitzschia, Thalassiosira, Leptocylindrus, Skeletonema</i>		
	Diversity Index	2.19	1.42	1.48	1.79	1.45	2.01		
Zooplankton	Population (no x 10 ³ /100m ³)	93.00	109.60	87.47	2.05	0.32	27.95		
	Total Group	3	4	2	3	4	7		
	Major Groups	Copepods	Copepods	Copepods	Copepods, Acetes sp	Gastropods, Foraminiferans	Acetes sp, Copepods		
	Biomass (ml/100m ³)	20.00	6.67	4.42	2.99	1.57	121.44		
	Diversity Index	0.16	0.00	0.00	0.21	0.59	1.02		
Benthos	Population (no x 10 ² /m ²)	0.83	0.00	12.50	4.58	5.42	11.66		
	Total Group	1	0	2	2	1	4		

Sample Details	Parameter	W 1	W 2	W 3	W 4	W 5		W 6	
		S	S	S	S	S	B	S	B
	Major group	Polychaete	-	Polychaete, Bivalve	Polychaete, Bivalve	Polychaete		Polychaete, Sipuncula	
	Biomass (gm/ m2)	0.67	0.00	148.66	44.52	0.65		5.47	
	Diversity Index	0.00	0.00	0.69	0.59	0.00		0.81	
Microbiology	Coliform/100 ml	*P	*A	*P	*P	*P	*A	*P	*P
	<i>E. coli</i>	*A	*A	*A	*A	*A	*A	*A	*A
*P – Present * A – Absent									

Table no. 6: Marine water biological analysis of various stations of project area during November 2015 continued

Sample Details	Parameter	W 7		W 8		W 9		W 10		W 11		W 12	W 13		
		S	B	S	B	S	B	S	B	S	B	S	S	B	
Phytoplankton	Population (no x 103/L)	43.2	28.2	43.2	17.6	21.6	13.6	14.4	20	35.2	23.2	475.2	44.8	53.6	
	Total Genera	15	13	13	11	8	9	12	12	12	10	12	15	14	
	Major Genera	Skeletonema , Nitzschia, Skeletonema , Thalassiosira		Skeletonema Nitzschia, Thalassiosira, Cyclotella		Thalassiosira, Skeletonema Nitzschia , Guinardia		Skeletonema Cyclotella, Rhizolenia		Thalassiosira, Leptocylindrus , Nitzschia , Skeletonema		Navicula, Thalassiosira, Leptocylindrus, pleurosigma		Thalassiosir, Skeletonema , Nitzschia, Chaetoceros	
	Diversity Index	2.47		2.25		2.20		2.45		2.10		1.58		2.31	
Zooplankton	Population (no x 103/100m3)	7.64		43.72		37.39		44.04		44.85		89.50		29.90	
	Total Group	6		6		6		6		6		6		6	
	Major Groups	Acetes sp Copepods		Acetes sp Copepods		Acetes sp Copepods		Copepods, Acetes sp		Acetes sp, Copepods		Foraminiferans, lamelllibranchs		Acetes sp, Copepods	

Sample Details	Parameter	W 7		W 8		W 9		W 10		W 11		W 12	W 13	
		S	B	S	B	S	B	S	B	S	B	S	S	B
Benthos	Biomass (ml/100m ³)	59.62		141.04		119.04		172.69		15592		40.00	114.78	
	Diversity Index	0.79		0.84		0.86		0.92		0.92		1.46	1.16	
	Population (no x 10 ² /m ²)	0.00		130.81		97.90		101.65		0.00		1.25	142.89	
	Total Group	0.00		3		2		3		0		2	3	
Benthos	Major group	-		Polychaete, Sipuncula		Polychaete, Amphipods		Polychaete, Amphipods		-		Polychaete, Amphipods	Polychaete, Amphipods	
	Biomass (gm/ m ²)	0.00		10.23		5.10		9.70		0.00		0.44	8.69	
	Diversity Index	0.00		0.14		0.03		0.05		0.00		0.64	0.34	

Microbiology	Coliform/100 ml	*A	*A	*A	*P	*A	*A	*A	*A	*A	*A	*P	*A	*A
	<i>E. coli</i>	*A	*A	*A	*A	*A	*A	*A	*A	*A	*A	*A	*A	*A
*P – Present * A – Absent														

Sampling Locations:**W1** – Extreme end of Gadhi River (up-stream)**W2** – Near Pargaon Village (200 m from W1) in Gadhi River**W3** – Near Jui Village (300 m 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 Railway Station (300 m) in Gadhi River

W8 Near Belpada (300 m from W7) in Gadhi River

W9 – Near Kokan Bhavan (300m from W8) in Gadhi River

W10 – Near Divala Village (300m from W10) in Gadhi river

W11 – At junction of Ulwe and Gadhi River in Panvel Creek

W12 – In Ulwe River

W13 – Near Rathi Bunder in Panvel Creek

Where: S – Surface, B – Bottom

Phytoplankton:

Phytoplankton population density ranges from $13.60-475.2 \times 10^3/l$, highest phytoplankton population at station 12 in Ulwe River may be due to influx of domestic water from surrounding villages; total generic groups ranges from 13-21 nos., maximum generic diversity observed at station 1 in upstream estuarine environment. Total Generic groups were noted as 32 of which *Nitzschia*, *Thalassiosira*, *Cyclotella* are most common ones, followed by rest of observed genera like *Pleurosigma*, *Navicula*, *Skeletonema*, *Biddulphia*, *Leptocylindrus*, *Gyrosigma*, *Scenedesmus* as major genera in Gadhi River. The other fresh water phytoplankton genera found are *Pediastrum*, *Actinastrum*, *Cosmarium*, *Phacus* (Solitary) and *Oscillatoria* (Filamentous). *Leptocylindrus* is common Genera noted in all 13 stations mostly present in surface water. The genera of phytoplankton represented in Figure no. 2. Graphical representation of phytoplankton population and total genera is represented in Figure no. 3.

Zooplankton:

The zooplankton biomass ranged from 1.57-172.69 ml/100 m³ with population density of 0.32109.60 nox10³/100m³ while having low faunal group ranging from 2-7 nos.

The zooplankton were noted with low population and low group diversity as well in Gadhi river, while inversely the zooplankton in Panvel creek was over populated with *Acetes* sp. obviously with high biomass. *Acetes* sp., Copepods, gastropods, lamellibranchs were common groups observed as shown in Figure no. 4 and Figure no. 5 represents zooplankton standing stock graphically.

Benthos:

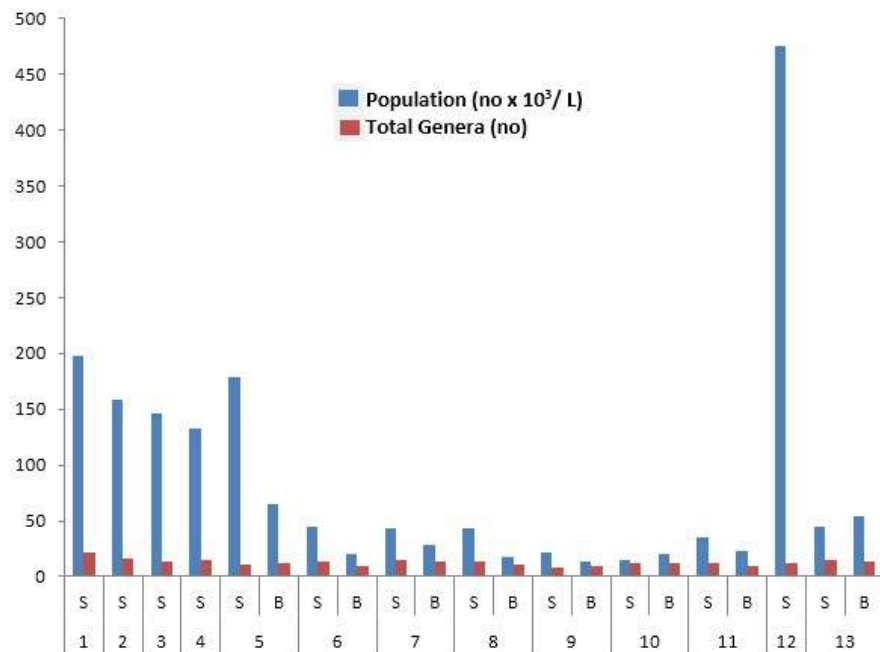
Macro benthos studies showed in different benthic pattern. Macro-benthic biomass ranged from 0.00 to 148.66 gm/m² with population ranging from 0.00- 142.89 x 10²/m². The faunal group found were Polychaete, Bivalves, Gastropods, Amhipods, Sipuncula, Crabs. At station 2, 7 and 11 no benthic samples collected because of rocky bottom. the benthos observed in water body was good in terms of living system of Benthos. The benthic organisms found at sampling area shown in Figure no. 6 and Figure no. 7 represents the graphical representation of population of benthic organisms' groups in percentage.

Microbiology:

E. coli & coliform microbes were present/absent at 13 stations at surface and bottom levels. E. coli were absent while coliforms were occasionally present in either of water levels. No specific trend was observed.

Figure

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no. 3: Graphical representation of phytoplankton population and total genera

above graph represents the population phytoplankton is more at stations 1,2,3 the Gadhi river and 12 in Ulwe River, is discharge of sewage and domestic is more. While at station 6,7, 8, 9 10 are proceeding from Gadhi River to Panvel and 11 and 13 are near to Panvel creek, phytoplankton population is less. The phytoplankton population trend is

almost same throughout the all stations.

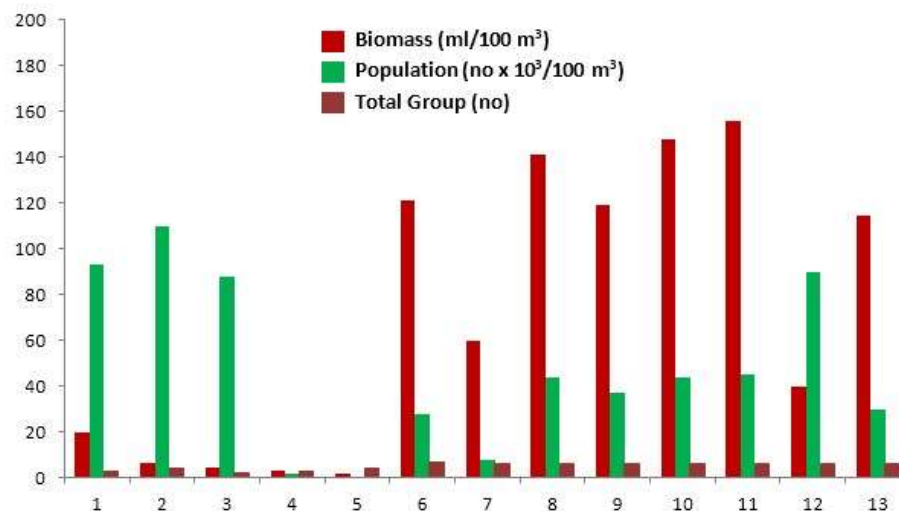


Figure no. 5: Graphical representation of Zooplankton Biomass, Population and total group

The above graph represents the high biomass reported from station 6 to 13 due to presence of Acetes group, these locations are near to Mangrove habitats which suggest it is nursing ground for fishes, the total group is almost same. Where population is high at station 1, and 3 in no. of organisms. There is biomass, population and total group was less at station 4 and 5.

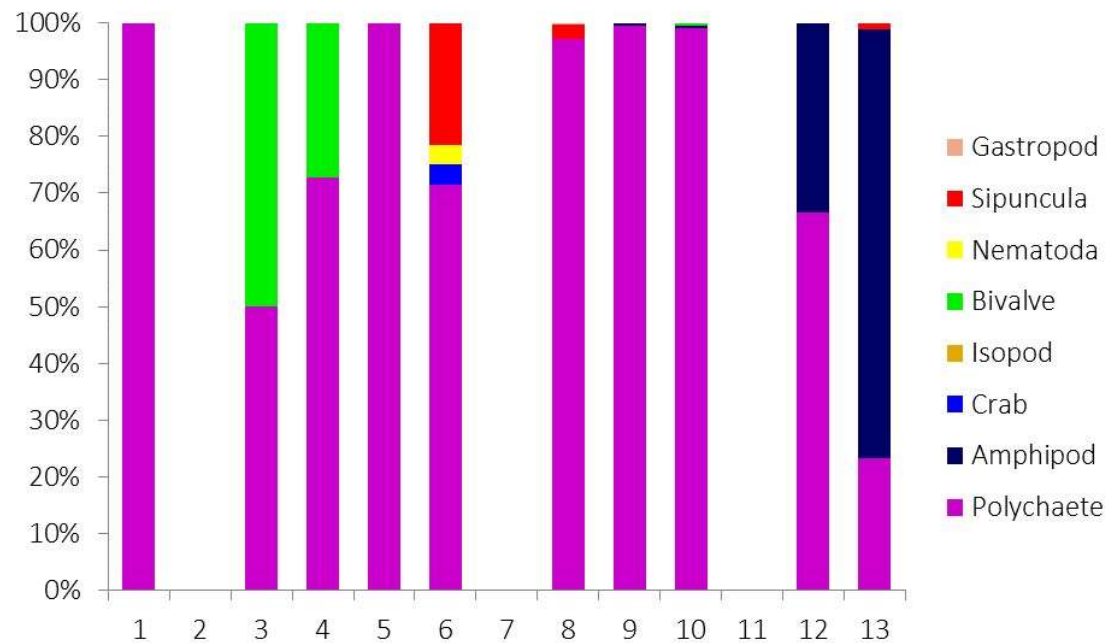


Figure no. 7: Graphical representation of population of benthic organisms

The above graph represents the Polychaete is major group at all stations except at station 13 where crab is major group. At station 3 and 4 Bivalve is present as minor group after Polychaete. At station 6 Sipuncula, Nematoda and crab are as minor group. At station 12 crab is present after

Section VI : Conclusion & Recommendation

On the basis of the impacts considering during the constructional phase of NMIA certain issues has been identified and their mitigation to minimize environmental impacts are suggested as below:

Air:

The air will get polluted by activities like excavation, land filling, controlled blasting, construction, material handling and transportation during construction phase due to traffic and high dust levels.

There will be provision for water sprinkling at the construction site for dust suppression. Trucks carrying earth, sand or stone will be covered with tarpaulin to avoid spilling. High tech equipment will be used for controlling blasting excavation which will generate minimal noise as well as dust. Construction machinery and equipment will be maintained in good working condition. All vehicles & construction equipment with internal combustion engines to reduce carbon particles, CO and HC emission. The vehicle which not meeting vehicular pollution standards will not be allowed within construction site.

Biodiversity and forests:

The loss of mangrove vegetation, marsh land will take place during construction phase.

There will be mangrove plantation over 245 ha. at Vaghivali on north of airport as mangrove park, which ensure regeneration of mangroves and aquatic flora & fauna associated with mangrove and add biodiversity of the region and will compensate the loss. Loss of estuarine biodiversity is temporary phase during construction of recourse channels for Ulwe and Gadhi Creek. It is expected that the biodiversity would equilibrate and resettle. In order to compensate loss of vegetation the plantation programme will be undertaken within airport area the plant would be local, fast growing and non-fruiting to reduce bird's mishaps. The contamination of estuary due to resuspension of sediments or dust from construction site both of which are temporary.

Ecosystems:

During the construction phase the ecological footprint will increase, the loss of marshy land ecosystem will take place, sediment runoff leading into the creek will damage local aquatic ecosystem.

During the dredging/channelization proper route alignment will be selected and dredging and excavation should be done in stages maintaining water flow, which will result the minimum impact of siltation and turbidity to reduce this impact on aquatic community, the dredging will be done in high tide. The Gadhi and Ulwe River going to recourse during the constructional phase, the proposed diverted alignment will have the same physiological characteristics to minimize the impacts on aquatic ecosystem. The turbidity will enhance during the diversion and will be temporary in nature.

The loss of marshy land is permanent. The alternate development of mangrove is part of mitigation activity.

Noise:

The noise will be generated due to blasting operations of hills, it will be onetime activity lasting for short duration, the impact of generated noise level on surrounding population will be negligible. Silencer will be used with equipments to reduce noise pollution. Hi tech instruments will be used to minimize noise level during blasting. Before controlled blasting the surrounding villages will be informed, the villagers and domestic animals will be offered safe place away from the project site. The construction activity which

produces high level of noise will be avoided between 10 pm to 6 am. The construction personnel exposed to high level noise will be provided with protective gear such as ear muffs. Equipments and construction machinery will be maintained properly to reduce noise.

Energy:

The consumption of energy will be increased during the construction phase.

Increase in energy consumption will increase air pollution at its source of generation. To reduce the use of energy maximum work should be carried in sun light and minimize the use of power during construction phase. Good insulators will be used to reduce the AC power consumption. Energy conservation programs/ protocols will be developed.

Land:

The change of river flow is inevitable and during the development due care will be taken to maintain the required hydraulic flow to avoid water logging in the upstream and also any water logging in the project area either during construction or operational phases.

Solid Waste:

The excavated material /construction waste would be used for land development or disposed off in pre-designates approved site.

Water:

The channelization of river will be carried out in stages keeping the water flow intact except for period during diversion of water course. This operation will result in minimum impact on community, the dredging will be done at high tide to reduce the impact of siltation and turbidity on aquatic community. For diversion of Ulwe and Gadhi river proper route will be selected which will have similar physiological characteristics.

The total water requirement which will be utilized in Airport development has been calculated which will minimize the use of water during construction phase.

Conclusion:

Air quality monitoring study shown that at all monitoring locations the level of air pollutants observed was below NAAQS level.

As per EPA standards noise level was below during ambient noise level monitoring.

The soil observed at all locations found fertile in nature suitable for growth of local plant varieties.

There is considerable variation between the physicochemical parameters analyzed which do not comply with IS 10500 (2012) hence ground water is not potable, monitoring is needed and steps should be taken to improve the quality of drinking water to reduce undesirable health effects.

In the post monsoon study of November 2015 at all 13 stations, results as per tables in biological section show *Scenedesmus* a fresh water phytoplankton represents the fresh water influx at 1 and 2 in Gadhi river; zooplankton high biomass in form of *Acetes sp.* population in Panvel Creek and vicinity of mangroves in that area shows it is nursing ground for *Acetes sp.* The Gadhi & Ulwe River samples were noted to be rich in phytoplankton density as well in diversity, at Station 7 as per diversity index indicated good health of phytoplankton population in Gadhi River. The pollution indicator genera *Skeletonema* is present all stations except 1, 2 and 12, which show presence of pollution in Gadhi as well as Panvel Creek. The zooplankton population, diversity and biomass as well were on lower side at Gadhi River, while with completely different scenario in Panvel creek which was rich in zooplankton standing stock. Benthic population doesn't show any specific trend. The low benthic diversity and standing stock may be able to be commented due to cosmopolitan hindrances as influx. Amongst the sampling locations, the richness and evenness of plankton is represented through diversity index.