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Ref: NMIAL/MOEF/GEN/0459 Date: 16 May 2024

To,
Regional Officer (WCZ),
Integrated Regional Office (IRO)
Ministry of Environment, Forest & Climate Change (MoEFCC),
Ground Floor, East Wing, New Secretariat Building,
Civil Lines, Nagpur-440001
Email - apccfcentral-ngp-mef@gov.in

Subject: – Submission of Half Yearly Compliance Report (October 2023 - March 2024) for all the conditions stipulated in the Environmental and CRZ Clearance in respect of proposed Navi Mumbai International Airport reg.

Reference: - Environmental and CRZ Clearance for on-going project granted No. 21-60/2021-IA-III dated: 28.11.2021

Sir,

With reference to above subject, it is to be informed that MoEF&CC has granted Environmental and CRZ clearance for ongoing project for establishment of Navi Mumbai International Airport (NMIA) at Panvel Tahsil, Raigad District by vide No 21-60/2021-IA-III dated November 28, 2021. and issued on December 01, 2021.

In the said environment clearance at the Standard condition B (VIII) Miscellaneous Sr. No. 3, it is stipulated that NMIA has to submit half yearly compliance report to all the conditions stipulated in the EC issued on Dec 01. 2021.

We are submitting herewith the half yearly Environmental Compliance Status report for the period from 01st October 2023 to 31st March 2024 for proposed establishment of green field airport at Navi Mumbai as per the following:

1. Data Sheet.
2. Clause wise EC Compliance Report for the period of Oct 23-Mar 24 with annexures.
3. Environmental Monitoring Report Oct 2023-Mar 2024.

Thanking you

Yours faithfully,

For **Navi Mumbai International Airport Pvt. Ltd.**

Charudatta Deshmukh
Joint President & Head - Planning & Design

Navi Mumbai International Airport Pvt Ltd
11th Floor, V Times Square, Plot no 3,
Sector 15, CBD Belapur,
Navi Mumbai – 400 614
Maharashtra, India

Tel +91 22 6851 9500

CIN - U45200MH2007PTC169174

Registered office: CSMI Airport, 1st Floor, Terminal 1B, Santacruz (E), Mumbai 400 099, India. T +91 22 6685 0900 / 6685 0901

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Copy to 1) The Vice Chairman & Managing Director, City & Industrial Development Corporation of Maharashtra Ltd. (CIDCO), CIDCO Bhavan, CBD Belapur, Navi Mumbai- 400614 for information and necessary action.

2) The Member Secretary, Maharashtra Pollution Control Board, 3rd Floor, Kalpataru Point, Sion, Mumbai – 400 022.

3) The Zonal Officer, Central Pollution Control Board, Survey no. 110, Heerbai Dhankude hall, Baner Road, Pune 411045.

4) The Chairman, Maharashtra Coastal Zone Management Authority, Room No. 217, Mantralaya (Annex Building), Mumbai – 400 032.

5) Monitoring Cell, MoEF&CC, Indira Paryavaran Bhavan, Jor Bagh Road, New Delhi – 3.

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Half Yearly Compliance Report of Environmental & CRZ Clearance

For Ongoing project For Establishment of Greenfield Airport

Navi Mumbai International Airport (NMIA)

At Panvel, Dist. Raigad, Maharashtra

Submitted to:

Integrated Regional Office (IRO),
Ministry of Environment, Forest & Climate Change (MoEF&CC), Nagpur.

Central Pollution Control Board, New Delhi.

Maharashtra Pollution Control Board, Mumbai

Submitted By:
Navi Mumbai International Airport Pvt Ltd. (NMIAL)

For

Period of October 2023 to March 2024

Index

Monitoring the Implementation of Environmental Safeguards
Ministry of Environment, Forest & Climate Change
Regional Office (West Central Zone), Nagpur
Monitoring Report
Part – I
DATA SHEET

1st October 2023 to 31st March 2024

1.	Project type: River-valley/ Mining/Industry/Thermal/ Nuclear/Other (Specify)	Other- Infrastructure, Greenfield International Airport at Navi Mumbai
2.	Name of the Project Proponent	Navi Mumbai International Airport Pvt. Ltd (NMIAL)
3.	Clearance letter (s)/OM No. And Date	Earlier EC and CRZ clearance granted to CIDCO as Nodal agency appointed by Government of Maharashtra as under: 1 EC received vide F. No. 10-53/2009-I.A.III dated. 22.11.10 valid up to 21.11.2017 2 Extension of validity received vide F. No. 10-53/2009-IA.III dt 20.12.17 up to 21.11.2020. EC transferred from CIDCO to NMIAL (Navi Mumbai International Airport Pvt. Ltd) by MoEFCC vide F. No. 10-53/2009-IA-III dated. 17.08.2020 with same validity. Validity extended vide S. O. No. 4254 (E) dated 27.11.20 up to 21st May 2021 for all projects due to COVID pandemic by MOEFCC. CRZ recommendation received from Environment & Climate Change Department, Govt. of Maharashtra vide Letter No. CRZ 2021/CR 156/TC 4 Dated – 27.09.2021. Environmental Clearance and CRZ Clearance for on-going project granted by MOEFCC vide No. 21-60/2021-IA-III dated: 28.11.2021 valid up to 27.11.2031.
4.	Location: a) District (s)	Raigad
	b) State (s)	Maharashtra

	c) Location	Taluka Panvel
	d) Latitude/Longitude	Longitude - 073° 04' 12.95" E Latitude - 18° 59' 39.78" N
5.	Address for correspondence. a) Address of the Concerned Project Chief Engineer (With Pin Code and telephone/telex/fax numbers)	**Mr. Charudatta Deshmukh,** **Joint President & Head - Planning and Design** Navi Mumbai International Airport (P) Limited (NMIAL), Navi Mumbai International Airport Pvt Ltd, C17, New Project Office, Ulwe, Navi Mumbai, 410206. **Tel** 022-68519505 **Email**: Charudatta.Deshmukh@adani.com
6.	Salient features a) Of the project	The proposed project is for the establishment of an International Airport on a site of area 1160 Ha. The airport is designed to accommodate the aircraft (A-380 and equivalent) compatible to ICAO Standard of aerodrome 4-F. The ultimate passenger capacity of the airport will be 60 MPPA and cargo capacity of 1.5 MTPA. Airport will have two parallel independent runways for simultaneous and independent operation with the provision of full-length parallel taxi ways along runways. The length of runway is of 3700 m x 45 m with Runway End Safety Area (RESA) of 240 m x 150 m. Central Terminal Complex (CTC) comprising of three terminal buildings catering to domestic and international passengers and ATC Tower, Cargo terminal building of domestic and international Cargo. Fuel tank farm for Aviation Turbine Fuel (ATF). Facilities such as Multi Level Parking, GSE storage area, ATC Tower, airport ground lighting, airport lighting, apron, GSE maintenance, hangars along with other allied facilities etc. The project activities during construction phase to be done by NMIAL are land development by cutting of balance portion of hill and filling from + 5.5m AMSL to average +8.5m AMSL.

<table>
<tr><td></td><td></td><td>• Phase- I & II BUA (20 MPPA)- 6,27,335.678 m^2.
• Total BUA Area (60 MPPA)- 14,13,069.178 m^2.
• Project Cost (Phase-I & II) – Rs 19,646 Crores
• Total Project Cost- Rs 41,302 Crores.</td></tr>
<tr><td></td><td>b) Of the Environmental management plans</td><td>NMIAL is planned to be a resource efficient & Green airport. Environment Management Plan at construction and operations phase includes the following:
• Incorporation of LEED requirements at the design stage
• Noise and dust pollution minimization during construction phase,
• Carbon neutrality followed by Net Zero emission commitments
• Zero Sewage Discharge
• Rainwater Harvesting Ponds
• Generation and Utilization of Solar Power
• Energy Optimization
• Waste Re-cycling
• Natural Day Lighting
• Sustainable Aviation Fuel (SAF) storage & supply system
• Plantation & Landscape</td></tr>
<tr><td>7.</td><td>Breakup of the project area

a) Submergence area forest and non-forest</td><td>Airside Area- 942.25 Ha.
Landside area- 217.75 Ha
Total Area – 1160 Ha
<table><tr><th>Land use</th><th>Area (Ha)</th></tr><tr><td>Facilities, pavements, building and structures</td><td>605.47</td></tr><tr><td>Green/ open spaces</td><td>384.90</td></tr><tr><td>Transportation roads, parking, metro</td><td>139.32</td></tr><tr><td>Utilities</td><td>10.12</td></tr><tr><td>Drains</td><td>20.19</td></tr><tr><td>Total</td><td>1160.00</td></tr></table>
Permission for Removal of Mangroves (Order from Hon’ble Bombay High Court) Notice of Motion No. 419 of 2011 in PIL No. 87of 2006 dated 29th Oct 2013.</td></tr>
</table>

		Forest Clearance- 250.0635 Ha (Stage I and Stage II clearance obtained vide F. No. 8-95/2012-FC dated 17 December 2013 and 24 April 2017 respectively)
	b) Others	Not Applicable
	a. Total Plot Area	Total Plot Area 1160 Ha.
	b. Built - Up Area (Including Road)	Phase- I&II BUA (20MPPA)- 6,27,335.678 m^2 Total BUA Area (60 MPPA)- 14,13,069.178 m^2
	c. Open Space available	Phase I & II (20 MPPA) – 270.67 Ha Total Final Phase (60 MPPA) – 384.9 Ha
	d. Green Belt Area	Same as above.
8.	Breakup of the project affected population with enumeration of those losing house/dwelling units only agricultural land only. Both dwelling units and agricultural land and landless laborers/ artisans:	CIDCO has provided encumbrance free Right of Way (RoW) over entire land for the airport site i.e., 1160 ha to NMIAL as per the Concession Agreement (CA).
	a) SC, ST/Adivasis	--
	b) Others	--
9.	Financial details: a) Project cost as originally planned and subsequent revised estimates and the year of price reference:	a) Total cost of the development of airport comprising of aeronautical and nonaeronautical activities works out for four Phases at FY 2020 prices as provided in EIA report of 2021 is Rs.41,302 Cr. b) Estimated cost of Construction of Phase 1 & 2 to achieve passenger handling capacity of 20 MPPA and Cargo handling capacity of 0.57 MTPA is Rs. 15,982 Cr of NMIAL + Rs. 3,665 Cr pre-development cost incurred by CIDCO (excluding R&R cost) is Rs. 19,647 crores.
	b) Allocation made for environmental management plans with item wise and year wise break-up.	NMIAL has allocated Rs. 291.37 Cr for EMP for Development & Operation Phase of NMIA up to final phase.
	c) Benefit cost ratio/Internal rate of return and the year of assessment	-
	d) Whether (c) includes the cost of environmental	-

	management as shown in the above	
	e) Actual expenditure incurred on the project so far	a) Expenditure by CIDCO on pre-development works including land acquisition, rehabilitation and resettlement of project displaced persons and land development works Rs. 5409.67 Cr. b) Expenditure by NMIAL on planning & design, contractor advances, etc. till 31st March 2024: Rs. 6,170.45 Cr.
	f) Actual expenditure incurred on the environmental management plans so far	Rs. 10.22 Cr incurred on EMP till 31st March 2024 out of budgeted Rs. 291.37 Cr. (Ref: EIA 2021 Page C10-57 section 10.4)
10.	Forest land requirement: a) The status of approval for diversion of forest land for non-forestry use	Diversion of 250.0635 Ha of forest land was required for the project. Stage-I Forest Clearance was accorded to CIDCO vide F.No.8-95/2012-FC dt. 17.12.2013. Stage-II Forest Clearance was accorded to CIDCO vide F. No. 8-95/2012-FC dt. 24.04.2017.
	b) The status of clearing felling	Total number of non-forest trees at NMIA site to be felled was 9,492 out of which 7,234 trees were felled by CIDCO and balance 2,258 trees were felled by NMIAL after completing requisite formalities of tree survey, and permission from Tree Authority as per the Maharashtra (Urban Areas) Protection and Preservation of Trees Act, 1975 and Rules called The Maharashtra (Urban Areas) Protection and Preservation of Trees Rules – Rule 2009.
	c) The status of compensatory afforestation if any	Status of Compensatory Afforestation I. 37000+ saplings have been planted under tripartite agreement between the Forest department of Maharashtra, NMIAL and an NGO at Jite village near Alibag. II. Stage-I & Stage-II forest clearance for 250.0635 Ha land has been obtained from MoEF&CC vide letter no 8-98/212-FC dated 17-12-2013 and 24.04.2017 respectively. III. CIDCO has undertaken 109 Ha of compensatory mangroves plantation on NE of airport site on S. No. 27, village Kolhekhar between Jui creek and Taloja creek through

		the Mangrove Cell of State Forest Dept. as per the condition stipulated in the Forest Clearance. IV.HOFF (Head of Forest Forces, Maharashtra state, Nagpur) has visited site on 12th Dec 2018 and reviewed the compliance to Forest Clearance.
	d) Comments on the viability and sustainability of compensatory afforestation program in the light of actual field experience.	Plantation and protection of Mangroves over 109 ha as compensatory afforestation has been completed by Mangrove Cell on the instance of CIDCO at village Kolhekhar. Thane Forest Division has certified vide letter dt. 31st Oct 2019 that out of 1,00,000 mangrove saplings planted at above site about 92.5 % survived.
11.	The status of clear felling in non-forest areas (such as submergence area of reservoir, approach roads), if any with quantitative information	Total number of non-forest trees at NMIA site to be felled was 9,492 out of which 7,234 trees were felled by CIDCO and balance 2,258 trees were felled by NMIAL after completing requisite formalities of tree survey, and permission from Tree Authority as per the Maharashtra (Urban Areas) Protection and Preservation of Trees Act, 1975 and Rules called The Maharashtra (Urban Areas) Protection and Preservation of Trees Rules – Rule 2009.
12.	Status of construction a) Date of commencement (Actual and/or planned)	April 2017 Pre-development works commenced by CIDCO.
	b) Date of completion (Actual and/or planned)	30th December 2024 (Phase-I & II, 20 MPPA) (planned)
13.	Reason for the delay if the project is yet to start	Pre-development work at site commenced soon after the Forest Clearance was granted to the project. Project work could not be commenced till April 2017 pending grant of Stage II Forest Clearance for the project. Construction work commenced soon after the encumbrance free RoW on all 1160 Ha airport land was provided by CIDCO to NMIAL in June 2022.
14.	Dates of site visits	

	a) The dates on which the project was monitored by the Regional Office on previous occasions, if any	Site visit done by RO, MOEFCC on 11th Nov 2020 for monitoring compliance of EC. Compliance Report was received from Integrated Regional Office, MoEF&CC Nagpur vide Letter No. 6-22/2010 (ENV)/ 7994 Dated 31.03.2021 for which action taken report was submitted vide NMIAL/MOEF/GEN/0069 dt 01st Oct 21 for closing the raised observations.
	b) Date of site visit for this monitoring report	MoEF&CC, Regional Office at Nagpur has not intimated date of site visit.
15.	Details of correspondence with project authorities for obtaining action plans / information on status of compliance to safeguards other than the routine letters for logistic support for site visits. (The first monitoring report may contain the details of all the letters issued so far, but the later reports may cover only the letters issued subsequently.)	1. Action Taken Report (ATR) of Certification EC Compliance Report submitted to Regional Office Nagpur MOEF&CC dated 1st Oct 2021. 2. Certified Compliance Report Received vide letter F. No: 6-22/2010(ENV)/7994 dated 31st March 2021. 3. RO- MOEFCC has visited NMIA site on 11th Nov 2020. 4. Letter dated 29th Oct 2020 sent to IRO, Nagpur with monitoring data sheet and additional information of project for issuance of certification of Compliance Report for NMIA 5. Request letter dated 12th Oct 2020 sent to MOEF&CC Nagpur for Issuance of Certification of Compliance Report for Navi Mumbai International Airport (NMIA). 6. Request letter dated 4th June 2020 sent to MOEF&CC Nagpur for Issuance of Certification of Compliance Report for Navi Mumbai International Airport (NMIA).

EC COMPLIANCE REPORT
(1st Oct. 2023 to 31st Mar 2024)

Introduction

Environmental Clearance (EC)and CRZ Clearance was granted to NMIA project with CIDCO as project proponent, by Ministry of Environment, Forest, and Climate Change (MoEF&CC) on November 22, 2010, and Extension of Validity to EC was granted on December 20,2017. It was valid till November 2020. The MoEF&CC had extended validity of the EC accorded to NMIA project till November 21, 2021, during pandemic period.

NMIAL received transfer of EC, which was in CIDCO's name and valid till November 21, 2021, on NMIAL's name on August 17, 2020, from MOEF & CC. Fresh EC and CRZ Clearance has been granted for on-going project for 60 million Passengers Per Annum (MPPA) & Cargo capacity 1.5 MTPA, NMIA as the project proponent by MoEF&CC granted on November 28, 2021, and issued on December 01, 2021.

Present Status of completed/ on-going works are given as follows:
It comprises the following: Ongoing activities for Phase I & II (20MAP) works are as follows:

1. Cutting and/or transplantation of trees in non-forest area in the site as directed by Tree authority has been completed.
2. Construction of Ulwe recourse channel on the south of site completed.
3. Re-routing of High Voltage Transmission Lines from NMIA site by Tata Power and MSETCL are completed.

- **Terminal building:**

1. RCC works for Head house (HH) and East Pier completed. Grade slab, Block masonry, flooring works, ceiling painting, Column & Wall cladding, MEP services, Baggage handling system & VHT works are in progress in Head house area.
2. RCC Structure works for West Pier are substantially complete. Grade slab & Block masonry is in progress. Column cladding, Façade & MEP works are in progress in West Pier.
3. Erection of Structural Steel for Head house & East pier is in progress and substantially completed for West pier. Roof layers installation in Head House & West Pier is in progress.
4. Forecourt: RCC works are in progress and structural steel roofing works are being taken up.

- **Airside works:**

1. Construction of Airside Drains are in the advanced stage & Box Culverts are completed.
2. Terminal, Cargo & GA Apron areas: WMM, CTB, PQC for pavement & AGL works including deep base cans installation are in progress.
3. Underground Distribution network (HT/LT/ICT) works are in progress.

- **Construction of Utility buildings:**

1. Receiving Substation (RSS): RCC works completed. Flooring, toilet units & installation of Doors & Windows along with MEP works are in progress.
2. Distribution Substation (DSS-E & W): RCC works are complete. Finishing (Blockwork, Plastering & Painting) works along with MEP works are in progress.
3. Water Storage Tank & Pump House (West & East): RCC Structure works are in progress.
4. Sewage Treatment Plant (West & East): Substructure work is ongoing.
5. Central Utility Plant Building: RCC works completed. Blockwork & MEP work is in progress.

- **Construction of Support & Landside Facilities:**

1. Airport Rescue Fire Fighting (ARFF) & ATC Tower: Superstructure RCC works are complete. Grade slab, Blockwork & MEP works are ongoing in the building.
2. ATC Technical Block: Superstructure RCC, Blockwork & MEP works are in progress.
3. India Metrological Department (IMD) Building: Superstructure RCC works are in progress.
4. Constant Current Regulator (West & East): RCC works are completed. Finishes & MEP works are in progress.
5. Airport Maintenance Building (AMB): Substructure & Superstructure RCC works in progress.
6. ASR-2 (within NMIA Site): RCC works are substantially completed. Grade slab & Blockwork is in progress.
7. DVOR & ILS Structure: AAI equipment installation on DVOR pedestals is ongoing. Hut RCC works completed. Foundations for localizer and Glide path equipment & frangible Hut completed at both 08R & 26L.
8. Landside works: Departure ramp, Vehicular & passenger Underpass and Drain works are in progress. In Western main access road & At grade parking, subbase filling is in progress. In Eastern main access road, select-fill & GSB works are substantially completed. Utility crossing works are in progress. Foundation works for MLCP have commenced.

- **Miscellaneous Facilities:**

1. Administration Building (W): Substructure works are in progress.
2. Fuel Farm:
    - 4ATF & 2FW Tanks: RCC works for ATF tank dyke wall is in progress. Fabrication & erection works for all the tanks are in progress.
    - Underground (UG) tanks: Substructure RCC works are in progress along with fabrication of these tanks.
    - Gantry shift office & Electrical room: Superstructure slab completed. Blockwork is in progress for electrical room.
    - Admin building, Workshop & Tank truck loading/unloading gantry: Substructure RCC works are in progress.
    - FW, FHS & Decanting Pump House: Structural steel erection works completed.

- Integrated Airport Cargo Terminal: RCC works are in progress for various buildings. Offsite PEB structural steel fabrication works are in progress for the Main Cargo building.

- Airport Operational Staff Facility (AOSF): Substructure works are in progress.
- GSE Maintenance Facility: Substructure works are in progress.
- Reserved Housing: Superstructure works for clubhouse and substructure works for remaining buildings are in progress.
- Police Station: Substructure works are in progress.
- Into Plane facility: Substructure works are in progress.
- Hazardous waste storage: Substructure works are in progress.
- Airport Health Organization: Substructure works are in progress.

Anticipated construction completion date for Phase I & II (20 MAP) works is 30th Dec'24.

MOEF&CC's Environment and CRZ Clearance identification No.EC21A029MH183036 & file no 21-60/2021-IA-III dated November 28, 2021, and issued on December 01, 2021.

Project is under construction. Detailed pointwise compliance report pertaining to the reporting period (October 2023 – Mar 2024) for construction phase is given below. Compliance with operation phase conditions will be complied prior to the commissioning of the airport.

	EC & CRZ Conditions-2021	Compliance Status
A	**Specific Condition**	
i.	Conditions specified in Environmental & CRZ Clearance issued vide letter No. 10-53/2009-IA.III dated 22.11.2010 shall be strictly complied.	**Agreed to Comply:** We will abide by the conditions specified in Environmental & CRZ Clearance issued vide letter No. 10-53/2009-IA.III Dated 22.11.2010. Status of compliance is given **Annexure-I.**
ii.	PP shall submit compliance report to IRO-MoEF&CC, Nagpur for pending compliances within 6 months.	**Complied-** We will abide by the condition.
iii	Where construction activity is likely to cause noise nuisance to nearby residents, restrict operation hours between 7 AM to 6 PM.	**Being Complied:** Noise making construction activities such as drilling are being carried out only during Day time between 7 AM and 6 PM. **Following measures are being taken to reduce load on Ambient Noise & Air:** ▪ The noise generating activities are being carried out only during daytime.

	EC & CRZ Conditions-2021	Compliance Status
		▪ Separate Entry & Exit for the construction vehicles has been provided. ▪ Construction vehicles are mostly within site and do not exit project site. However, vehicles if any, entering or exiting site, for that separate exit & entry have been provided.
iv	Hazard Identification and Risk Assessment for the project shall be carried out and adequate mitigation measures shall be adopted to ensure that all safety issues are addressed. The documentation shall be reviewed periodically and shall be submitted to the regional office along with six-monthly compliance report.	**Agreed to Comply:** NMIAL has engaged an EPC contractor for ongoing work. Contractor has own HSE team at site which is supervised by NMIAL site HSE Team led by GM – Safety of NMIAL. Each contractor works out an Occupational Health, and Safety Emergency plan identifying occupational safety hazards, assesses probability of occurrence of the hazard along with intensity of likely damage and how risk posed by these hazards will be mitigated. Contractor adopts following tools to identify safety measures required during ongoing work. - conduct Training program - Tool Box Talks on HSE issues - Safety committees - HSE audit - HIRA - accident investigation - Monthly & quarterly reports Similar practices are being continued during construction phase.
v	A detailed traffic management and traffic decongestion plan shall be drawn up to ensure that the current level of service of the roads within a 05 km radius of the project is	**Complied:** CIDCO, the nodal agency for Navi Mumbai International Airport has prepared "Detailed Traffic Management and Traffic Decongestion Plan for Navi Mumbai

	EC & CRZ Conditions-2021	Compliance Status
	maintained and improved upon after the implementation of the project. This plan should be based on cumulative impact of all development and increased habitation being carried out or proposed to be carried out by the project or other agencies in this 05 Kms radius of the site in different scenarios of space and time and the traffic management plan shall be duly validated and certified by the State Urban Development Department and the P.W.D./ competent authority for road augmentation and shall also have their consent to the implementation of components of the plan which involve the participation of these departments.	International Airport (NMIA)" in April 2020 which ensure that the current level of service of the roads within a 05 km radius of the project is maintained and improved upon after the implementation of the project. CIDCO has submitted final report for "Detailed Traffic Management and Traffic Decongestion Plan for Navi Mumbai International Airport (NMIA)" to MOEF vide letter No. CIDCO/GM(ENV&F)/NMIA/2020 /491 dated 14th July 2020. MMRDA also published "Updation of Comprehensive Transportation Study (TRANSFORM -2) for Mumbai Metropolitan Region" in year 2020 including Traffic decongestion plans and suggestions for Navi Mumbai International Airport at Regional and local level. Development of all transportation infrastructure required for NMIA (along with obtaining clearances and compliances for the same) is being done by CIDCO as per NOC for transfer of EC and CRZ clearance given by CIDCO to NMIAL vide letter No. CIDCO/T&C/CT&CP/ NMIA/1317 dt 10th Feb 2020.
vi	Solar power generation capacity of 22.14 MW shall be established as proposed.	**Agreed to Comply:** NMIA is likely to enhance solar power installation capacity to approximately 28 MW from Phase I & II (20 MPPA) current commitment of 22.14 MW in EMP. In final phase solar power installation capacity will increase to about 36 MW.
vii	Rainwater harvesting pond of 29,747 cum capacity shall be provided as proposed. Rainwater harvesting structures shall conform of CGWA designs. Before recharging the surface run off, pre-treatment must	**Agreed to Comply:** Since project is yet to be operational, we assure to abide by the condition. Design and planning of the surface drainage includes creation of RWH ponds of requisite capacity.

	EC & CRZ Conditions-2021	Compliance Status
	be done to remove suspended matter, oil and grease.	Necessary pre-treatment like oil water separator and silt ponds are also proposed to remove suspended matter, oil and grease.
viii	A certificate from the competent authority/ agency handling municipal solid wastes should be obtained, indicating the existing civic capacities of handling and their adequacy to cater to the M.S.W generated from project.	**Agreed to Comply:** During the reporting period, only land development and construction work is ongoing at site. EPC contractors have appointed authorized waste handlers for MSW generated at labour camp. To handle MSW at the operational phase, in planning and design, various strategies have been incorporated to minimize waste going to the landfill site. NMIAL has received a letter from CIDCO, vide No. CIDCO/T&C/CGM(T&A)/2023/E-715 dated October 20, 2023, wherein CIDCO has agreed to accept the MSW waste generated by NMIAL during the operation phase.
ix	Fresh water requirement from local authority shall not exceed 10.61 MLD during final operational phase. As committed, no groundwater abstraction shall be done during construction as well as operation phase of the project.	**Agreed to Comply:** We will abide by the condition. The total water demand in final phase is 21.80 MLD. Of which, freshwater demand of 10.60 MLD will be sourced from CIDCO and balance 11.20 MLD will be recycled water from on – site STPs. There will be no ground water abstraction carried out during construction phase as well as operational phase of project.
x	As proposed, wastewater shall be treated in onsite STPs of total 14.25 MLD capacity (during final phase). Treated water from the STP shall be recycled and reused for gardening, flushing etc. There shall be no discharge of treated water from the project as proposed.	**Agreed to Comply:** Since project is yet to be operational, we assure to abide by the condition. Design and Planning of the facility has incorporated STPs of requisite capacity for Phase 1 & 2 and treated water from STPs will be used for flushing, gardening & HVAC purpose.

	EC & CRZ Conditions-2021	Compliance Status
		There will be no discharge of treated water from the project.
xi	The project proponents would commission a third-party study on the implementation of conditions related to quality and quantity of recycle and reuse of treated water, efficiency of treatment systems, quality of treated water being supplied for flushing (specially the bacterial counts), comparative bacteriological studies from toilet seats using recycled treated waters and fresh waters for flushing, and quality of water being supplied through spray faucets attached to toilet seats.	**Agreed to Comply:** Since project is yet to be operational, we assure to abide by the condition.
xii	Area for greenery shall be provided as per the details provided in the project document i.e., about 384.90 ha. will be developed as green area.	**Agreed to Comply:** Since first phase of project is under implementation and project is yet to be operational, we assure to abide by the condition, by final phase.
xiii	PP shall explore the use of non-ozone depleting substances in air conditioning systems.	**Agreed to Comply:** Non-ODP refrigerant is specified for chillers & DX units (air conditioning system) to avoid depletion of ozone layer in environment. We assure to abide by the condition.
xiv	The PP shall also provide electric charging points in the parking areas for e-vehicles.	**Agreed to Comply:** Provisions are made in NMIA Master Plan for charging points for e-vehicles in parking areas.
xv	The proposed ongoing work of Navi Mumbai International Airport should be carried out strictly as per the provisions of CRZ Notification, 2011 as amended from time to time and with a commitment of protection and conservation of coastal environment.	**Agreed to Comply:** provisions of CRZ Notification will be strictly complied. Project has obtained CRZ recommendation from Environment & Climate Change Department, Govt. of Maharashtra vide letter No. CRZ 2021/CR 156/TC 4 dated 27.09.2021 on the basis of which MOEF&CC has issued CRZ clearance along with EC.

	EC & CRZ Conditions-2021	Compliance Status
xvi	NMIA shall carry out the balance work without change in location, scope, area or capacity.	**Agreed to Comply:** NMIA will carry out development work without change in location, scope, area, or capacity.
xvii	No mangrove destruction is allowed to carry out balance ongoing work of the project. There shall not be violation of the Hon'ble High Court order dated 23rd October 2013 in PIL 87/2006.	**Agreed to Comply**: We undertake that no mangrove destruction will be carried out for balance ongoing work at the project, and that there will not be violation of the Hon'ble High Court order dated 23rd October 2013 in PIL 87 /2006.
xviii	Work of diversion of Ulwe and Gadhi River is completed. NMIA shall carry out the studies pertaining hydraulic flow conditions, to understand the impact of diversion of Ulwe and Gadhi streams on Panvel Creek coastline, its coastal ecology and surrounding area/ settlements/ habitat/ social economic pattern. The hydraulic study shall also consider the anticipated impacts of climate change and sea level rise on proposed airport site and surrounding area. Hydraulic studies need to be carried out with an objective to anticipate the probable flooding situations in low lying areas and accordingly implement the possible mitigation measures.	**Complied:** It may be noted, as per CIDCO report, as submitted to MOEFCC, that: 1. CWPRS, Pune has carried out 1D, 2D mathematical & physical Model studies based on the MoEF's approved layout plan of airport covering 1160 Ha. CIDCO has designed the master drainage plan of surrounding areas by incorporating the various recommendations of CWPRS. 2. The detailed drainage plan for the airport has been prepared by the NMIAL as a part of Airport Master Plan, incorporating CWPRS recommendations and integrating with CIDCO drainage plan and abiding by the EC conditions. The storm Water from NMIA project area will be discharged in Panvel creek and Gadhi River after settling fine particles in the silt pond proposed before outfall. 3. The Drainage Master Plan of airport is prepared for the worst conditions (highest high tide, tidal surge, maximum rainfall intensity of 148.1 mm and simultaneous flooding in all rivers). NMIAL had engaged CWPRS to review the internal drainage system designed for the airport area to ensure its compatibility and suitability with external Drainage

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		Master Plan of CIDCO for surrounding areas. 4. The Master plan developed by NMIA has ensured that there will be no discharge into the Ulwe recourse channel from Airport as mandated in EC.
xix	NMIA shall regularly monitor the marine water quality of the Panvel creek during construction and post construction of the project.	**Agreed to Comply:** During construction period Marine Water quality monitoring is carried out once every three months by NMIAL through MoEF&CC recognized & NABL accredited Laboratory. Monitoring will be continued during operation phase. Environmental monitoring reports for the reporting period are enclosed herewith as **Annexure-II**.
xx	NMIA shall ensure that all ground service vehicles will be operated on Electric or CNG. No petrol/diesel vehicles would be allowed in the Airport Premises.	**Agreed to Comply:** Since project is yet to be operational, NMIA assures to abide by the condition subject to the availability of functionally suitable EVs approved by the authorities.
xxi	Mangrove Park shall be developed in consultation with Mangrove Cell, on site identified by the CIDCO.	**Agreed to Comply:** All matters pertaining to development and maintenance of mangrove pockets will be in scope of CIDCO as per NOC for transfer of EC and CRZ clearance given by CIDCO to NMIAL vide letter No. CIDCO/T&C/ CT&CP/NMIA/1317 dt. 10th Feb 2020. NMIA has requested for an update from CIDCO regarding mangrove park development.
xxii	NMIA to implement environment measures such as rainwater harvesting, solar lighting, efficient solid and hazardous waste management practices. NMIA shall ensure the zero liquid discharge	**Agreed to Comply:** Rainwater harvesting has been planned for implementation by the final phase. Roof top solar panels will be installed in Terminal-1. Source segregated waste management

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	during construction and operation of the project.	system has been planned for Phase 1 & 2 (20MPPA). Requisite energy conservation and water conservation measures will be adopted. Entire quantity of treated sewage will be recycled for various purposes within the NMIA boundary thereby ensuring Zero Liquid Discharge.
xxiii	NMIA during construction shall not disturb the coastal ecology comprising mangroves/mudflats present along the Panvel creek, present outside the northern boundary of the project site.	**Agreed to Comply:** During construction stage, all activities will remain within the boundary of 1160 Ha. EPC contractors through contractual terms and conditions are instructed to ensure that no area out of NMIA premises of 1160 Ha should be disturbed due to the construction activities of the contractors. Along the northern boundary, a road of 60 meter width is being constructed by non-NMIA contractors for CIDCO.
xxiv	NMIA should carry out detailed study on the impact of fishing and livelihood of people depending on local fishing and take efforts to maintain the livelihood of traditional fisher folks supposed to be affected by the project directly or indirectly.	**Agreed to Comply:** NMIA construction activities are confined within the NMIA boundary, there is no work proposed in water or at waterfront, therefore there is no direct impact of NMIA project on fishing activity in surrounding water bodies. NMIA shall comply with the condition by studying the relevant data about fishermen from 9 settlements from 8 revenue villages on the NMIA site which were resettled elsewhere by CIDCO.
xxv	Green belt area (33% of total project area) of adequate width and density with local species along the periphery of the project site shall be developed so as to provide protection against particulate matter and noise	**Agreed to Comply:** Green Area of 33% of Airport site area has been provided.

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xxvi	NMIA shall set up a full-fledged in-house Environment Management Cell comprising concern experts for effective implementation of Environment Management Plan. The EM Cell shall carry out marine water quality monitoring, erosion/accretion status of the coastline along Panvel Creek, monitoring of tidal flow patterns due to diversion of Ulwe & Gadhi streams, development of mangrove park etc. and implement recommendations of the Socio-economic study as well as Disaster Management Plan.	**Agreed to Comply:** NMIA has a full-fledged in -house Environment Management Cell comprising of Deputy General Manager (Environment and Sustainability) with a site Health, Safety and Environment (HSE) Team headed by General Manager (HSE) which is part of construction vertical. Deputy General Manager – E & S reports to the Joint President & Head - Planning and Design. Marine water quality monitoring is being carried out on quarterly basis through NABL approved laboratory and results are uploaded on NMIA web site regularly.
xxvii	NMIA/ CIDCO to implement. the recommendations of the report on the BNHS with respect to protection/ conservation of the biodiversity around the Airport site.	Agreed to Comply: BNHS was appointed by CIDCO to do the Base Line Survey of Avian Fauna between 2012 to 2016. CIDCO has also signed a long-term MOU (ten-year period ending 2028) with BNHS. Aim of this decadal study is long term monitoring, conservation, and supervision of the terrestrial and water birds with reference to NMIA and associated regions and implementation of Bird Threat Mitigation Plan. NMIAL presented its concerns regarding some of the bird sites (NRI colony (NRI), Training Ship Chanakya (TCS) and Delhi Public School (DPS)) being located close to the airport, as they come within Inner Horizontal Surfaces (IHS) of NMIA. BHNS Annual Report 2022-2023 has presented preliminary observations on flight pattern of birds at Thane Creek. The Report in its preliminary observations No.5 (Pg.28) of **Annexure-IV** states that "The flight pattern of birds in Thane Creek,

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		potentially including their path intersecting with the approach path of NMIA runways 08L & 08R (for westerly takeoffs/landings), has been subject to study by BNHS. According to the data visualization, it appears that aircraft taking off or landing on NMIA runways typically maintain an altitude above the observed flight elevation of birds in Thane Creek. This is also the case for Runway 09-27 of existing Mumbai airport, as its eastern approach passes near Thane Creek Flamingo Sanctuary". CIDCO/ NMIA shall implement the BNHS recommendations for conservation of the biodiversity around the airport site.
xxviii	The Environmental and CRZ Clearance to the project is primarily under provisions of EIA Notification, 2006 and CRZ Notification, 2011. The Project Proponent is under obligation to obtain approvals/clearances under any other Acts/ Regulations or Statutes as applicable to the project.	**Complied:** NMIAL is obtaining all necessary approvals for the project for establishment of green field airport on 1160 Ha site. Similarly, CIDCO is obtaining separate approvals for associated infrastructure at area surrounding the airport.
B	**Standard Conditions:**	
I	**Statutory compliance:**	
i.	The project proponent shall obtain forest clearance under the provisions of Forest (Conservation) Act, 1980, in case of the diversion of forest land for non-forest purpose involved in the project.	**Complied:** Stage-I & Stage-II forest clearance for 250.0635 Ha land has been obtained from MoEF&CC vide letter no 8-98/212-FC dated 17-12-2013 and 24.04.2017 respectively.
ii.	The project proponent shall obtain clearance from the National Board for Wildlife, if applicable.	**Complied:** Wildlife Clearance was recommended in the 29th Meeting of Standing Committee and communicated vide Minutes No. P.No.6-43/2007 WL-I dt. 1st August, 2013 of Wildlife Division of Ministry of Environment & Forest, Govt. of India.
iii	The project proponent shall prepare a Site-Specific Conservation Plan &	**Agreed to Comply:** Discussion with wildlife conservation consultants is in

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	Wildlife Management Plan and approved by the Chief Wildlife Warden. The recommendations of the approved Site-Specific Conservation Plan/ Wildlife Management Plan shall be implemented in consultation with the State Forest Department. The implementation report shall be furnished along with the six-monthly compliance report (in case of the presence of Schedule-I species in the study area).	progress. The study will be completed and approval from the Wildlife Warden will be obtained in due course of time post which Site-Specific Conservation Plan/ Wildlife Management Plan shall be implemented in consultation with the State Forest Department.
iv.	The project proponent shall obtain Consent to Establish/Operate under the provisions of Air (Prevention & Control of Pollution) Act, 1981 and the Water (Prevention & Control of Pollution) Act, 1974 from the concerned State Pollution Control Board/ Committee,	**Complied:** NMIA has been granted CTE for Phase 1 & 2 of the project for passenger capacity of 20 MPPA & 0.57MTPA Cargo by MPCB vide letter dated June 15, 2022 (**Annexure-III**).
V.	The project proponent shall obtain the necessary permission from the Central Ground Water Authority, in case of drawl of ground water/ from the competent authority concerned in case of drawl of surface water required for the project.	**Not applicable** No ground water to be tapped during construction or operation phases. CIDCO has assured water supply for the project.
vi	Clearance from Directorate General of Civil Aviation (DGCA) and Airports Authority of India (AAI) for safety and project facilities shall be obtained.	**Agreed to Comply:** NMIAL has prepared Airport safety and security plan which are approved by DGCA, AAI, BCAS & CIDCO as per following details. 1. In-Principal Approval to NMIA Master Plan for Construction of Navi Mumbai International Greenfield Airport at Navi Mumbai by Director General of Civil Aviation (DGCA), Govt. of India vide AV.20024/40/2003-AL dt 28th August 2018 2. In-Principal Approval to NMIA Master Plan for Construction of Navi Mumbai International Greenfield Airport at Navi Mumbai by Bureau of

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		Civil Aviation Security (BCAS), Govt. India vide CAS-6/2018/Div-Ops-I/Navi Mumbai (E-135357) dt 28th August 2018. 3. Approval of Bureau of Civil Aviation Security (BCAS), Govt. of India for construction of Terminal-1 Building on NMIA vide CAS-6/2018/Div-Ops-I/Navi Mumbai (E-135357) dt 26th July 2019. 4. Approval of BCAS GoI for Security Vetting/ Security Clearance to updated Master Plan for Phase 1 & 2 (combined) of Navi Mumbai International Airport (NMIA), vide CAS(M)-2018/DIV-II/F-97 /Navi Mumbai (E-131269) dated 02/02/2023. 5. Approval of updated plan 2022 design stage security vetting for proposed airport operations and support facility building for Phase 1&2 (Combined) of Navi Mumbai International Airport (NMIA)- reg. dated 11th Aug 2023.
vii	A certificate of adequacy of available power from the agency supplying power to the project along with the load allowed for the project should be obtained.	**Agreed to Comply:** The energy demand is estimated under the Master Plan prepared by the NMIAL and shows that cumulative peak power demand will be 96 MVA which is much lower than the CEIA-2017 estimate of 190 MVA, by adhering to ECBC norms. The power supply requirement will be met through Maharashtra State Electricity Transmission Company Limited (MSETCL) Approval/NoC from MSETCL for Power Supply to NMIA vide MSETCL/CO/STU/EHV Cons/ NMIA/ NO13379 dt 27th December 2018.
viii	All other statutory clearances such as the approvals for storage of diesel	**Agreed to Comply:**

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	from Chief Controller of Explosives, Fire Department, Civil Aviation Department shall be obtained, as applicable by project proponents from the respective competent authorities.	NMIAL has obtained Fire safety approvals as per following details. 1. Approval/ NoC of Fire Dept. CIDCO for Location of Airport Rescue & Fire Fighting Stations (ARFF) in NMIA Master Plan vide CIDCO/FIRE/HQ/ 2019/542 dt 30th September 2019. 2. Fire NoC from Fire Dept. CIDCO for Construction of Terminal-1 Building on NMIA vide CIDCO/FIRE/HQ/ 665/2019 dated 20th December 2019. 3. Petroleum & Explosives Safety Organization (PESO) approval regarding Class B Petroleum Storage Installation in Fuel Farm of NMIA received vide-A/P/HQ/MH/15/7592 (P562332) dated 20th April 2023. Other requisite approvals will be obtained progressively as project reaches respective stages.
I.	**Air quality monitoring and preservation:**	
i.	The project proponent shall install system to carryout Ambient Air Quality monitoring for common/criterion parameters relevant to the main pollutants released (e.g., PM_{10} and $PM_{2.5}$ in reference to PM emission, and SO_2 and NOx in reference to SO_2 and NOx emissions) within and outside the airport area at least at four locations (one within and three outside the plant area at an angle of 120 each), covering upwind and downwind directions.	**Agreed to Comply:** At Operations stage, air quality monitoring will be carried out by Continuous Ambient Air Quality Monitoring Station of NMIAL at suitable location. In the meantime, at construction stage, NMIAL has appointed a Laboratory recognized by MOEFCC, for the monitoring for Air & noise (9 stations) and Ground water sampling (up to 5 locations) on monthly basis. Marine/ Surface water (10 stations), & soil sampling (up to 5 locations) on quarterly basis. Environmental monitoring reports for the reporting period are enclosed herewith. (**Annexure-II**)

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ii	Diesel power generating sets proposed as source of backup power should be of enclosed type and conform to rules made under the Environment (Protection) Act, 1986. The height of stack of DG sets should be equal to the height needed for the combined capacity of all proposed DG sets. Use of low Sulphur diesel. The location of the DG sets may be decided with in consultation with State Pollution Control Board.	**Agreed to Comply**: We assure MOEFCC to abide by the condition during construction & operational phases. The DG sets will be operated only during power failure. Location of DG sets will be in utility blocks and plan showing utility block locations is submitted to MPCB at the time of grant of CTE.
iii	Soil and other construction materials should be sprayed with water prior to any loading, unloading or transfer operation so as to maintain the dusty material wet.	**Being Complied**: At present, during construction phase, water is being sprinkled on trucks carrying excavated material, as also on roads and near construction sites e.g., material handling, RMC plant etc. to suppress dust prior to loading, unloading at regular intervals.
iv	The excavation working area should be sprayed with water after operation so as to maintain the entire surface wet.	**Being Complied**: Excavation working area is sprayed with water during construction activity.
v	Excavated materials shall be handled and transported in a manner that they do not cause any problems of air pollution.	**Being Complied:** Excavated material is mostly rock and has minimal soil. However, for such movement of any soil, spraying with water is being carried out. Excavation working area is sprayed with water during construction activity.
vi	The soil/ construction materials carried by the vehicle should be covered by impervious sheeting to ensure that the dusty materials do not leak from the vehicle.	**Being Complied:** for all incoming and outgoing vehicles (carrying Soil/Loose Construction Material) from site the vehicle tops are being covered.
	II. Water quality monitoring and preservation:	
i	Run off from chemicals and other contaminants from aircraft maintenance and other areas within the airport shall be suitably contained and treated before disposal. A spillage and contaminant plan shall be drawn	**Agreed to Comply**: Oil water separator and silt pond are planned at all apron area to remove oil and chemicals in storm water. Storm

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	up and implemented to the satisfaction of the State Pollution Control Board.	water will be disposed as per MPCB norms.
ii	Proper drainage systems, emergency containment in the event of a major spill during monsoon season etc. shall be provided.	**Agreed to Comply**: The storm water drainage system of NMIA is designed for 100 years return record with rainfall intensity 148.1 mm/hr. which is capable to handle any major spill during monsoon season. To contain major spills, specially designed kits containing absorbent pads and cushions will be provided on oil dispensing vehicles during operations phase.
iii	The runoff from paved structures like Runways, Taxiways, can be routed through drains to oil separation tanks and sedimentation basins before being discharged into rainwater harvesting structures.	**Agreed to Comply**: The runoff from paved area like runways, taxiways are routed through oil water separator at various places and treated water will be discharged as per MPCB norms.
iv	Storm water drains are to be built for discharging storm water from the airfield to avoid flooding/ water logging in project area. Domestic and industrial wastewater shall not be allowed to be discharged into storm water drains.	**Agreed to Comply:** Separate storm water drainage system is planned to prevent water logging in airfield. Separate sewage system is planned to collect the sewage from airport. Sewage will be treated in sewage treatment plant with UF, and RO. Entire treated water will be used for flushing, gardening and HVAC purpose and there will be no discharge at outfall.
v	Rainwater harvesting for roof run-off and surface run-off, as plan submitted should be implemented. Rainwater harvesting structures shall conform to CGWA designs. Before recharging the surface run off, pre-treatment must be done to remove suspended matter, oil and grease.	**Agreed to Comply**: We assure MOEFCC to abide by the condition during operational phase. Surface run-off from apron areas will pass through oil & grease separator before reaching RWH pond. Silt pond has been provided prior to outfall to settle other particulate matter.
vi	Total freshwater use shall not exceed the proposed requirement as provided in the project details. Prior permission from competent authority	**Agreed to Comply**: The total water demand in final phase is 21.80 MLD. Of which, freshwater demand of

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	shall be obtained for use of fresh water.	10.60 MLD will be sourced from CIDCO. Water supply assurance has been obtained from Water Supply Dept. CIDCO for Water Supply to NMIA vide CIDCO/ EE (Hetwane)/ 2018/ 322 dt 3rd August 2018.
vii	A certificate from the competent authority for discharging treated effluent/untreated effluents into the Public sewer/ disposal / drainage systems along with the final disposal point should be obtained.	**Being Complied**: Consent to Establish Phase-I&II granted by MPCB. Vide Format1.0/CAC/UAN No MPCB-CONSENT-0000128221 /CE/2206000673 dated 15th Jun 2022. (**Annexure -III**) 100% Recycling and reuse of treated sewage water is being planned in cooling tower make-up, flushing and gardening. STP including quaternary system of RO has been proposed. Since, project is yet to be operational. We assure MOEFCC to abide by the condition
viii	A detailed drainage plan for rainwater shall be drawn up and implemented.	**Being Complied**: NMIA has prepared the detailed drainage master that was reviewed and approved by CWPRS. The same drainage master plan is being implemented.
III.	**Noise monitoring and prevention:**	
i	Noise level survey shall be carried as per the prescribed guidelines and report in this regard shall be submitted to Regional Officer of the Ministry as a part of six-monthly compliance report.	**Being Complied**: Ambient Noise monitoring is regularly carried out every month & reports in this regard submitted to regional office of the Ministry as part of six- monthly compliance report regularly. (**Annexure II**)
ii	Noise from vehicles, power machinery and equipment on-site should not exceed the prescribed limit. Equipment should be regularly serviced. Attention should also be given to muffler maintenance and enclosure of noisy equipment's.	**Agreed to Comply**: We assure MOEFCC to abide by the condition during construction & operational phases. All contractors have been asked to ensure regular servicing of the equipment and vehicles.

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iii	Acoustic enclosures for DG sets, noise barriers for ground-run bays, ear plugs for operating personnel shall be implemented as mitigation measures for noise impact due to ground sources.	**Agreed to Comply**: We assure MOEFCC to abide by the condition. DG sets will be CPCB certified with acoustic enclosure, PPE shall be provided to the DG set operator. Wherever permissible, noise barriers will be installed for ground-run bays.
iv	During airport operation period, noise should be controlled to ensure that it does not exceed the prescribed standards. During nighttime the noise levels measured at the boundary of the building shall be restricted to the permissible levels to comply with the prevalent regulations.	**Agreed to Comply**: We assure MOEFCC to abide by the condition during airport operation period.
IV.	**Energy Conservation measures:**	
i.	Energy conservation measures like installation of LED/CFL.s/TFLs for the lighting the areas outside the building should be integral part of the project design and should be in place before project commissioning.	**Agreed to Comply**: Energy efficient light fittings have been considered in the design of lighting system. Necessary energy conservation and water conservation measures will be adopted.
V.	**Waste management:**	
i.	Soil stockpile shall be managed in such a manner that dust emission and sediment runoff are minimized. Ensure that soil stockpiles are designed with no slope greater than 2:1 (horizontal/ vertical).	**Being Complied**: We assure MOEFCC to abide by the condition during construction phase. Opportunity to conserve the stockpile is limited as most of the excavated material is used in raising plot level to 8.5 m AMSL.
ii	The project activity shall conform to the fly Ash notification issued under the E P. Act of 1986.	**Being Complied**: Fly ash has been considered in the concrete mix design and is being used during construction. EPC contractor has been asked to maintain record for use of fly ash.
iii	Solid inert waste found on construction sites consists of building rubble, demolition material, concrete; bricks, timber, plastic, glass, metals, bitumen etc. shall be reused/	**Being Complied**: Inert material comprising of construction and demolition debris is collected and filled at a designated place within NMIA site. EPC contractors are giving

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	recycled or disposed of as per Solid Waste Management Rules, 2016 and Construction and Demolition Waste Management Rules, 2016.	other recyclable material such as glass, metal, cardboard, paper, etc. to a registered scrap dealer.
iv	Any wastes from construction and demolition activities related thereto shall be managed so as to strictly conform to the Construction and Demolition Waste Management Rules, 2016.	**Being complied**: Construction and demolition waste generated during development phase is being handled as per The Construction and Demolition (C&D) Waste Management Rules, 2016. We assure MOEFCC to abide by the condition during construction phase.
v	The project proponents shall implement a management plan duly approved by the State Pollution Control Board and obtain its permissions for the safe handling and disposal of:	**Agreed to Comply**: NMIAL shall prepare Waste Management Plan for operations stage and submit the same along with application for Consent to Operate to be obtained from MPCB prior to the commencement of airport operation.
	a. Trash collected in flight and disposed at the airport including segregation, collection and disposed.	**Agreed to Comply:** Trash collected at flight will be transported to the solid waste plant at NMIA wherein segregation will take place. The reusable, recyclable will be stored in closed room and to be taken away by MPCB authorised vendors. Non degradable and inert waste to be transferred to authorized waste disposal area of CIDCO.
	b. Toilet wastes and sewage collected from aircrafts and disposed at the Airport.	**Agreed to Comply:** Sewage cart trucks shall be taken to aircraft location and sewage from aircraft shall be collected in sewage tank inside sewage carts loaded sewage truck shall be taken to Triturator for primary treatment and further will be pumped to sewage treatment plant for final treatments. Treated sewage will be used for non-potable purpose.
	c. Wastes arising out of maintenance and workshops	**Agreed to Comply:** Wastes arising from maintenance and workshop will be stored at NMIA in closed room at

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		ambient temperature and the same will be taken away by MPCB/CPCB authorised vendors.
	D. Wastes arising out of eateries and shops situated inside the airport complex.	**Agreed to Comply:** Wastes from eateries will be sent to bio-conversion plant proposed at NMIA to form compost and biogas. Compost will be used as a manure to landscape area of NMIA.
	e. Hazardous and other wastes	**Agreed to Comply**: Hazardous Wastes arising from maintenance and workshop will be stored at NMIA in closed room at ambient temperature and the same will be taken away by MPCB/CPCB authorised vendors.
vi.	The solid wastes shall be segregated as per the norms of the Solid Waste Management Rules, 2016. Recycling of wastes such as paper, glass (produced from terminals and aircraft caterers), metal (at aircraft maintenance site), plastics (from aircrafts, terminals and offices), wood, waste oil and solvents (from maintenance and engineering operations), kitchen wastes and vegetable oils (from caterers) shall be carried out. Solid wastes shall be disposed in accordance to the Solid Waste Management Rules, 2016 as amended.	**Agreed to Comply**: We assure MOEFCC to abide by the condition during construction & operational phases. Requisite area has been provided for waste collection, segregation, safe storage and compliant disposal as per Solid Waste Management Rules 2016.
vii.	Used CFLs and TELs should be properly collected and disposed off/ sent for recycling as per the prevailing guidelines/rules of the regulatory authority to avoid mercury contamination.	**Agreed to Comply:** Since project is yet to be operational, we assure to abide by the condition. Used CFL and TFLs will be collected and disposed of through MPCB authorized disposal facilities.
VI.	**Green Belt:**	
i.	Green belt shall be developed in area as provided in project details, with native tree species in accordance with Forest Department. The	**Agreed to Comply:** Since first phase of project is under implementation and project is yet to be operational,

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	greenbelt shall inter alia cover the entire periphery of the Airport.	we assure to abide by the condition by final phase. Green belt/ vegetation along periphery of the airport shall be developed at locations outside NMIA which are complying to operational safety requirement of airport. However, green area/open area amounting to 33% of NMIA site area has been planned.
	Topsoil shall be separately stored and used in the development of green belt.	**Being Complied**: Topsoil is being separately stored for use in the development of green belt.
VII.	**Public hearing and Human health issues:**	
i	Construction site should be adequately barricaded before the construction begins.	**Complied:** Initially barricading was done with metal sheets. Now since the final design of the concrete compound wall has been approved, the metal sheet barricading is gradually being replaced with permanent RCC boundary wall along periphery of the project site.
ii	Traffic congestion near the entry and exit points from the roads adjoining the airport shall be avoided. Parking should be fully internalized, and no public space should be utilized.	**Being Complied**: Traffic management plan prepared by EPC contractor is being implemented to ensure that the traffic congestion shall be avoided at the adjacent roads of NMIA. Also provision for all parking including construction vehicles are made inside the premises of NMIA and no public place is used for parking of vehicles outside NMIA.
iii	Provision of Electro-mechanical doors for toilets meant for disabled passengers. Children nursing/feeding room to be located conveniently near arrival and departure gates.	**Agreed to Comply:** Disabled person toilets are being designed as per National Building Code, 2016. Children nursing/ feeding room being provided as per international best practice for airport passenger services.

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iv	Emergency preparedness plan based on the Hazard identification and Risk Assessment (HIRA) and Disaster Management Plan shall be implemented.	**Agreed to Comply:** EPC contractors have prepared risk assessment, HIRA and disaster management plan under the terms of the EPC contract for construction phase, implementation of which is supervised by the safety team of NMIA. Disaster Management Plan is under preparation which will be completed in due course of time.
v	Provision shall be made for the housing of construction labor within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, crèche etc. The housing may be in the form of temporary structures to be removed after the completion of the project.	**Being Complied**: EPC Contractors have made requisite provisions for labour camp at site as per this condition. We assure MOEFCC to abide by the condition during construction phase.
vi	Occupational health surveillance of the workers shall be done on a regular basis.	**Being Complied**: Regular health check-up of workers is being carried out by contractors appointed by NMIAL. We assure MOEFCC to abide by the condition during construction & operational phases.
VIII.	**Miscellaneous:**	
i	The project proponent shall make public the environmental clearance granted for their project along with the environmental conditions and Safeguards at their cost by prominently advertising it at least in two local newspapers of the District or State, of which one shall be in the vernacular language within seven days and in addition this shall also be displayed in the project proponent's website permanently.	**Complied:** Public was informed about the grant of EC by advertisement in newspaper Business Standard Mumbai on 10.12.2021 and Lokmat (Marathi) on 10.12.2021 and copies of Newspaper cutting were submitted with EC Compliance report July-December 2021. Copy of EC and CRZ clearance, Consent to establish are available on NMIAL web site (https://www.nmiairport.co.in/circulars)
ii	The copies of the environmental clearance shall be submitted by the project proponent to the Heads of local bodies, Panchayats and	**Complied:** MOEF&CC granted EC copy submitted to Local Bodies, Panchayats and municipal bodies. Acknowledgement copies were

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	Municipal Bodies in addition to the relevant offices of the Government who in turn must display the same for 30 days from the date of receipt.	submitted with EC Compliance report July- December 2021.
iii	The project proponent shall upload the status of compliance of the stipulated environment clearance conditions, including results of monitored data on their website and update the same on half-yearly basis.	**Agreed to Comply**: All EC related compliance reports filed by NMIAL are uploaded on NMIAL website and available at the link (https://www.nmiairport.co.in/circulars)
iv	The project proponent shall submit six-monthly reports on the status of the compliance of the stipulated environmental conditions on the website of the Ministry of Environment, Forest, and Climate Change at environment clearance portal.	**Agreed to Comply**: All EC related compliance reports filed by NMIAL are uploaded on NMIAL website and available at the link (https://www.nmiairport.co.in/circulars) Also, same will get uploaded on Parivesh portal of Ministry of Environment, Forest and Climate Change for environment clearance on regular basis.
v	The company shall have a well laid down environmental policy duly approved by the Board of Directors. The environmental policy should prescribe for standard operating procedures to have proper checks and balances and to bring into focus any infringements/ deviation/ violation of the environmental /forest/ wildlife norms/ conditions. The company shall have defined system of reporting infringements/ deviation/ violation of the environmental/ forest/ wildlife norms/ conditions and/or shareholder's/ stake holders. The copy of the board resolution in this regard shall be submitted to the MoEF&CC as a part of six-monthly report.	**Agreed to Comply**: NMIAL has Environmental, Social and Governance Policy approved by the Chief Executive Officer of NMIAL in August 2023. Environmental management Plan for construction phase has been prepared which provides standard operating procedures and a system of checks and balances through continuous inspection and monitoring of environment, health & safety standards, & records of requisite data. This EMP has been circulated to all in design and construction teams. Similar EMP will be prepared at operations stage to minimize environmental impacts of operations.

	EC & CRZ Conditions-2021	Compliance Status
vi	A separate Environmental Cell both at the project and company head quarter level, with qualified personnel shall be set up under the control of senior Executive, who will directly report to the head of the organization.	**Complied**: Separate environmental team has been deployed at both project and company headquarter.
vii	Action plan for implementing EMP and environmental conditions along with responsibility matrix of the company shall be prepared and shall be duly approved by competent authority. The year wise funds earmarked for environmental protection measures shall be kept in separate account and not to be diverted or any other purpose. Year wise progress of implementation of action plan shall be reported to the Ministry/Regional Office along with the Six-Monthly Compliance Report.	**Agreed to Comply**: Environmental management plan for construction phase and operations phase has been presented in Chapter 10 of EIA along with the budget. The expenditure incurred on EMP implementation during the reporting period is presented in Point No. 9 (e) and 9 (f) of the Data Sheet in the beginning of this report.
viii	Self-environmental audit shall be conducted annually. Every three years third party environmental audit shall be carried out.	**Being Complied:** NMIAL's environment team conduct inspection of all activities of EPC contractors. Independent engineer appointed by CIDCO, and external auditor appointed by the NMIAL also conducts regular review of compliances.
ix	The project proponent shall submit the environmental statement for each financial year in Form-V to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently and put on the website of the company.	**Agreed to Comply:** Since the project is yet to be operational, we assure to abide by the condition. Numbers about resource consumption and waste generation in the Consent to Establish are pertaining to operations stage of Phase 1 & 2 (20 MPPA). Environmental Statement as per Form V will be prepared during operation phase and will be submitted to MPCB.
x	The criteria pollutant levels namely, PM10, PM2.5, SO2, NOx (ambient levels) shall be monitored and displayed at a convenient location	**Agreed to Comply:** All EC related compliance reports are being uploaded on NMIAL website.

	EC & CRZ Conditions-2021	Compliance Status
	near the main gate of the company in the public domain.	NMIA does regularly monitor pollutants like PM_{10}, $PM_{2.5}$, SO_2, NOx through NABL approved laboratory and displays the results near the main gate of NMIA project site.
xi	The project proponent shall inform the Regional Office as well as the Ministry, the date of financial closure and final approval of the project by the concerned authorities, commencing the land development work and start of production operation by the project.	**Agreed to Comply:** Financial Closure for NMIA project Phase I & II (20 MPPA) was achieved on March 29, 2022, when State Bank of India (SBI) as a lead bank agreed to underwrite full loan amount of Rs. 12,770 Cr.
xii	The project. authorities must strictly adhere to the stipulations made by the State Pollution Control Board and the State Government.	Noted
xiii	The project proponent shall abide by all the commitments and recommendations made in the EIA/EMP report, commitment made during Public Hearing and also that during their presentation to the Export Appraisal Committee.	Agreed
xiv	No further expansion or modifications in the plant shall be carried out without prior approval of the Ministry of Environment, Forests and Climate Change (MoEF&CC).	Agreed
xv	Concealing factual data or submission of false/fabricated data may result in revocation of this environmental clearance and attract action under the provisions of Environment (Protection) Act, 1986.	Noted
xvi	The Ministry may revoke or suspend the clearance, if implementation of any of the above conditions is not satisfactory.	Noted

	EC & CRZ Conditions-2021	Compliance Status
xvii	The Ministry reserves the right to stipulate additional conditions if found necessary. The Company in a time bound manner shall implement these conditions.	Noted
xviii	The Regional Office of this Ministry shall monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the officer (s) of the Regional Office by furnishing the requisite data/information/ monitoring reports.	Noted
xix	The above conditions shall be enforced, inter-alia under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986, Hazardous and Other Wastes (Management and Transboundary Movement| Rules, 2016 and the Public Liability Insurance Act, 1991 along with their amendments and Rules and any other orders passed by the Hon'ble Supreme Court of India/ High Courts/NGT and any other Court of Law relating to the subject matter.	Noted
xx	Any appeal against this EC shall lie with the National Green Tribunal. if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.	Noted

Annexure-I

Compliance to conditions stipulated in Environment Clearance & CRZ Clearance No.10-53/2009-I.A. III dt. 22.11.2010 & dt 20.12.2017

Present Status of Compliance to Conditions stipulated in EC &CRZ Clearance No.10-53/2009-I.A. III dt. 22nd Nov 2010 & dt 20th Dec 2017 (Annexure- I)

Sr. No		Stipulated Condition-2010	Compliance status
		Specific Condition	
I.		**Construction Phase**	
	(i)	"Consent for Establishment" shall be obtained from State Pollution Control Board under Air and Water Act and a copy shall be submitted to the Ministry before start of any construction work at the site.	**Complied:** Consent to Establish (CTE) is granted to NMIA by MPCB vide letter No. Format 1.0/ CAC/UAN No. MPCB-CONSENT- 0000128221/CE-2206000673 dt. 15.06.2022 for Phase I & II (20 MPPA & Cargo Capacity 0.57 MTPA) which is valid up to 5.10.2026. (**Annexure III**) This document supersedes the previous CTE obtained by NMIAL.
	(ii)	CIDCO shall rehabilitate about 3000 families of 10 settlements from 7 villages falling within the airport zone as per the R & R policy of the Government of India or the Government of Maharashtra, whichever is more beneficial to the project affected persons.	**Complied:** R and R package development and implementation was in scope of CIDCO as per NOC for transfer of EC and CRZ clearance given by CIDCO to NMIAL vide letter No. CIDCO/T&C/CT&CP/ NMIA/ 1317 dated 10th Feb 2020. CIDCO has handed over 100% encumbrance free RoW of the project site of 1160 Ha to NMIAL on 10th June 2022.
	(iii)	CIDCO shall obtain necessary permission from Hon'ble High Court of Bombay for cutting or damaging of mangroves and clearance under Forest Conservation Act 1980 as per the orders in respect of notice of Motion no. 417 of 2006 in PIL no. 87/2006, as required.	**Complied:** Necessary approvals / clearances have been taken by CIDCO from the MoEF&CC (stage II Forest clearance vide File No.: 8-95/2012-FC dated 24th April 2017 for diversion of 250.0635 ha area) and Permission for Removal of Mangroves over 108.607 Ha (98 Ha within site and balance in offsite area) vide Bombay High Court order dated October 29, 2013, as applicable.
	(iv)	The plantation and protection of mangroves over an area of 615 ha (245 hectares of good quality Mangroves Park shall be developed at Vaghivli on the north of the	**Complied:** The Urban Development Department, GoM has sanctioned change in Navi Mumbai Development Plan vide letter G.R.No.TPS/1711/2495/ C.R.202/11

Sr. No		Stipulated Condition-2010	Compliance status
		airport area + 60 hectare area located on the west side of the airport site around Moha creek and Panvel Creek + 310 hectares area on the northeast of the airport site between Gadhi River, Mankhurd Panvel Rail corridor and National Highway 4B shall be declared as No-development zone and CIDCO shall under take the development as Mangroves park/green area) would be developed and maintained in the shape of Biodiversity Mangrove Parks well before the airport project is initiated and its progress reported to the high level committee mentioned below at (xxxiii). CIDCO shall formally amend the land use in the sectioned development plan of Navi Mumbai following the due procedure under MRTP Act to achieve this objective.	/UD -12 dated 21st march, 2012. It was noted that work of plantation & Protection of 310 ha + 60ha + 20 ha has been completed by Mangrove Cell, State Forest department as submitted in the earlier six-monthly report. In addition, 108 ha mangrove plantation has been completed in Kolekhar village near this, NDZ has been declared as per the Forest clearance condition of compensatory mangrove plantation. Details of mangrove pockets development including compensatory mangrove plantation and development of other pockets has been submitted by CIDCO vide letter CIDCO/GM(ENV&F)/NMIA/2019/038 dtd 11th September 2020.
	[v]	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 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	**Complied:** It may be noted, as per CIDCO report, as submitted to MOEFCC, that: 1. CWPRS, Pune has carried out 1D, 2D mathematical & physical Model studies based on the MoEF's approved layout plan of airport covering 1160 Ha. CIDCO has also completed designing the master drainage plan of surrounding areas by incorporating the various recommendations of CWPRS. 2. The detailed drainage plan for the airport has been prepared by the NMIAL as a part of Airport Master Plan, incorporating CWPRS recommendations and integrating with CIDCO drains plan and abiding by EC conditions. The storm Water from NMIA project area will be discharged in Pavel creek and Gadhi River after

Sr. No		Stipulated Condition-2010	Compliance status
		re-coursing 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.	settling fine particles in the silt pond proposed before outfall. 3. The Drainage Master Plan of airport is prepared for the worst conditions (highest high tide, tidal surge, maximum rainfall intensity of 148.1mm/hr and simultaneous flooding in all rivers). NMIAL had engaged CWPRS to review the internal drainage system designed for the airport area to ensure its compatibility and suitability with external Drainage Master Plan of CIDCO for surrounding areas. 4. The Master plan developed by NMIA has ensured that there will be no discharge into the Ulwe recourse channel from Airport as mandated in EC.
	(vi)	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	**Complied:** Main drains designed based on 148.1mm/hr for 1 in 100-year Return Period value recommended by CWPRS. Recommendations of the CWPRS report on Comprehensive Master Plan for Surface drainage and Flood protection and its compliance has been submitted to MOEFCC as a part of Comprehensive EIA report of 2021 which is being complied through the planning and design process. The earlier report was submitted to MOEFCC in 2017.

Sr. No		Stipulated Condition-2010	Compliance status
		shall submit the above Master Plan to the Ministry.	
	(vii)	Systemic 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-subsurface flow as well as impact on aquifers.	**Complied:** NMIAL has appointed a Laboratory recognized by MOEFCC, for the monitoring for Air & noise (9 stations) and Ground water sampling (up to 5 locations) on monthly basis. Marine/ Surface water (10 stations), & soil sampling (5 locations) on quarterly basis. Environmental analytical reports for the reporting period are enclosed herewith. (**Annexure II**) Since entire project is being constructed on land filled with broken rocks to an average level of 8.5 m AMSL and since ground water is not being mined for any project activity, sub-surface flow or the aquifer is not likely to be impacted.
	(viii)	CIDCO shall prepare a Management Plan to handle the runoff from the airport and to ensure that runoff associated risks/ impacts such as siltation in receiving water body are avoided and are taken care within airport area during monsoons.	**Complied:** Drainage Master Plan Report of Airport and its surrounding area is prepared which includes the issue of management of runoff and associated risks during the monsoon. CWPRS studies show that siltation rates in Gadhi River and Panvel creek are low and obstructions due to such factors are considered while designing Master Drainage layout. During construction phase run off will be passed through silt traps before letting it out to Panvel Creek and Gadhi River. The Storm Water drains are designed incorporating in-line features like silting chamber and oil water separator (for surface runoff from aprons) to remove suspended matter and oils.
	(ix)	On the northern part of the airport there is a secondary channel of the	**Complied:** It may be noted, as per CIDCO report vide Letter

Sr. No		Stipulated Condition-2010	Compliance status
		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.	CIDCO/GM(ENV&F)/NMIA/2019/938 dated 11th September 2020 available at URL: https://cidco.maharashtra.gov.in/pdf/EC_Complience/160043466783295_NMIAECComplianceStatusFinal-.pdf as submitted to MOEFCC, that: 1. The proposed North connecting channel is designed in accordance with the Model studies carried out at CWPRS, Pune as submitted by CIDCO. 2. As per CWPRS recommendations Northern Channel is planned with 75 m width. Further, studies carried out with 75 m Northern channel having bed levels of -2 m and -1 m revealed that there are no significant changes in maxima flood levels predicted with earlier studies as reported in CWPRS report. CIDCO has also submitted to MOEFCC that at present 60% area of the channel is covered by Mangroves and hence is being retained as it is. However, sufficient care is ensured that flow is not obstructed. Construction of new Channel for Gadhi River, north of NMIA Site shall be completed by CIDCO. NMIAL has requested for an update from CIDCO in this regard.
	[x]	The flow channels and the low - lying mangrove area which will receive water from diverted recourse/ channels should remain undisturbed. No road, embankment or any other construction shall be permitted. Any island formed due to deposition of sediment in front of Panvel creek shall be periodically removed.	**Complied:** It may be noted, as per CIDCO report vide Letter CIDCO/GM(ENV&F)/NMIA/2019/938 dated 11th September 2020 available at URL: https://cidco.maharashtra.gov.in/pdf/EC_Complience/160043466783295_NMIAECComplianceStatusFinal-.pdf, as submitted to MOEFCC, that all the flow channels in No Development Zone (615 Ha.) are kept undisturbed. CWPRS studies show that siltation

Sr. No		Stipulated Condition-2010	Compliance status
			rates in Gadhi River and Panvel creek are low.
	[xi]	A detailed map shall be submitted by CIDCO to the Ministry with quantification of affected mangrove area with density i.e., initial proposal & modified proposal and proposed mangrove forestation with species. The work on the proposed compensatory mangrove park should commence well before the construction of the airport is undertaken. The mangrove irrigation systems and diverse species selections for all the four areas may be scientifically made. The river front development in all the areas not protected by adequate mangrove buffer along the Panvel creek and Gadhi river may be considered through studies.	**Complied:** It may be noted, as per CIDCO report vide Letter CIDCO/GM(ENV&F)/NMIA/2019/938 dated 11th September 2020 as submitted to MOEFCC, that: 1. Mumbai University has quantified the affected mangroves using Satellite Imagery for years 1995, 2000, 2005 and 2010. and qualitative analysis is done by field study to ascertain Density & Dominance of affected mangrove area. 2. The same was incorporated in the Updated EIA Report of 2011 and Comprehensive EIA Report 2017. 3. CIDCO has developed compensatory mangrove plantation over 108.67 Ha at S. No. 27, village Kolhekhar in between Jui creek and Taloja creek through the Mangrove Cell of State Forest Dept. Further, CIDCO has modified Navi Mumbai Development Plan (NMDP) to provide mangrove cover in four NDZ pockets over 616.2 Ha which was approved by GoM vide G.R. dt 12.03.12. 4. The scheme for regeneration of Mangroves is prepared through a consultant M/s. Lewis Environment Services USA. The regeneration of mangroves was done in a phased manner, in consultation with the Mangrove Cell of State Forest Dept. through FDCM in the 310 Ha of NDZ to the Northeast of airport, 60 Ha in Moha Creek and 20 Ha on North of Airport. A certificate from Mangrove Cell, Forest department showing completion of Mangrove regeneration over 390 Ha and photographs have been submitted. CIDCO's position

Sr. No		Stipulated Condition-2010	Compliance status
			regarding development of Mangrove biodiversity park is replied in item sr. no. (iv) above.
	[xii]	Whatever EIA data was submitted and presented was related to a situation for "no airport condition". The project proposal has undergone many changes in terms of converting the lagoon as Mangrove Park, shifting of non-aeronautical activities to the south etc. Updated EIA report with all the modifications and commitments given by CIDCO shall be submitted to the MoEF, MPCB and to MCZMA. This updated EIA report will serve as the preliminary baseline data. CIDCO shall submit the second report (EIA Report II) after finalization of all the facilities followed by Comprehensive EIA report prepared with approved layout of the airport, new hydrological scenario, altered topography and land use. The Comprehensive EIA report should also include ecological aspects answering quires raised by BNHS and several other points raised during the meeting. After completion of Phase I of the project, the CIDCO shall conduct the "Environmental Audit" with a reputed organization and the audit shall also include the "Validation of the conclusions drawn in the EIA Report" and to submit to MoEF, MPCB and to MCZMA and shall be uploaded on the website.	**Complied:** Updated EIA report was submitted to MoEF, MPCB and MCZMA on 21st April, 2011 by CIDCO. Further, a Comprehensive EIA report incorporating the various studies / activities carried out by CIDCO post Environmental Clearance, has been prepared and submitted to MoEF, MPCB and MCZMA vide letter dtd 29th August, 2017. NMIAL has submitted EIA report 2021 to MOEFCC vide letter dated 25th Oct 2021 for obtaining fresh clearance. The EIA report is uploaded on web site also & link is: (https://www.nmiairport.co.in/circulars) Environmental Audit will be conducted after commissioning of phase I&II (20MPPA) which is under construction. It may be noted that the same has been mandated in the Concession Agreement for NMIA.
	[xiii]	The water quality of the River Gadhi, Ulwe, the Panvel Creek and the ground water is to be monitored	**Complied**: Marine Surface Water quality monitoring is being carried out on quarterly basis and ground water

Sr. No		Stipulated Condition-2010	Compliance status
		on quarterly basis for TOC, Pb, Cd and Hg at all the locations identified in the EIA study for a period of at least 2 years from the commencement for the construction work and the quarterly reports to be submitted to Ministry of Environment and Forests Govt. of India and MPCB.	monitoring on monthly basis by NMIAL through MoEF&CC recognized Lab. Environmental analytical reports for the reporting period are enclosed as **Annexure -II**
	(xiv)	The wastewater generated from the aircraft maintenance hangars may contain hazardous materials like lead, chromium, Sulphates, Phenolic compounds, V.O.C's etc. The surface runoff from the airport area shall also contain oils, grease, Sulphates etc, which cannot be sent directly to sewage treatment plant for the treatment. A separate treatment plant for managing the wastewater shall be specified and adopted.	**Agreed to Comply:** Since project is yet to be operational, we assure to abide by the condition. Primary treatment will be provided at hangars to remove all heavy metals and then the sewage will be discharged to STP followed with UF and RO.
	[xv]	Based on the geological profile underneath the proposed airport, suitable consolidation factor shall be arrived to assess the additional noise/ vibration levels that would be produced during impact of landing & take off the air crafts simultaneously on both the runways. Further, the partially quarried hills in the vicinity will become a rebound shell for noise. CIDCO shall examine the details of noise/ vibration levels those are likely to be increased both during day and nighttime and the mitigation measures shall be installed to reduce the (noise/ vibration levels) impacts.	**Agree to Comply**: It may be noted that runway pavement has been designed taking into consideration subsoil condition, and the subgrade below pavement is not a source of noise/vibration. Any noise on landing is sourced from the aircraft undercarriage and therefore subject to aircraft attributes and undercarriage improvements by aircraft manufacturers. On take off the dominant noise is from the engines. Engine noise is being reduced progressively due to development of high-bypass engines and development of engine nacelles.
	[xvi]	Standard instrument arrival and departure procedure shall be designed to minimize the noise levels within the permissible limits	**Being complied-** Standard instrument arrival and departure procedures are designed by Airport Authority of India (AAI)

Sr. No		Stipulated Condition-2010	Compliance status
		for the area falling in the funnel near the airport on either side.	considering International Civil Aviation Organization (ICAO) standards and recommended practices.
	(xvii)	Energy conservation to the extent of 20% shall be incorporated in the bidding documents including water conservation (reuse/ recycle, rainwater harvesting and water efficient fixtures) and other green building practices for various buildings proposed within the airport complex. CIDCO shall consider ECBC Guidelines 2009 to achieve the energy – efficient design.	**Being Complied:** NMIA is in process of getting LEED BD+C V4 Certification for Passenger Terminal-1 Building Preliminary energy assessment shows saving more than 20%. Energy, water conservation and green practices being implemented for Passenger Terminal Building are as per LEED guidelines and for the other buildings ECBC norms are being followed.
	(xviii)	CIDCO shall prepare a detailed traffic management plan to take care of increased vehicular traffic which should also cover/ clearly delineate widening/ increasing the existing roads and associated road infrastructure approving / installation of road safety features/ pedestrian facility/ FOB / under passes etc. (that can be done by carrying out road safety audits). Measures shall be taken to prevent encroachment along/within the ROWs on connecting/ main arterial roads.	**Complied:** It may be noted, as per CIDCO report, as submitted to MOEFCC, that a detailed Connectivity Study "Regional and Local Transport Connectivity Plan for Navi Mumbai International Airport" has been carried out through international consultant M/s. Lea Associates South Asia Pvt Ltd. Based on the findings of study, CIDCO and various state Government agencies have taken up various projects for improving the connectivity through various modes, by giving emphasis to public transport.
	(xix)	Necessary road (National and State Highways) and rail connectivity shall also be upgraded to handle the increased passenger and cargo traffic, in addition to metro for transition of passengers. The proposal of Hoverport shall not be taken up on the north part of the airport area as this shall damage the mangroves.	**Complied:** It may be noted, as per CIDCO report, vide Letter CIDCO/GM(ENV&F)/NMIA/2019/938 dated 11th September 2020 as submitted to MOEFCC, the National and State Highway surrounding the airport are being upgraded for increased traffic by Mumbai JNPT Port Road Company Ltd (MJPRCL) and PWD. The proposal was to widen the existing National and State Highways in the airport vicinity to 8 Lane with service roads and further to 6 Lane

Sr. No		Stipulated Condition-2010	Compliance status
			with service roads has been completed by MJPRCL. Widening of Sion – Panvel highway up to 10 lanes is also completed. Further, additional bridges are being constructed at the Thane Creek bridge on Sion- Panvel Highway. The Seawoods-Uran Rail link has been commissioned as part of this work. These connectivity development projects include Mumbai Trans Harbour Link (MTHL) (connecting Sewri and Navi Mumbai) is commissioned by MMRDA, expansion of Amra Marg (west of NMIA site) and NH4B bypass (east of NMIA site) by MJPRCL is completed construction of North road and road to the south of the NMIA project by CIDCO is under implementation.
	(xx)	The measures should be taken to improve public transportation including dedicated road / MRTS corridors to access to Airport, may also be considered for the same. Energy Efficient dedicated rail based public transport facility; suburban/ metro train in particular, may be created between the Santa Cruz and the Navi Mumbai Airport in addition to all other links connecting various parts of Mumbai city.	**Being Complied:** It may be noted, as per CIDCO report vide Letter CIDCO/GM(ENV&F)/NMIA/2019/938 dated 11th September 2020 as submitted to MOEFCC, that CIDCO has initiated discussions with Mumbai Railway Vikas Corporation Ltd (MRVC) as well as MMRDA for planning a direct metro rail link to the airport. The Master Plan of airport envisages metro connectivity from Mumbai and Navi Mumbai to western and eastern part of airport. In continuation to above, CIDCO appointed an agency for "Preparation of Detailed Project Report (DPR) for proposed Metro Line from CSMIA-Mankhurd NMIA & (Extension of CSMIA- Mankhurd Metro Line-B)," in November 2022. CIDCO is also planning to integrate Metro Line from Mankhurd to NMIA with Belapur-NMIA Line-IA (Extension of Navi Mumbai Metro Line-I Belapur-Pendhar) at Sagarsangam station.

Sr. No		Stipulated Condition-2010	Compliance status
			Detailed Project Report for the same is being prepared.
	(xxi)	Traffic Management during construction phase should be clearly planned so that the traffic situation is not further worsened on the existing connecting roads. Installations of Noise barrier/ Green Belts should be clearly indicated in the plan (After identifying critical locations).	**Being Complied:** Construction phase traffic management plan has been prepared with entry/ exit scheme and queue length for NMIA construction vehicles. Also, necessary parking space has been created within the NMIA site so that public space is not occupied for parking of construction vehicles. During construction phase, vehicles related to the construction activities of NMIA are planned to ply on the external roads in non-peak hour. This shall reduce the traffic load on external roads and maintain the desirable Level of Services. Also, construction vehicles shall only ply on the service roads of external roads not disturbing through traffic. Airport boundary wall is being constructed and shall act as a noise barrier for external roads.
	(xxii)	To avoid accidental damage (fire, hazardous material waste handling, oil spills, wastewater disposal) in the adjacent ecologically fragile surroundings and mangrove area – a risk assessment plan and disaster management plan should be prepared and with periodic compliance of safety measures in place to avoid loss due accidental damage that could have been otherwise avoided. Further CIDCO shall appoint a dedicated professional team/cell to handle disaster and associated risks.	**Agreed to Comply:** Since project is yet to be operational, we assure to abide by the condition. Risk Assessment and Disaster Management Plan shall be prepared to avoid accidental damage in the adjacent ecologically fragile surroundings and mangrove area. Disaster Management Plan will be updated periodically. EPC contractors have prepared risk assessment and disaster management plan under the terms of the EPC contract for construction phase, implementation of which is supervised by the safety team of NMIA.
	(xxiii)	In addition to the above – CIDCO shall ensure that all the risks (such as fire, hazardous material waste handling, oil spills, waste – both	**Agreed to Comply:** Since project is yet to be operational, we assure to abide by the condition. However, we assure

Sr. No		Stipulated Condition-2010	Compliance status
		liquid/solid wastes) associated/ resultant risk during various stages of development (like planning, construction, operation) are managed within the airport area. In case of any unforeseen event as stated above the liability – environmental and social will rest with the developer/ CIDCO, the decision of the high-level Committee, stipulated below will be full and final for liability fixations.	that action will be taken as per condition (xxii) cited above.
	[xxiv]	The compliance report of the monitoring committee shall be made 'public' (put online and/or also displayed for wider dissemination of compliance) at all stages (planning, construction, operation) to ensure effective monitoring and compliance of conditions.	**Complied:** Approval of MoEF&CC for transfer of Environment & CRZ Clearance of NMIA from CIDCO to NMIAL has been obtained vide letter No. F. No. 10-53/2009-IA-III dated 17th August 2020. Since then, NMIAL has uploaded on NMIA website, the EC Compliance Report at the following link every semester. https://www.nmiairport.co.in/circulars
	[xxv]	Environment Management Plan or associated monitoring plan shall ensure that mitigation measures detailed out in terms of role, responsibility, budgetary provisions, timeline for completion, frequency of monitoring and compliance etc.	**Complied** Detailed Construction and Operation phase EMP and monitoring plan with budgetary allocation have been dealt in EIA report September 2021 which was submitted to MOEF&CC. Further, we assure you to abide by the condition.
	[xxvi]	In order to meet all the essential aeronautical requirements and the further airport expansions, no property development shall be undertaken within the proposed aeronautical Airport Zone area (1160 ha).	This condition is not applicable as all the land requirements of future expansion have been planned for. Moreover, EC of 2021 does not offer any limitation/ restriction in this regard.
	[xxvii]	The Master plan/ Development plan of Navi Mumbai shall be revised and recasted in view of the airport development to avoid and unplanned haphazard growth	**Complied:** It may be noted, as per CIDCO report vide Letter CIDCO/GM(ENV&F)/NMIA/2019/938 dated 11th September 2020, as submitted to MOEFCC, that:

Sr. No		Stipulated Condition-2010	Compliance status
		around the airport. The land use should take care of bird menace including that from the Mangrove Parks.	1.The Navi Mumbai Development Plan has been revised vide Govt. Order No. TPS-1711/2495/C.R. 202/11/UD-12 vide dtd. 21st March, 2012 & copy was submitted. 2., GoM has issued notification dated 10th January, 2013, declaring the area around proposed International Airport as "Navi Mumbai Airport Influence Notified Area" (NAINA) and appointed CIDCO as the Special Planning Authority to avoid haphazard development around the airport. Copy of NAINA Notification was also submitted to R.O. MOEFCC, Nagpur. 3. BNHS is conducting decadal avifauna study in NMIA region. Copy of BNHS Fifth Annual Report 2022-23 is attached as Annexure-IV.
	[xxviii]	All other nearby villages, if not required to be relocated should be provided with best possible infrastructure so that they compare well with the adjoining ultra-modern airport infrastructure.	**Complied:** It may be noted, as per CIDCO report vide Letter CIDCO/GM(ENV&F)/NMIA/2019/938 dated 11th September 2020, as submitted to MOEFCC, that all the nearby villages are being provided physical and social infrastructure under Gaothan expansion scheme & Grant in Aid scheme is implemented to develop social infrastructure in nearby villages for improvement of social infrastructure like water supply, sanitation, providing sewerage system, roads etc.
	[xxix]	CRZ provisions shall be applicable on the tidally influenced diverted channels of Ulwe and Gadhi Rivers and CIDCO shall finalize the Airport plans accordingly.	**Agreed to Comply:** CRZ clearance has been obtained by NMIAL along with EC-2021 wherein, NMIA boundary has been clearly demarcated. All developmental activities of the project are within this boundary. CIDCO has obtained requisite CRZ clearance for off-site infrastructure such as north boundary road, bridges

Sr. No		Stipulated Condition-2010	Compliance status
			of eastern side, etc. wherever road component touches tidal influence area of the rivers. Master Plan was prepared for NMIA development is in strict compliance with the applicable CRZ provisions and requirement for compliance in this regard has been incorporated appropriately into the Concessionaire Agreement with NMIAL. Further, it shall be monitored by Environment Cell.
	[xxx]	Any cutting or filling up the airport site will create significant turbidity problem. CIDCO shall examine the impact on the marine life. The details will be put up on the website every 3 months.	**Complied:** Turbidity during pre-construction and construction period is tested and analyzed regularly through MOEF & CC recognized laboratory appointed to carry out quarterly environmental monitoring at pre-defined locations in surface waters around the airport. The quarterly monitoring of turbidity is being carried out. Environmental analytical reports for the reporting period are enclosed herewith. (**Annexure -II**).
	[xxxi]	CIDCO shall conduct the baseline survey of avian fauna before the start of construction and the details shall be put up every 3 months on the website in association with BNHS.	Being Complied: BNHS was appointed by CIDCO to do the Base Line Survey of Avian Fauna between 2012 to 2016. Quarterly reports of BNHS are available on CIDCO website in public domain. CIDCO has also signed a long-term MOU (ten-year period ending 2028) with BNHS. Aim of this decadal study is long term monitoring, conservation, and supervision of the terrestrial and water birds with reference to NMIA and associated regions and implementation of Bird Threat Mitigation Plan. BNHS Annual Report 2022-2023 on Long-Term Bird Monitoring Programme of Navi Mumbai International Airport (NMIA) Area and its Surroundings during

Sr. No		Stipulated Condition-2010	Compliance status
			Construction and Operational Phases is attached as **Annexure-IV.**
	[xxxii]	The Environmental Clearance / CRZ Clearance is recommended below is only for the Navi Mumbai Airport project. CIDCO shall obtain the Environmental and CRZ clearance separately for off airport facilities and other off infrastructure projects after finalizing the locations and details as may be required under the EIA Notification 2006 and the CRZ Notification.	**Complied:** CIDCO has sought separate approvals for associated infrastructure of airport. The status of various clearances is as below: • The CRZ clearance for off-site physical infrastructure of roads, bridges and interchanges has been granted by MCZMA vide letter dated 15th February 2016 which was due for expiry in Feb 2023. Extension of 3 years up to 12 Feb 2026 has been obtained by CIDCO. • CRZ clearance for Shifting of EHVT lines has been granted by MOEF vide letter no. F.No.11-38/2016-Ia.III dated 28th August 2017. The work of shifting of EHVT lines has been completed. • Forest Clearance Stage I & II for shifting of EHVT Lines was received vide letter dt. 02.08.18; and 31.03.2022 respectively The Bombay High Court permitted CIDCO to clear Mangroves for the rerouting of EHVT lines for development of NMIA vide its Order dt. 19th December 2013 in WP no 22362 OF 2019. The work of shifting of EHVT lines has been completed.
	[xxxiii]	Taking a cue from the man-made 26/11 incident arising out of external threat to our country, a strategic airport safety and security plan covering also surrounding inhabited areas of the airport shall be prepared and put in place in consultation with appropriate government departments	**Agreed to Comply:** The Bureau of Civil Aviation Security (Ministry of Civil Aviation) guidelines will be followed. Further, regular coordination with Navi Mumbai Police for Coastal security and internal risks.
	[xxxiv]	A high level advisory and monitoring committee which	**Agreed to Comply:** The implementation was discussed in the

Sr. No		Stipulated Condition-2010	Compliance status
		should include international experts of repute, reporting directly to the highest Airport Management Authority shall be constituted by CIDCO to plan, execute and maintain the environmental issues / recommendations mentioned above. The monitoring shall be done at various stages (planning, construction, operation) of project for compliance of conditions. Budgetary provisions shall be made to the satisfaction of this Committee. The committee shall meet at least once in three months and the decisions taken in the meetings shall be put up on the web site for public information.	EAC 74th Meeting held on 8th Oct 2021, and it was explained that the project is periodically monitored by CM, GOM and Chief Secretary, GOM. Thus, condition may be considered as complied and no separate meeting is required.
	[xxxv]	Regular modeling study of air, noise shall be carried out due to the increase in traffic.	**Complied**: Air and noise modelling was carried out during EIA study. Monthly monitoring of ambient air and noise levels is being continued by NMIAL and reports are being submitted along with six monthly compliance reports (**Annexure - II**). Modeling study of air and noise will be carried out again after the project goes operational.
	[xxxvi]	The solid waste shall be properly collected, segregated and disposed as per the provision of Solid Waste (Management and Handling) Rules, 2000.	**Being Complied**: At present, during construction phase, compliance with solid waste management has been included as a responsibility of EPC contractors. NMIAL's environment team monitors the compliance on regular basis.
	[xxxvii]	Provision shall be made for the housing of construction labour within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, crèche etc. The housing may be in the form of	**Being complied**: EPC Contractor has provided labour housing facilities as per BoCW Act and corresponding Rules and as per requirements of CA and EC.

Sr. No		Stipulated Condition-2010	Compliance status
		temporary structures to be removed after the completion of the project.	
	[xxxviii]	A First Aid Room will be provided in the project both during construction and operation of the project.	**Being Complied**: First aid facilities have been provided at site offices of various contractors as also in labour colony. In addition, EPC contract mandates contractor to maintain an ambulance and have tie up with local Hospitals to ensure that in case of emergency necessary medical facilities will be available. Safety team of NMIAL regularly monitors safety compliance of the contractor.
	[xxxix]	Disposal of muck during construction phase should not create any adverse effect on the neighboring communities and be disposed taking the necessary precautions for general safety and health aspects of people, only in approved sites with the approval of competent authority.	**Being Complied**: C&D waste is being disposed as a filler material at a designated place within the NMIA site. No muck is taken out of NMIA site during the ongoing Phase I & II (20 MPPA) construction for disposal.
	[xl]	Soil and ground water samples will be tested to ascertain that there is no threat to ground water quality by leaching of heavy metals and other toxic contaminants.	**Complied:** Soil & ground water quality monitoring during pre-development work was being carried out by CIDCO through MOEFCC recognized Lab and regular reports have been submitted to MOEFCC along with six monthly compliance reports. NMIAL has continued the monitoring for Air & noise (9 stations) and Ground water sampling (up to 5 locations) on monthly basis. Marine/ Surface water (10 stations), & soil sampling (5 locations) on quarterly basis. Environmental analytical reports for the reporting period are enclosed herewith (**Annexure-II**).
	[xli]	Construction spoils, including bituminous material and other hazardous materials, must not be	**Being Complied**: Inert construction spoils are collected and deposited at a designated area

Sr. No		Stipulated Condition-2010	Compliance status
		allowed to contaminate watercourses and the dump sites for such material must be secured so that they should not leach into the ground water.	within the site as a filler material. Bituminous waste is collected given to Hot Mix Plant for recycling. No material is allowed to contaminate surface water or ground water.
	[xlii]	Installation and operation of DG set shall comply with the guidelines of CPCB.	**Being complied**: DG sets installed on site as per complying with the CPCB guidelines.
	[xliii]	The diesel generator sets to be used during construction phase should be low sulphur diesel type and should conform to Environment (Protection) Rules prescribed for air and noise emission standards.	**Being Complied**: Tender condition stipulates that the EPC contract should use DG set only in case of power failure and fuel used in DG sets should be low sulphur quality.
	[xliv]	The diesel required for operating DG sets shall be stored in underground tanks and if required, clearance from Chief Controller of Explosives shall be taken.	**Being Complied**: During construction, diesel is not being stored at site as of now. Instead, oil company's bowser reaches each DG set, equipment and vehicle to dispense the fuel with proper safety precaution.
	[xlv]	Vehicles hired for bringing construction material to the site should be in good condition and should have a pollution check certificate and should conform to applicable air and noise emission standards and should be operated only during non-peak hours.	**Being Complied**: We assure MOEFCC that this condition is being complied. PUC certificate of each vehicle and its condition is checked by respective contractors while entering the NMIA project site for validity and emission standards.
	[xlvi]	Ambient noise levels should conform to residential standards both during day and night. Incremental pollution loads on the ambient air and noise quality should be closely monitored during construction phase. Adequate measures should be made to reduce ambient air and noise level during construction phase, so as to conform to the stipulated standards by CPCB/ MPCB.	**Being Complied:** Noise making construction activities such as drilling are being carried out only during Day time between 7 AM and 6 PM. **Following measures are being taken to reduce load on Ambient Noise & Air:** ▪ The noise generating activities are being carried out only during daytime.

Sr. No		Stipulated Condition-2010	Compliance status
			▪ Separate Entry & Exit for the construction vehicles has been provided. Construction vehicles are mostly within site and do not exit project site. However, vehicles if any, entering or exiting site, for that separate exit & entry have been provided.
	[xlvii]	Fly ash should be used as building material in the construction as per the provisions of Fly Ash Notification of September, 1999 and amended as on 27th August, 2003.	**Being Complied**: Fly ash has been considered in the concrete mix design and is being used during construction. EPC contractors have been asked to maintain record for use of fly ash.
	[xlviii]	Ready mixed concrete must be used in building construction.	**Being complied**: Ready mixed concrete is being used in building construction.
	[xlix]	Storm water control and its re-use as per CGWB and BIS standards for various applications.	**Being Complied:** Storm water drains are provided with the silt pond before discharge. At construction stage, storm water is not being reused. During operations phase, water from Rainwater Harvesting Pond will be used for landscape development. .
	(l)	Water demand during construction should be reduced by use of pre-mixed concrete, curing agents other best practices referred.	**Being complied**: We assure MOEFCC to abide by the condition during construction phase. Curing agents have been included in the tender specifications for all grades of concrete.
	(li)	Use of glass may be reduced by upto 40% to reduce the electricity consumption and load on air-conditioning. If necessary, use high quality double glass with special reflective coating in windows.	**Being Complied:** Passenger terminal building is being designed as per ASHARE standards and other airport buildings have been designed in accordance with ECBC standards to make them more energy efficient.
	(lii)	The approval of the competent authority shall be obtained for structural safety of the buildings due to earthquake, adequacy of firefighting equipment, etc. as per National Building Code including	**Being Complied**: Requisite fire NoC and structural stability certification/ approval is being obtained for buildings to be constructed in the Airport.

Sr. No		Stipulated Condition-2010	Compliance status
		protection measures from lightening etc.	
	(liii)	Regular supervision of the above and other measures for monitoring should be in place all through the construction phase, so as to avoid disturbance to the surroundings.	**Being Complied:** Various functional teams of NMIAL including Environment team continuously supervise EPC contractor's work for quality as well as compliance.
II.	**Operation Phase: -** Project is under construction, the condition pertaining to operation phase will be implemented.		
	i)	Diesel power generating sets proposed as source of backup power for elevators and common area illumination during operation phase should be of enclosed type and conform to rules made under the Environment (Protection) Act, 1986. The height of stack of DG sets should be equal to the height needed for the combined capacity of all proposed DG sets. Use of low sulphur diesel. The location of the DG sets may be decided with in consultation with Maharashtra Pollution Control Board.	**Agreed to Comply**: Noted and shall be adhered during operation phase.
	ii)	Noise should be controlled to ensure that it does not exceed the prescribed standards. During night time the noise levels measured at the boundary of the building shall be restricted to the permissible levels to comply with the prevalent regulations.	**Agreed to Comply**: Noted and shall be adhered during operation phase.
	iii)	The green belt of the adequate width and density preferably with local species along the periphery of the plot shall be raised so as to provide protection against particulates and noise.	**Agreed to Comply**: Since first phase of project is under implementation and project is yet to be operational, we assure to abide by the condition. Green belt/ vegetation along periphery of the airport shall be developed at locations outside NMIA which are in compliance to operational safety requirement of airport.

Sr. No		Stipulated Condition-2010	Compliance status
			However, green area/open area amounting to 33% of NMIA site area has been planned.
	iv)	Weep holes in the compound walls shall be provided to ensure natural drainage of rainwater in the catchment area during the monsoon period.	**Being complied**: Drainage plan of the site is such that the rainwater will get accumulated in the drains and not along compound wall.
	v)	Rainwater harvesting for roof run-off and surface run- off, should be implemented. Before recharging the surface run off, pre-treatment must be done to remove suspended matter, oil and grease. The borewell for rainwater recharging should be kept at least 5 mts. above the highest ground water table.	**Being Complied:** This condition will be complied during construction stage – it is proposed to have rainwater harvesting ponds to the Northwest of the site (total capacity 29,747 cum) and the harvested rainwater will be used for landscaping purpose. In addition, shallow water bodies are also planned along main airport access road which shall be as water retention tanks and landscape water bodies.
	vi)	The ground water level and its quality should be monitored regularly in consultation with Central Ground Water Authority.	**Complied:** Monitoring of ground water level and its quality around the project site have been carried out by CIDCO and reports were submitted along with Six monthly compliance report to MOEFCC. NMIAL has continued the monitoring for Air & noise (9 stations) and Ground water sampling (up to 5 locations) on monthly basis. Marine/ Surface water (10 stations), & soil sampling (5 locations) on quarterly basis. Environmental analytical reports for the reporting period are enclosed herewith (**Annexure -II**).
	vii)	Traffic congestion near the entry and exit points from the roads adjoining the proposed project site must be avoided. Parking should be fully internalized and no public space should be utilized.	**Agreed to Comply**: In terms of Phase I & II (20 MPPA) operational point of view, necessary parking provisions made at Central Terminal Complex (at Underground parking), Taxi Staging

Sr. No		Stipulated Condition-2010	Compliance status
			area, Bus Terminal, and CTC Bus Terminal.
	viii)	Energy conservation measures like installation of CFLs/TFLs for the lighting the areas outside the building should be integral part of the project design and should be in place before project commissioning. Use CFLs and TFLs should be properly collected and disposed off/sent for recycling as per the prevailing guidelines/ rules of the regulatory authority to avoid mercury contamination. Use of solar panels may be done to the extent possible.	**Agreed to Comply**: Noted and shall be adhered during operation phase.
	ix)	Efforts should be made to use solar energy to the maximum extent possible.	**Noted:** Shall be adhered to during Operations stage. Terminal building including all other building shall have solar PV panels installed on the roof. Additional panels will be installed along the side of runway.
General Conditions:			
(i)		In the event of any change in the project profile a fresh reference shall be made to the Ministry of Environment and Forests.	**Agreed to Comply**: We will abide by the condition.
(ii)		This Ministry reserves the right to revoke this clearance, if any, of the conditions stipulated are not complied with to the satisfaction of this Ministry.	**Noted.**
(iii)		This Ministry or any other competent authority may stipulate any additional conditions subsequently, if deemed necessary, for environmental protection, which shall be complied with.	**Noted.**
(iv)		Full support should be extended to the officers of this Ministry's Regional Office at Bhopal and the offices of the Central and State	**Complied:** Full support was extended to the officers of Environment Ministry's Regional Office during visit

Sr. No	Stipulated Condition-2010	Compliance status
	Pollution Control Board by the project proponents during their inspection for monitoring purposes, by furnishing full details and action plans including the action taken reports in respect of mitigative measures and other environmental protection activities.	and assured to render the same as & when required.
8	These stipulations would be enforced among others under the provisions of water (Prevention and Control of Pollution) Act, 1974 the Air (Prevention and Control of Pollution) Act 1981, the Environment (Protection) Act, 1986, the Public Liability (Insurance) Act, 1991 and Municipal Solid Wastes (Management and Handling) Rules, 2000 including the amendments and rules made thereafter.	**Noted.**
9	All other statutory clearances such as the approvals for storage of diesel from Chief Controller of Explosives, Fire Department and Civil Aviation Department from height point of view, Forest Conservation Act, 1980 and Wildlife (Protection) Act, 1972 etc. shall be obtained, as applicable by project proponents from the respective competent authorities.	**Complied:** All the necessary approvals required for the project have been obtained and copies have been submitted to R.O, MOEFCC, Nagpur. NMIAL shall abide by the condition.
10	The project proponent should advertise in at least two local Newspapers widely circulated in the region, one of which shall be in the vernacular language informing that the project has been accorded CRZ Clearance and copies of clearance letters are available with the State Pollution Control Board and may also be seen on the website of the Ministry of Environment and Forests at	**Complied:** Public was informed about the grant of EC by advertisement in newspaper DNA, Mumbai on 30th Nov 2010 and Lokmat (Marathi) on 30th Nov 2010 and copies of Newspaper cutting were submitted to Regional Office.

Sr. No	Stipulated Condition-2010	Compliance status
	http://www.envfor.nic.in. The advertisement should be made within 10 days from the date of receipt of the Clearance letter and a copy of the same should be forwarded to the Regional office of this Ministry at Bhopal.	
11	Environmental Clearance is subject to final order of the Hon'ble Supreme Court of India in the matter of Goa Foundation Vs. Union of India in Writ Petition (Civil) No.460 of 2004, if applicable to this project.	**Noted.**
12	A copy of the clearance letter shall be sent by the proponent to concerned Panchayat, Zilla Parisad / Municipal Corporation, Urban Local Body and the Local NGO, if any, from whom suggestions/ representations, if any, were received while processing the proposal. The clearance letter shall also be put on the website of the company by the proponent.	**Complied:** CIDCO had submitted status as "Complied" in the earlier compliance report.
13	The proponent shall upload the status of compliance of the stipulated EC conditions, including results of monitored data on their website and shall update the same periodically. It shall simultaneously be sent to the Regional Office of MoEF, the respective Zonal Office of CPCB and the SPCB. The criteria pollutant levels namely; SPM, RSPM, SO_2, NOx (ambient levels as well as stack emissions) or critical sectoral parameters, indicated for the project shall be monitored and displayed at a convenient location near the main gate of the company in the public domain.	**Complied:** CIDCO has been submitting six monthly compliance reports regularly. All EC related compliance reports are uploaded on the CIDCO website at the following link: https://cidco.maharashtra.gov.in/navi_mumbai_airport# under Pre-Development tab as submitted by CIDCO. MoEF&CC approved Transfer of Environment & CRZ Clearance from CIDCO to NMIAL in 2020. , Since then, NMIAL has uploaded all documents pertaining to EC compliance on NMIA website at the following link. https://www.nmiairport.co.in/circulars

Sr. No	Stipulated Condition-2010	Compliance status
14	The project proponent shall also submit six monthly reports on the status of compliance of the stipulated EC conditions including results of monitored data (both in hard copies as well as by e-mail) to the respective Regional Office of MoEF, the respective Zonal Office of CPCB and the SPCB.	**Complied:** Same as mentioned above in General Condition 13.
15	The environmental statement for each financial year ending 31st March in Form-V as is mandated to be submitted by the project proponent to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be put on the website of the company along with the status of compliance of EC conditions and shall also be sent to the respective Regional Offices of MoEF by e-mail.	**Agreed to Comply**: Will be submitted in Operation Phase of project.

Compliance to additional conditions stipulated by MOEFCC while granting Extension of Validity for Environmental and CRZ Clearance to NMIA Project vide letter dated 20th Dec 2017.

No.	Stipulated Condition- Extension Validity for EC -2017	Compliance status
i)	Certified report on sources and availability of water from the local body supplying water along with the permission received by them for the shall be submitted. This report shall specify the total annual water availability with the organization (local Body), the quantity of water already committed to other development projects, the quantity of water committed for this project and the balance water available for distribution. This should be specified separately for ground water and surface water sources and ensure that there is no impact on other uses.	**Complied:** CIDCO has submitted water Adequacy Report as a part of Compliance report for the period of Jan- June 2018 vide letter no. CIDCO/ GM (ENV & F)/NMIA/2018/184 dated 21st Sept. 2018. NMIAL has ensured that water requirement for the project is much lower (22 MLD at 60 MPPA) than that envisaged at the time of 2017 CEIA studies by CIDCO (41 MLD at 60 MPPA).
ii)	Detailed traffic management and traffic decongestion plan, to ensure that the current level of service of the roads within a 5 kms radius of the project site is maintained and improved upon, shall be drawn up through an organization of repute and specializing in Transportation Planning within next 6 months. This should be based on the cumulative impact of all development and increased inhabitation being carried out by the project or other agencies in this 5 kms radius from the site under different scenarios of space and time and shall be implemented to the satisfaction of State Urban Development and Transports Departments with the consent of all the concerned implementing agencies.	**Complied:** CIDCO, the nodal agency for Navi Mumbai International Airport has prepared "Detailed Traffic Management and Traffic Decongestion Plan for Navi Mumbai International Airport (NMIA)" in April 2020 which ensure that the current level of service of the roads within a 05 km radius of the project is maintained and improved upon after the implementation of the project. CIDCO has submitted final report for "Detailed Traffic Management and Traffic Decongestion Plan for Navi Mumbai International Airport (NMIA)" to MOEF vide letter No. CIDCO/GM(ENV&F)/NMIA/2020 /491 dated 14th July 2020. As per the report, various connectivity requirements are under implementation by CIDCO along with various Authorities.
iii)	Treated effluents shall also be used for irrigation and Roadside plantation after taking due permissions from the concerned authorities/Forest department.	**Agreed to Comply**: We assure to abide by the condition.

No.	Stipulated Condition- Extension Validity for EC -2017	Compliance status
iv)	Project proponent shall satisfactorily address all the complaints that have been received against the project and submit a compliance report to the Ministry.	**Agreed to Comply:** Compliance was submitted to MOEF vide letter No. CIDCO/ GM (ENV & F)/NMIA/2017/1017 dated 2nd November 2017. We assure to abide by the condition.
v)	The extension of validity is being granted for the original proposal for which Environmental and CRZ Clearance was granted earlier. The Project proponents will not make any changes in the project nature, structure and configuration and limit themselves to activities for which the Environmental and CRZ Clearance has been given earlier.	**Agreed to Comply:** The approval of MoEF&CC for Transfer of EC from CIDCO to NMIAL has been obtained vide letter No. F. No. 10-53/2009-IA-III dated 17th August 2020. NMIAL had applied to MOEFCC for grant of fresh EC & CRZ clearance. Validity of existing EC was extended up to 21st Nov 2021 in reference to MOEFCC's Notification dated 18th Jan 2021. Fresh EC and CRZ Clearance for on-going project was granted on 28.11.2021 (No. 21-60/2021-IA-III) and issued on 1st Dec 2021.

Annexure-II

Environmental Monitoring Report
(October 2023- March 2024)

ENVIRONMENTAL COMPLIANCE MONITORING REPORT
for
Navi Mumbai International Airport (NMIA)

Sponsor:

Navi Mumbai International Airport Pvt. Ltd. (NMIAL)

Period:

October 2023 to March 2024

PREPARED BY

ADITYA ENVIRONMENTAL SERVICES PVT.LTD.
MOEFCC Recognized Laboratory under EP Act 1986
Accredited under ISO 9001: 2015 & 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 in Maharashtra. Mumbai is known as the commercial capital of India and the MMR is an industrially and technologically advanced region, which has experienced rapid growth in income and employment. The increase in trading, business and financial services demands the highest order of infrastructure. There is a need for enhancement of the available capacity of the airport, as the existing airport in Mumbai is under tremendous pressure to meet the air traffic demands of this vibrant region. Realizing this need, the Government of Maharashtra conceptualized the Navi Mumbai International Airport (NMIA) project and appointed City and Industrial Development Corporation of Maharashtra Ltd. (CIDCO) as the Nodal Agency for implementation of the project.

This project was taken up on Public Private Partnership (PPP) basis, on approval of the Government of India and the Government of Maharashtra. After an open global bidding process, CIDCO issued Letter of Award dated 25th October 2017 to Mumbai International Airport Pvt Ltd (MIAL) for development of the project.

The objective of the monitoring is to understand the Ambient Air quality, Ambient Noise quality, Ground water quality, soil and marine water quality at Navi Mumbai International Airport site and nearby villages.

The focus of compliance monitoring is to assess the reporting period environmental conditions in and around the surrounding project area to check for possible impacts on environment at an early stage so that necessary actions can be initiated. The assignment comprises monitoring of following parameters:

- Ambient Air Monitoring
- Ambient Noise Level Monitoring
- Soil
- Ground/Surface Water
- Marine Water for Biological and Physicochemical Parameters
- DG Stack Monitoring

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2. SCOPE OF MONITORING WORK

2.1 Scope of Monitoring Work as per Work Order:

Scope of monitoring work as per Work Order are as given below:

Table 2-1: Scope of Environmental Monitoring Work as per Work Order

Sr. No.	Parameters – as per Annexure B	Location	Frequency	Samples/ Year
1.	**Ambient Air Quality:** As per NAAQS standards Published by CPCB (12 Parameters)	9	9 Stations per Month	108
2.	**Noise: Parameters: Leq Noise level** - Day time & Nighttime separately as per CPCB norms.	10	10 Stations per Month	120
3.	**Ground Water Quality:** As per IS 10500:2012 Revised (RA 2018)	5	5 Stations per Month	60
4.	**Soil: Parameters:** pH, Texture, EC, Na, Available N, Available K, Available Phosphorus, Sulphate, Chloride, Ca, Mg, Fe, Mn, Cu, Hg, Cd, As, Pb, Zn, Al, Ni, Co, Cr, Na	8	8 Stations (Quarterly)	32
5.	**Marine/Surface Water Quality parameters:** **Physico Chemical parameters:** PH, Temperature, Turbidity, EC, Salinity (ppt), **Chemical Parameters:** DO, BOD, Magnesium, Hardness, Alkalinity, Chloride, Sulphate, Fluoride, Sodium, Potassium, Phenol, Total phosphorus, Total Nitrogen. **Heavy Metals:** Fe, Zn, Mg, Mn, Cd, Cr, Hg, Pb **Bacteriological parameters:** Coliform Colonies (MPN). **Marine Biology:** Chlorophyll, Phaeophytin, Phytoplankton, Zooplankton, Benthos, Diversity indices	10	10 stations (Quarterly)	40
6.	**DG Set Stack Monitoring**	1	1 station (Quarterly)	4

2.2 Locations of Monitoring:

Details of monitoring stations for Ambient Air Quality, Ambient Noise, Soil, Ground Water, Marine Water- physicochemical & biological showing station locations are as given below:

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Table 2-2: Details of Ambient Air Quality Monitoring Stations

Station Code	Station	Remarks
A1	Owale	Residential Village
A2	Pargaon	Receptor oriented - 400m from proposed runway
A3	Ulwe Node	Area near highway
A4	NMIA Project Site	Within project site
A5	Kille Gaothan	Receptor oriented – on main access road
A6	Balaji Site Office/ L&T Site Office (Onwards from November 2023)	Within Project site
A7	Diwale Koliwada	Receptor oriented – on main access road
A8	Jui	Eastern end of NMIA, outside project site
A9	Panvel	residential zone

Figure 2-1 Ambient Air Monitoring Locations

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* Ambient Air Monitoring stations can be changed on the basis of access to villages situated within NMIA project site and other locations. The air sampling was done at the location of Balaji Site Office till October 2023, it is replaced with L&T Site Office from November 2023.

Table 2-3: Ambient Noise Level Monitoring Stations

Sr. No.	Station Name	Category of area
N1	Owale	Residential Area
N2	Pargaon	Sensitive area (Mixed category)
N3	Ulwe Node	Sensitive Area
N4	Karanjade	Residential Area
N5	NMIA Project site	Within Airport site
N6	Kille Gaothan	Receptor oriented – on main access road
N7	Balaji Site Office/ L&T Site Office (Onwards November 2023)	Within Airport site
N8	Diwale Koliwada	Receptor oriented – on main access road
N9	Jui	Eastern end, outside project site
N10	Panvel	Residential Area (Mixed category)

Figure 2-2 Noise Level Monitoring Locations

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Table 2-4: Soil Quality Monitoring Stations

Station Code	Stations Name
S1	Pargaon
S2	Chinchpada
S3	Koli
S4	Kopar
S5	Ulwe
S6	NMIA project Site
S7	Kombadbhuje
S8	Owale

Figure 2-3 Soil Sampling Locations

* Soil Sampling locations can be changed on the basis of access to villages situated within NMIA project site and other locations.

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Table 2-5: Details of Ground and Drinking Water Quality Monitoring Stations

Station Code	Month	Station Code	Month
	October, December, February		**November, January, March**
GW1	Open well at Kille Gaothan	GW I	Dugwell at Kombadbhuje
GW2	Dugwell at Ulwe	GW II	Dugwell at Owale
GW3	Dugwell at Pargaon	GW III	Open well at Dapoli
GW4	Open well at Jui	GW IV	Open well at Chinchpada
GW5	Open well at Panvel	DW 1	NMIA Project site/ V Time Office

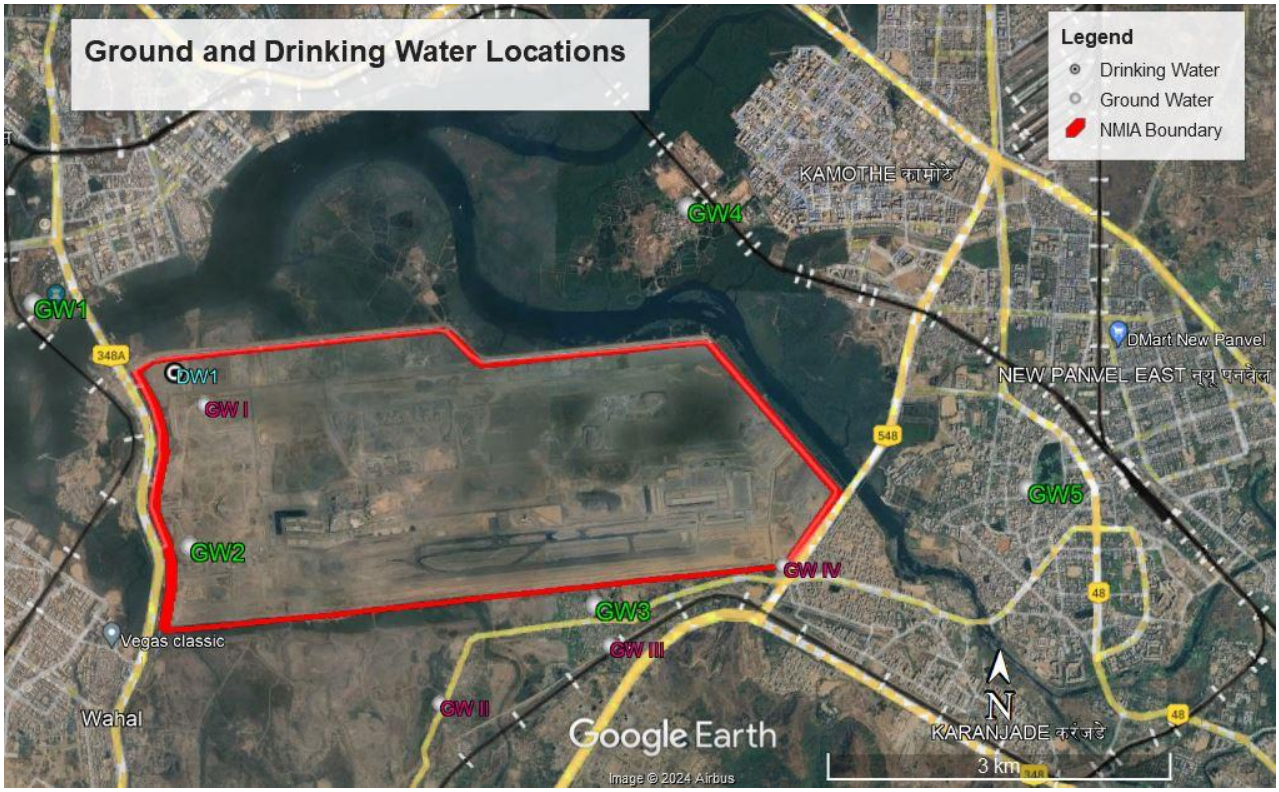

Figure 2-4 Ground Water and Drinking Sampling Locations

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Table 2-6: Details of Marine Water Quality Monitoring Stations

Station Code	Station details / Location
MW1	Extreme end of Gadhi River (upstream side)
MW2	Near Chinchpada village (2 km from MW1) in Gadhi River
MW3	Near Jui Village (1.8 from MW2) in Gadhi River
MW4	At Junction of Ulwe and Gadhi Rivers in Panvel Creek
MW5	Near Vaghivali village (2 km from MW4) in Gadhi River
MW6	Near CBD Belapur (1.5 km from MW5) in Panvel Creek
MW7	Near Vaghivali Creek Junction (800m from MW6) in Gadhi River
MW8	Near Rathi bander in Panvel Creek
MW9	Mouth of Panvel Creek
MW10	Ulwe River near Owle Village

Figure 2-5 Marine Water Sampling Locations

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Table 2-7: Details Stack Monitoring Stations

Station Code	Station details / Location
DG 1	NMIA Project site

Figure 2-6 DG Stack monitoring Location

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2.3 Period/Time of Sampling (October 2023 to March 2024):

The sampling survey was planned to carry out as per schedule mentioned in Table below.

Table 2-8: Period/Time of Sampling for this Survey

Month	Parameter	Sampling Stations	Dates of Sampling	Time Period
October 2024	AAQ	A1,A2,A3	09.10.2023	24 hours
		A4, A5, A6	10. 10.2023	
		A7,A8,A9	11. 10.2023	
	Noise Level	N1, N2, N3, N10	09.10.2023	24 hours starting from 06:00am
		N4,N5, N6	10. 10.2023	
		N7,N8, N9	11.10.2023	
	Ground water	GW1, GW2, GW3, GW4, GW5	09. 10.2023	Grab Sample
November 2023	AAQ	A1, A2, A3	08.11.2023	24 hours
		A4, A5, A6	09.11.2023	
		A7, A8, A9	10.11.2023	
	Noise Level	N1,N2, N3, N4	06.11.2023	24 hours starting from 10:00am
		N5, N7, N7	09.11.2023	
		N8, N9, N10	10.11.2023	
	Ground water	GW II, GW III, GW IV	08.11.2023	Grab Sample
		GWI	09.11.2023	
	Drinking Water	DW1	10.11.2023	
	DG Set	DG 1	09.11.2023	Grab Sample
December 2023	AAQ	A1, A2,A3	11.12.2023	24 hours
		A4,A5, A6	12.12.2023	
		A7, A8, A9	13.12.2023	
	Noise Level	N1, N2,N3, N4	11.12.2023	24 hours starting from 10:00am
		N5, N6, N7	12.12.2023	
		N8, N9 N10	13.12.2023	
	Ground water	GW1, GW3, GW4, GW5	11.12.2023	Grab Sample
		GW2	13.12.2023	
	Soil	S1, S2, S3, S4, S5, S6, S7, S8	14.12.2023	Grab Sample
	Marine Water	MW5, MW6, MW7, MW8, MW9	15.12.2023	Grab Sample
		MW1, MW2, MW3, MW4, MW1(	16.12.2023	
January 2024	AAQ	A1, A2,A3	15.01.2024	24 hours
		A7, A8,A9	16. 01.2024	
		A4, A5, A6	17. 01.2024	
	Noise Level	N1, N2 ,N3	15.01.2024	24 hours starting from 06:00am
		N4, N8, N9, N10	16. 01.2024	
		N5, N6, N7	17. 01.2024	

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Month	Parameter	Sampling Stations	Dates of Sampling	Time Period
	Ground Water	GW I, GWII, GWIII, GWIV	15.01.2024	Grab Sample
February 2024	AAQ	A1, A2, A3	12.02.2024	24 hours
		A4, A5,A6	13.02.2024	
		A7, A8, A9	14. 02.2024	
		DG 2	13.02.2024	
	Noise Level	N1, N2, N3, N4	12.02.2024	24 hours starting from 06:00am
		N5, N6, N7	13.02.2024	
		N8, N9, N10	14. 02.2024	
	Ground Water	GW1, GW2, GW3	12.02.2024	Grab Sample
		GW4, GW5	13.02.2024	
	DG Set	DG 1	16.03.2023	Grab Sample
March 2024	AAQ	A1, A2,A3	11.03.2024	24 hours
		A4, A5, A6	12.03.2024	
		A7, A8,A9	13.03.2024	
	Noise Level	N1, N2 ,N3, N4	11.03.2024	24 hours starting from 06:00am
		N5, N6, N7	12.03.2024	
		N8, N9, N10	13.03.2024	
	Ground Water	GW I, GWII, GW 2, GWIV	11.02.2024	Grab Sample
	Drinking water	DW1	13.03.2024	
	Soil	S4, S5, S6	13.03.2024	Grabe Sample
		S1, S2, S3, S7, S8	14.03.2024	
	Marine Water	MW5, MW6, MW7, MW8, MW9	15.03.2024	Grab sample
		MW1, MW2, MW3, MW4, MW10	16.03.2024	

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3. METHODOLOGY ADOPTED FOR ENVIRONMENTAL MONITORING

3.1 AMBIENT AIR QUALITY

3.1.1 Reconnaissance Survey:

Reconnaissance survey in study area (10 km around proposed airport site) shows that sources of air pollution include the following:

- Airport land development work and predevelopment works
- Heavy traffic along Amara Marg, NH4/4BB and Uran / JNPT Road
- Construction activity in Ulwe node and nearby areas
- Industries in Panvel (private), MIDC Taloja (6km NE of site) & MIDC TTC (4km N of site)
- Burning of poor quality fuels in villages to the south of proposed site

In the month of October and November 2023 exceedance in the particulate matter level is due to increase in traffic and other developmental activities in the areas. This is also due to the influence of regional weather conditions of stagnation on the Arabian Sea, due to which background concentration of particulate matter all over MMRDA region was very high.

In order to arrest the deterioration in air quality, Govt. of India has enacted Air (Prevention and Control of Pollution) Act in 1981. The responsibility has been further emphasized under Environment (Protection) Act, 1986. The National Ambient Air Quality Standards (NAAQS) have been published by CPCB in November 2009 giving methods for measurement.

3.1.2 Methodology for Ambient Air Quality Monitoring:

To monitor Air Pollutants in Ambient air following method of analysis adopted

Table 3-1 Technique and Methods Adopted for Analysis of AAQ Parameters

S N	Parameter	Technique	Method of Analysis
1.	PM_{10}	Respirable Dust Sampler (Gravimetric Method)	IS-5182 (Part-XXIII) 2012
2.	$PM_{2.5}$	Fine Respirable Dust (Gravimetric Method)	40 CFR Parts 53 and 58, NAAQMS/37/201213:2013
3.	SO_2	Modified West and Gaeke Method	IS-5182 (Part-II) 2012
4.	NO_X	Jacob & Hochheiser Method	IS-5182 (Part-VI) 2012
5.	NH_3	Indophenol Blue method	APHA 401- Air 3rd Edition
6.	CO	Gas Chromatography Method	NAAQ 2006 Notification
7.	Ozone	Spectrophotometric method	IS-5182 (Part-IX) 2014
8.	Benzene[C_6H_6]	Gas Chromatography	IS-5182 (Part-XI) 2012
9.	Benzopyrene	Solvent extraction followed by GC	IS-5182 (Part-XII) 2014
10.	Lead	AAS after sampling EPM filter Paper	IS-5182 (Part-XXII) 2006
11.	Arsenic [As]		IS-5182
12.	Nickel [Ni]		IS-5182

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Figure 3-1 Ambient Air Quality Monitoring

3.1.3 Selection of air sampling location

Selection of representative location is very important. Following precautions have been taken while installing AAQM stations:

- It is away from source & other interferences
- Samplers are installed at free flowing well mixed area (3m) above ground level
- Only Calibrated Air Samplers are used
- the samples are transported to the laboratory at the earliest for further analysis
- Gaseous samples were preserved in cold box before taking to laboratory

3.2 AMBIENT NOISE LEVEL

3.2.1 Reconnaissance Survey:

Reconnaissance survey in study area (10 km around proposed airport site) shows that sources of air pollution include the following:

- Airport land development work and predevelopment works
- heavy traffic along Amara Marg, NH4/4BB and Uran / JNPT Road
- construction activity in Ulwe node and nearby areas
- industries in Panvel (private), MIDC Taloja (6km NE of site) & MIDC TTC (4km N of site)
- burning of poor quality fuels in villages to the south of proposed site

Noise pollution in urban areas is now being recognized as a major environmental issue around the world. With increasing awareness of the adverse impacts of noise on human health, more and more people becoming less tolerant to environmental noise. The objective of this exercise is to assess the baseline status within study area and to compare the noise levels with Ambient Noise Standards as prescribed under Environmental Protection Act, 1986.

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3.2.2 Methodology for Sample Collection

Integrated Sound Level Meter C390 was used for undertaking the surveys and installed on tripods at the selected locations over a 24-hour period. This Meter is then taken to laboratory where the data collected is downloaded onto PC using specialized software.

Center C-390 Sound level Meter with data

Noise is measured in decibel (dB) and 'A' weighting is used for this entire monitoring since in this method of frequency weighting, the signal generated reproduces the way the human ear responds to a range of acoustic frequencies. Leq: The equivalent continuous Sound Pressure Level for a particular duration. The Day-Night Equivalent Sound Level refers to average sound exposure over a 24- hour period. Leq day & night values are calculated from hourly Leq values, with the Leq values for the nighttime increased by 10 dB to reflect the greater disturbance potential from nighttime noises.

Figure 3-2 Ambient Noise level Monitoring

3.3 Soil

The purpose of soil testing is to identify contamination of soil due to land development works and the soil fertility from a viewpoint of use for landscape development.

3.3.1 Reconnaissance Survey:

Southern side of study area is rural in character and large tracts are being cultivated as paddy fields. Soil is also seen plentifully at bottom of hills where it supports large vegetation. However, Northern portion of study area is mostly urban in character since it has seen largescale development being part of Navi Mumbai.

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3.3.2 Methodology of Sample Collection:

Soil samples are collected after removing top two inches – which may contain high amount of organic carbon and humus. The soil area and volume could be a large field, a small garden, or simply the root zone of a single tree or shrub. The most difficult step in soil testing is accurately representing the desired area of soil. When the sampling area is determined, a sufficient number of soil cores taken to acquire a representative sample. This is generally 10 to 20 cores. The depth of sample for surface soils was taken from 0 to 6 inches or as deep as the primary tillage.

Soil samples collected from proposed project stations by using stainless steel soil sampling probe, packed in labeled polythene bags & send for analyze the physicochemical characteristics. The sample so collected is then made representative by coning- quartering and then stored in plastic bags, sealed and then sent to laboratory for analysis.

Figure 3-3 Soil Sample Collection

3.4 GROUND WATER SAMPLING

3.4.1 Reconnaissance Survey:

The villages to the south of airport site use ground water from open/bore well 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.

3.4.2 Methodology of Sampling:

Ground water samples are 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.

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Figure 3-4 Ground Water Sampling

3.5 MARINE WATER, SEDIMENTS & PLANKTON SAMPLING EQUIPMENTS

3.5 1 Reconnaissance Survey:

The site for the project is located in four different micro water sheds – viz Panvel creek, Gadhi river, Kasardi river, Ulwe river. The study area represents complex hydrodynamic system. The Ulwe river flows down through the mountains (to the south) towards the centre of project site and has been diverted/retrained as part of the project. The Gadhi river flows from the East to the West and is 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 flowing adjacent to the North of site which drains into the Arabian sea to the west. The Panvel creek also receives treated effluents from CETP at MIDC Taloja and sewage from NMMC STPs in Nerul.

3.5.2 Methodology of Sampling:

3.5.2.1 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.

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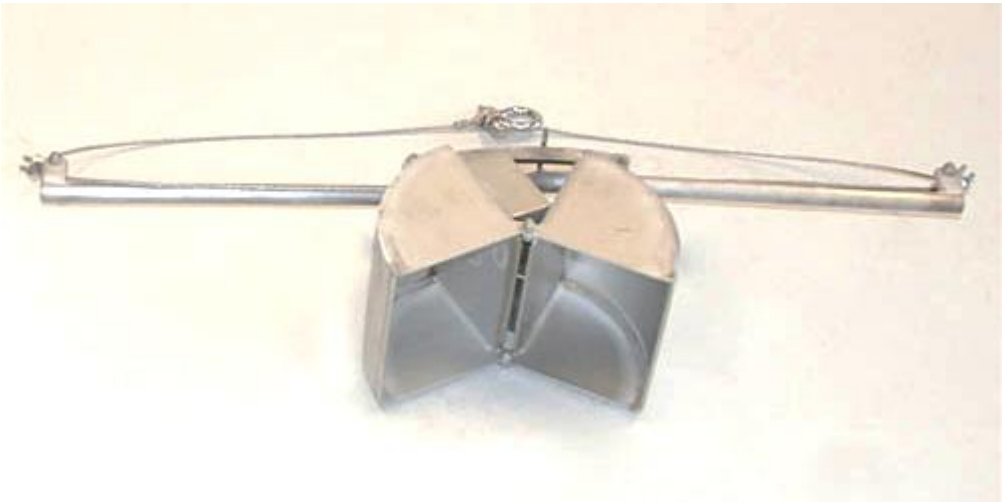
3.5.2.2 Plankton Net - Biological Samples

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)

3.5.2.3 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

3.5.2.4 Selection of Stations, Preservation and Transportation of Samples:

Marine water samples were collected from sampling locations in Gadhi River, Ulwe River and Panvel Creek at the locations indicated by NMIAL – in all, 10 samples were collected from 10 sampling locations for physicochemical and biological samples (Stations 1 to 4 are located in Gadhi River & Station 5 & 8 are Panvel Creek while station 9 Mouth of Panvel Creek and Station 10 in Ulwe River. A good amount of mangrove vegetation was noted on either side of stream 2,

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3, 4 and 7. Sampling locations were approached by boats (wherever possible) and collection done irrespective of tide. Sampling was done only for surface water. The samples were preserved and taken to the laboratory using vehicle on same day.

3.6 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.

- 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 (vide Certificate No. 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 manufacturers & are regularly calibrated.
- Chemicals used are Analytical Reagent grade and from reputed manufacturer.
- Analytical Instrumentation used in the laboratory is regularly calibrated.
- Laboratory has a 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.
- Laboratory has CRMs (Certified Reference Material) for heavy metals from reputed manufacturers for heavy metals and Standard Sea water which we use for analysis.
- Laboratory is 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.

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4. COMPILATION OF DATA & INFERENCE

4.1 Ambient air quality monitoring report

4.1.1 AAQM Data

Ambient Air Quality was monitored at various locations for relevant parameters as per NAAQS standards published by CPCB in November 2009. Data is compiled and presented below:

Table 4-1: Ambient Air Quality monitoring at various stations during October 2023

Sampling Locations	Owale Village	Pargaon High School	Ulwe Node	Kille Gaothan Guest House	NMIA Project Site	Balaji Office	Panvel	Diwale Koliwada	Jui Village	Limit #	Unit
Sampling Date	**09.10.2023**			**10.10.2023**			**11.10.2023**				
SO_2	29.83	26.99	33.38	35.51	22.73	27.70	28.41	24.15	30.54	80*	µg/m³
NO_X	44.34	37.41	47.81	50.58	39.49	42.26	49.19	45.03	54.04	80*	µg/m³
PM_{10}	79.83	85.34	75.36	80.27	82.46	87.10	78.82	71.42	84.25	100*	µg/m³
$PM_{2.5}$	29.17	32.92	25.83	30.83	34.17	37.08	28.33	25.83	33.33	60*	µg/m³
Ozone (O_3)	24.55	19.80	21.20	27.34	17.85	14.23	20.64	18.97	22.04	180**	µg/m³
Lead (Pb)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL (DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	1***	µg/m³
CO	0.79	0.73	0.65	0.58	0.82	0.85	0.96	0.67	0.91	4**	mg/m³
Benzene (C_6H_6)	BDL(DL-0.2)	BDL(DL-0.2)	BDL(DL-0.2)	BDL(DL-0.2)	BDL(DL-0.2)	BDL(DL-0.2)	BDL(DL-0.2)	BDL(DL-0.2)	BDL(DL-0.2)	8***	µg/m³
Benzopyrene	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	1***	ng/m³
Arsenic (As)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	8***	ng/m³
Nickel (Ni)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	20***	ng/m³
NH_3	36.19	33.53	38.51	40.50	27.89	30.21	31.21	35.52	43.82	400*	µg/m³

BDL–Below Detectable Limit (Note # Limits as per National Ambient Air Quality Standards NAAQS,2009)

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[*] 24 hour monitoring value; [**] 1 hour monitoring value; [***] Annual monitoring value

Results:

Particulate Matter (PM_{10}): A maximum value for PM_{10} is observed at Balaji Office as 87.10 µg/m^3 with the minimum value observed at Diwale Koliwada as 71.42 µg/m^3.

Particulate Matter ($PM_{2.5}$): A maximum value for $PM_{2.5}$ is observed at Balaji Office as 37.08 µg/m^3 [exceeds NAAQS limits] with the minimum value observed at Diwale Koliwada and Ulwe Node as 25.83 µg/m^3 respectively.

Ozone(O_3): A maximum value for Ozone is observed at Kille Gaothan Guest House as 27.24 µg/m^3 with minimum value observed at Balaji Site Office as 14.23 µg/m^3.

Sulphur Dioxide (SO_2): A maximum value for SO_2 is observed at Kille Gaothan Guest House as 35.51 µg/m^3 with the minimum value observed at NMIA project site as 22.73 µg/m^3.

Oxides of Nitrogen (NO_X): Maximum value for NO_x is observed at Jui as 54.04 µg/m^3 with the minimum value observed at Pargaon High School as 37.41 µg/m^3.

Carbon Monoxide (CO): The maximum value for CO is observed at Panvel as 0.96 mg/m^3; with the minimum value observed at Kille Gaothan Guest House as 0.58 mg/m^3 respectively.

Ammonia (NH_3): The maximum value for NH_3 is observed Jui as 43.82 µg/m^3 with the minimum value observed at NMIA project site as 27.89µg/m^3.

All above parameters are in compliance with permissible limits as per NAAQ Standards. Also, parameters such as Lead (Pb), Arsenic (As), Nickel (Ni), Benzo(a)Pyrene (BaP) and Benzene (C6H6) were found within the below detectable limits in the month of October 2023.

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Table 4-2: Ambient Air Quality monitoring at various stations during November 2023

Sampling Locations	Ulwe Node	Pargaon High School	Owale Village	Kille Gaothan Guest House	NMIA Project site	L & T Site Office	Panvel	Diwale Koliwada	Jui Village	Limit #	Unit
Sampling Date	**08.11.2023**			**09. 11.2023**			**10. 11.2023**				
SO_2	35.50	38.35	32.67	28.41	30.54	24.86	23.44	31.25	26.28	80*	µg/m³
NO_X	52.42	58.63	48.97	42.08	47.60	35.18	40.01	50.35	45.53	80*	µg/m³
PM_{10}	152.73	172.03	139.58	85.63	88.45	75.68	83.87	78.60	90.62	100*	µg/m³
$PM_{2.5}$	64.58	67.50	71.67	35.00	32.92	28.33	33.75	30.82	38.33	60*	µg/m³
Ozone (O_3)	25.66	23.43	20.92	24.55	22.59	19.80	16.18	15.06	18.13	180**	µg/m³
Lead (Pb)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	1***	µg/m³
CO	0.95	0.85	0.89	0.77	0.70	0.80	0.88	0.70	0.80	4**	mg/m³
Benzene (C_6H_6)	BDL (DL-0.2)	BDL (DL-0.2)	BDL (DL-0.2)	BDL (DL-0.2)	BDL (DL-0.2)	BDL (DL-0.2)	BDL (DL-0.2)	BDL (DL-0.2)	BDL (DL-0.2)	8***	µg/m³
Benzopyrene	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	1***	ng/m³
Arsenic (As)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	8***	ng/m³
Nickel (Ni)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	20***	ng/m³
NH_3	41.66	44.27	39.06	31.25	34.60	30.13	29.39	40.55	33.85	400*	µg/m³

BDL–Below Detectable Limit (Note # Limits as per National Ambient Air Quality Standards NAAQS,2009)
[*] 24 hour monitoring value; [**] 1 hour monitoring value; [***] Annual monitoring value

Results:

Particulate Matter (PM_{10}): A maximum value for PM_{10} is observed at Pargaon High School as 172.03 µg/m³, Ulwe Node as 152.73 µg/m³ and Owale 139.58 µg/m³ respectively [exceeds NAAQ limits] with the minimum value observed at L&T site Office as 75.68 µg/m3 .

Particulate Matter ($PM_{2.5}$): A maximum value for $PM_{2.5}$ is observed at Owale as 71.67 µg/m³, Pargaon High School as 67.5 µg/m³ and Ulwe node as 64.58 µg/m³ respectively [exceeds NAAQ limits] with the minimum value observed at L&T Site Office as 28.33 µg/m³.

Ozone (O_3): A maximum value for ozone is observed at Ulwe Node as 25.66 µg/m³ with minimum value observed at Diwale Koliwada as 15.06 µg/m³.

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Sulphur Dioxide (SO_2): Maximum value for SO_2 is observed at Pargaon High School as 38.35 µg/m³ with the minimum value observed at Panvel as 23.44 µg/m³.

Oxides of Nitrogen (NO_x): Maximum value for NO_x is observed at Pargaon High School as 58.63 µg/m³ with the minimum value observed at L&T Site Office as 35.18 µg/m³.

Carbon Monoxide (CO): The maximum value for CO is observed at Ulwe Node as 0.95 mg/m³ with the minimum value observed at Diwale Koliwada as 0.70 mg/m³.

Ammonia (NH_3): The maximum value for NH_3 is observed at Pargaon High School as 44.27 µg/m³ with the minimum value observed at Panvel as 29.39 µg/m³.

All above parameters except PM10 and PM2.5 are observed to be in compliance with permissible limits as per NAAQ Standards in the month of November 2023. Also, parameters such as Lead (Pb), Arsenic (As), Nickel (Ni), Benzo(a)Pyrene (BaP) and Benzene (C6H6) were found within prescribed limits. Exceedance in the particulate matter level is due to increase in traffic and other developmental activities in the areas. This is also due to regional weather conditions influence by stagnation on the Arabian Sea, due to which background concentration of particulate matter all over MMRDA region was very high.

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Table 4-3: Ambient Air Quality monitoring at various stations during December 2023

Sampling Locations	Owale Village	Pargaon	Ulwe Node	NMIA Project site	Kille Gaothan	L & T Site Office	Diwale Koliwada	Jui	Panvel	Limit #	Unit
Sampling Date	**11.12.2023**			**12.12.2023**			**13.12.2023**				
SO_2	36.22	30.54	39.77	25.57	34.09	29.83	37.64	31.96	20.60	80*	µg/m³
NO_X	51.73	44.15	56.56	40.70	49.66	43.46	54.49	38.63	35.18	80*	µg/m³
PM_{10}	98.64	95.61	97.99	98.44	91.60	99.00	95.15	96.66	95.57	100*	µg/m³
$PM_{2.5}$	42.05	40.00	48.50	47.60	39.17	48.70	38.94	41.84	41.67	60*	µg/m³
Ozone (O_3)	18.41	20.64	22.87	15.90	17.85	23.43	22.31	16.18	19.25	180**	µg/m³
Lead (Pb)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	1***	µg/m³
CO	0.80	0.77	0.88	0.90	0.85	0.80	0.88	0.77	0.85	4**	mg/m³
Benzene (C_6H_6)	BDL (DL-0.2)	BDL (DL-0.2)	BDL (DL-0.2)	BDL (DL-0.2)	BDL (DL-0.2)	BDL (DL-0.2)	BDL (DL-0.2)	BDL (DL-0.2)	BDL (DL-0.2)	8***	µg/m³
Benzopyrene	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	1***	ng/m³
Arsenic (As)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	8***	ng/m³
Nickel (Ni)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	20***	ng/m³
NH_3	43.15	36.83	44.27	29.39	39.43	35.34	44.27	37.20	30.13	400*	µg/m³

BDL–Below Detectable Limit (Note # Limits as per National Ambient Air Quality Standards NAAQS,2009)
[*] 24 hour monitoring value; [**] 1 hour monitoring value; [***] Annual monitoring value

Results:

Particulate Matter (PM_{10}): A maximum value for PM_{10} is observed at L&T site Office as 99.00 µg/m³ with the minimum value observed at Kille Gaothan Guest Office as 91.60 µg/m³.

Particulate Matter ($PM_{2.5}$): A maximum value for $PM_{2.5}$ is observed at L&T Site Office as 48.7 µg/m³ with the minimum value observed at Diwale Koliwada as 38.94 µg/m³.

Ozone (O_3):A maximum Value for Ozone is observed at L&T Site Office as 23.43 µg/m³ with minimum values observed at NMIA project site 15.90 µg/m³.

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Sulphur Dioxide (SO_2): Maximum value for SO_2 is observed at Ulwe Node as 39.77 µg/m^3 with the minimum value observed at Pavel as 20.6 µg/m^3.

Oxides of Nitrogen (NO_x): Maximum value for NO_x is observed at Ulwe Node as 56.56 µg/m^3 with the minimum value observed at Panvel as 35.18 µg/m^3.

Carbon Monoxide (CO): The maximum value for CO is observed at Panvel and NIMA Project site as 0.90 µg/m^3 respectively, with the minimum value observed at Jui as 0.77 µg/m^3.

Ammonia (NH_3): The maximum value for NH_3 is observed at Diwale Koliwada as 44.27 µg/m^3 with the minimum value observed at NMIA project site as 29.39 µg/m^3.

All above parameters are observed to be in compliance with permissible limits as per NAAQ Standards. Also, parameters such as Lead (Pb), Arsenic (As), Nickel (Ni), Benzo(a)Pyrene (BaP) and Benzene (C6H6) were found within prescribed limits in the month of December 2023.

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Table 4-4: Ambient Air Quality monitoring at various stations during January 2024

Sampling Locations	Owale Village	Pargaon	Ulwe Node	Diwale Koliwada	Panvel	Jui	NMIA Project site	Kille Gaothan	L & T Site Office	Limit #	Unit
Sampling Date	**15.01.2024**			**16.01.2024**			**17.01.2024**				
SO_2	31.25	26.18	33.79	30.41	24.49	28.72	23.65	20.27	32.94	80*	µg/m³
NO_X	47.6	39.32	51.73	49.66	44.15	43.46	35.18	36.56	48.29	80*	µg/m³
PM_{10}	79.66	97.66	98.64	93.99	91.39	96.88	90.78	85.24	95.29	100*	µg/m³
$PM_{2.5}$	30.42	46.67	43.75	44.17	49.17	45.00	46.25	40.83	43.75	60*	µg/m³
Ozone (O_3)	21.4	16.91	19.02	20.61	17.17	18.5	22.19	15.59	13.48	180**	µg/m³
Lead (Pb)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	1***	µg/m³
CO	0.85	0.90	0.98	0.80	0.70	0.85	0.95	0.88	0.77	4**	mg/m³
Benzene (C_6H_6)	BDL (DL-0.2)	BDL (DL-0.2)	BDL (DL-0.2)	BDL (DL-0.2)	BDL (DL-0.2)	BDL (DL-0.2)	BDL (DL-0.2)	BDL (DL-0.2)	BDL (DL-0.2)	8***	µg/m³
Benzopyrene	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	1***	ng/m³
Arsenic (As)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	8***	ng/m³
Nickel (Ni)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	20***	ng/m³
NH_3	36.82	31.65	39.08	38.11	35.85	34.56	26.81	32.95	37.47	400*	µg/m³

BDL–Below Detectable Limit (Note # Limits as per National Ambient Air Quality Standards NAAQS,2009)

[*] 24 hour monitoring value; [**] 1 hour monitoring value; [***] Annual monitoring value

Results:

Particulate Matter (PM_{10}): A maximum value for PM_{10} is observed at Ulwe Node as 98.64 µg/m³ with the minimum value observed at Owale as 79.66 µg/m³.

Particulate Matter ($PM_{2.5}$): A maximum value for $PM_{2.5}$ is observed at Panvel as 49.17 µg/m³ with the minimum value observed at Owale as 30.42 µg/m³.

Ozone (O_3): A maximum value for Ozone is observed at NMIA project site as 22.19 µg/m³ with the minimum value observed at L&T site Office as 13.48 µg/m³.

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Sulphur Dioxide (SO_2): Maximum value for SO_2 is observed at Ulwe Node as 33.79 µg/m^3 with the minimum value observed at Kille Gaothan as 20.27 µg/m3.

Oxides of Nitrogen (NO_x): Maximum value for NO_x is observed at Ulwe Node as 51.73 µg/m^3 with the minimum value observed at NMIA project site as 35.18 µg/m^3.

Carbon Monoxide (CO): The maximum value for CO is observed at Ulwe Node as 0.98 mg/m^3 with the minimum value observed at Panvel as 0.70 mg/m^3 respectively.

Ammonia (NH_3): The maximum value for NH_3 is observed at Ulwe Node as 39.08 µg/m^3 with the minimum value observed at NMIA project site as 26.81 µg/m^3.

All above parameters are observed to be in compliance with permissible limits as per NAAQ Standards November,2009. Also, parameters such as Lead (Pb), Arsenic (As), Nickel (Ni), Benzo(a)Pyrene (BaP) and Benzene (C6H6) were found within prescribed limits in the month of January 2024.

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Table 4-5: Ambient Air Quality monitoring at various stations during February 2024

Sampling Locations	Owale Village	Pargaon	Ulwe Node	NMIA Project site	Kille Gaothan	L & T Site Office	Diwale Koliwada	Panvel	Jui	Limit #	Unit
Sampling Date	**12. 02. 2024**			**13. 02. 2024**			**14.02.2024**				
SO_2	33.79	32.1	31.25	28.72	24.49	26.18	35.47	29.56	23.65	80*	µg/m³
NO_X	50.35	47.6	54.49	43.46	45.53	39.32	52.42	41.39	46.22	80*	µg/m³
PM_{10}	87.04	92.58	95.42	83.28	89.26	90.22	98.38	88.44	85.59	100*	µg/m³
$PM_{2.5}$	32.5	37.92	39.17	30.42	36.25	41.67	47.08	38.75	34.58	60*	µg/m³
Ozone (O_3)	16.65	19.55	24.04	18.5	20.61	15.85	17.44	21.4	14.53	180**	µg/m³
Lead (Pb)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.8)	BDL(DL-0.8)	BDL(DL-0.8)	BDL(DL-0.8)	BDL(DL-0.8)	BDL (DL-0.8)	1***	µg/m³
CO	0.81	0.84	0.88	0.92	0.83	0.84	0.86	0.76	0.91	4**	mg/m³
Benzene (C_6H_6)	BDL(DL-0.2)	BDL(DL-0.2)	BDL(DL-0.2)	BDL(DL-0.2)	BDL(DL-0.2)	BDL(DL-0.2)	BDL(DL-0.2)	BDL(DL-0.2)	BDL(DL-0.2)	8***	µg/m³
Benzopyrene	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	1***	ng/m³
Arsenic (As)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	8***	ng/m³
Nickel (Ni)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	20***	ng/m³
NH_3	41.67	39.08	36.18	31.65	34.56	29.39	43.28	33.27	38.11	400*	µg/m³

BDL–Below Detectable Limit (Note # Limits as per National Ambient Air Quality Standards NAAQS,2009)

[*] 24 hour monitoring value; [**] 1 hour monitoring value; [***] Annual monitoring value

Results:

Particulate Matter (PM_{10}): A maximum value for PM_{10} is observed at Diwale Koliwada as 98.38 µg/m³ with the minimum value observed at NMIA project site as 83.28 µg/m³.

Particulate Matter ($PM_{2.5}$): A maximum value for $PM_{2.5}$ is observed at Diwale Koliwada as 47.08 µg/m³ with the minimum value observed at NMIA project site as 30.42 µg/m³.

Ozone (O_3):A maximum value for Ozone is observed at Ulwe Node as 24.04 µg/m³ with minimum value observed at Jui as 14.53 µg/m³.

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Sulphur Dioxide (SO_2): Maximum value for SO_2 is observed at Diwale Koliwada as 35.47 µg/m³ with the minimum value observed at Jui as 23.65 µg/m³.
Oxides of Nitrogen (NO_x): Maximum value for NO_x is observed at Ulwe Node as 54.49 µg/m³ with the minimum value observed at L&T Site Office as 39.32 µg/m³.
Carbon Monoxide (CO): The maximum value for CO is observed at NMIA project site as 0.92 mg/m³ with the minimum value observed at Panvel as 0.76 mg/m³.
Ammonia (NH_3): The maximum value for NH_3 is observed at Diwale Koliwada as 43.28 µg/m³ with the minimum value observed at L&T Site Office as 29.39 µg/m³.

All above parameters are observed to be in compliance with permissible limits as per NAAQ Standards in the month of February 2024. Also, parameters such as Lead (Pb), Arsenic (As), Nickel (Ni), Benzo(a)Pyrene (BaP) and Benzene (C_6H_6) were found within prescribed limits.

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Table 4-6: Ambient Air Quality monitoring at various stations during March 2024

Sampling Locations	Owale Village	Pargaon	Ulwe Node	NMIA Project site	Kille Gaothan	L & T Site Office	Diwale Koliwada	Panvel	Jui	Limit #	Unit
Sampling Date	**11.03.2024**			**12.03.2024**			**13.03.2024**				
SO_2	35.47	29.56	28.72	26.18	21.12	30.41	25.34	32.94	27.03	80*	µg/m³
NO_X	54.25	41.89	49.45	38.46	40.52	45.32	36.4	56.31	39.14	80*	µg/m³
PM_{10}	84.27	95.51	91.33	87.41	78.19	94.54	85.13	92.63	81.9	100*	µg/m³
$PM_{2.5}$	36.67	41.67	32.08	35.42	27.08	46.67	28.33	38.75	30.42	60*	µg/m³
Ozone (O_3)	19.55	14.27	21.67	16.65	17.44	20.87	15.32	22.72	12.95	180**	µg/m³
Lead (Pb)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	1*	µg/m³
CO	0.8	0.89	0.91	0.84	0.79	0.85	0.89	0.94	0.88	4**	mg/m³
Benzene (C_6H_6)	BDL (DL-0.2)	BDL (DL-0.2)	BDL (DL-0.2)	BDL (DL-0.2)	BDL (DL-0.2)	BDL (DL-0.2)	BDL (DL-0.2)	BDL (DL-0.2)	BDL (DL-0.2)	5***	µg/m³
Benzopyrene	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	BDL (DL-0.5)	1***	ng/m³
Arsenic (As)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	6***	ng/m³
Nickel (Ni)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	BDL (DL-5)	20***	ng/m³
NH_3	44.39	33.47	42.63	28.54	29.6	39.81	31.36	46.51	32.06	400*	µg/m³

BDL–Below Detectable Limit (Note # Limits as per National Ambient Air Quality Standards NAAQS,2009)

[*] 24 hour monitoring value; [**] 1 hour monitoring value; [***] Annual monitoring value

Results:

Particulate Matter (PM_{10}): A maximum value for PM_{10} is observed at Pargaon High School as 95.51 µg/m³ with the minimum value observed at Kille Gaothan Guest Office as 78.19 µg/m³.

Particulate Matter ($PM_{2.5}$): A maximum value for $PM_{2.5}$ is observed at L&T Site Office as 46.67 µg/m³ with the minimum value observed at Kille Gaothan Guest Office as 27.08 µg/m³.

Ozone (O_3): A maximum value for Ozone is observed at Panvel, as 22.72 µg/m³ with the minimum value observed at Jui as 12.95 µg/m³.

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Sulphur Dioxide (SO_2): Maximum value for SO_2 is observed at Owale as 35.47 µg/m^3 with the minimum value observed at Kille Gaothan Guest Office 21.12 µg/m^3.
Oxides of Nitrogen (NOX): Maximum value for NOx is observed at Panvel as 56.31 µg/m^3 with the minimum value observed at Diwale Koliwada as 36.40 µg/m^3.
Carbon Monoxide (CO): The maximum value for CO is observed at Panvel as 0.94 mg/m^3 with the minimum value observed at Kille Gaothan Guest House as 0.79 mg/m^3.
Ammonia (NH_3): The maximum value for NH_3 is observed at Panvel as 46.51 µg/m^3 with the minimum value observed at NMIA Project site as 28.54 µg/m^3.

All above parameters are observed to be in compliance with permissible limits as per NAAQ Standards. Also, parameters such as Lead (Pb), Arsenic (As), Nickel (Ni), Benzo(a)Pyrene (BaP) and Benzene (C6H6) were found within prescribed limits in the month of March 2024.

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4.1.2 Inference of AAQM Data

The concentration of Particulate Matter – 10 µ (PM_{10}) was observed in range of 71.42 – 172.03 µg/m^3 and level of Particulate Matter - 2.5 µ (PM 2.5) were noted ranged from 25.83 to 71.67 µg/m^3. PM10 and PM 2.5 exceeds NAAQS limit at Pargaon High school, Ulwe Node and Owale during November 2023. Gaseous pollutants - Nitrogen Oxide, Sulfur Dioxide, Carbon Monoxide, Ozone and Ammonia are under NAAQS norms during collection period during October 2023 to March 2024 (Refer Tables 4.1 to 4.6 above) Lead, Benzene (C_6H_6), Benzopyrene, Arsenic, Nickel were found below detectable level.

4.2 AMBIENT NOISE LEVEL MONITORING REPORT

4.2.1 Noise Level Data

Ambient Noise level was monitored over 24 hours' duration for Day and Nighttime as per Schedule - II of Environmental Protection Act 1986 for Industrial, Commercial, Residential and Sensitive Area (Refer Table 2.3).

Results of analysis are compiled below:

Table 4-7: Ambient Noise Level monitoring during October 2023– March 2024

Stn Code	Sampling Location	Sampling Date	Observed Value (Leq) (dB(A))						Limiting Standard (Leq) as per EP Act Schedule II. dB(A)	
			Day Time			Nighttime				
			Max	Min	Avg	Max	Min	Avg	Day Time	Nighttime
N1	Owale	09.10.2023	57.1	51.3	54.4	46.3	42.6	44.3	55	45
N2	Pargaon		57.3	51.3	54.6	47.9	42.1	44.7	55	45
N3	Ulwe Node		67.5	56.0	61.5	55.5	54.3	54.8	55	45
N4	Karanjade		53.5	47.3	51.7	45.8	44.2	48.8	55	45
N5	NMIA Project site	10.10.2023	60.2	44.3	51.3	52.1	50.3	50.8	75	70
N6	Kille Gaothan		57.5	53.2	54.9	48.9	40.6	44.9	55	45
N7	Balaji Site Office		57.9	47.3	54.3	55.8	47.7	51.5	75	70
N8	Diwale Koliwada	11.10.2023	57.4	49.5	54.6	47.1	42.8	44.5	55	45
N9	Jui		63.0	47.7	53.5	47.0	42.8	44.9	55	45
N10	Panvel		56.7	51.6	54.3	48.3	42.0	44.9	55	45
N1	Owale	06.11.2023	63.2	34.4	46.3	35.2	30.5	32.0	55	45
N2	Pargaon		58.7	52.1	54.9	46.1	34.4	38.5	55	45

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Stn Code	Sampling Location	Sampling Date	Observed Value (Leq) (dB(A))						Limiting Standard (Leq) as per EP Act Schedule II. dB(A)	
			Day Time			Nighttime				
			Max	Min	Avg	Max	Min	Avg	Day Time	Nighttime
N3	Ulwe Node		65.0	63.0	64.2	54.7	51.0	53.7	55	45
N4	Karanjade		52.2	47.9	54.8	62.9	46.3	38.6	55	45
N5	NMIA Project site	09.11.2023	61.4	55.6	57.4	56.5	55.8	56.2	75	70
N6	Kille Gaothan		58.3	48.2	58.8	46.2	43.2	44.8	55	45
N7	L&T Site Office		58.1	48.5	42.4	48.7	47.7	48.2	75	70
N8	Diwale Koliwada	10.11.2023	58.0	51.9	56.3	54.4	49.8	51.4	55	45
N9	Jui		58.3	46.3	52.7	43.6	38.3	41.3	55	45
N10	Panvel		54.8	36.8	48.4	33.6	31.4	32.7	55	45
N1	Owale	11.12.2023	66.1	31.5	40.8	36.1	30.2	32.7	55	45
N2	Pargaon		56.3	47.5	53.7	47.3	42.8	44.8	55	45
N3	Ulwe Node		60.1	49.0	57.0	55.3	47.1	51.7	55	45
N4	Karanjade		67.0	38.2	49.6	38.1	34.7	35.9	55	45
N5	NMIA Project site	12.12.2023	63.4	56.1	60.8	58.1	53.8	56.0	75	70
N6	Kille Gaothan		57.8	52.1	54.9	46.8	42.8	44.7	55	45
N7	L&T Site Office		60.1	47.0	55.1	56.3	54.2	55.0	75	70
N8	Diwale Koliwada	13.12.2023	58.0	52.6	54.8	46.8	43.2	44.8	55	45
N9	Jui		56.9	52.0	54.8	46.3	42.1	44.0	55	45
N10	Panvel		58.2	46.9	54.4	48.9	40.3	43.4	55	45
N1	Owale	15.01.2024	54.9	40.4	47.8	38.6	33.9	35.3	55	45
N2	Pargaon		54.8	46.1	52.7	45.8	42.8	43.9	55	45
N3	Ulwe Node		54.8	46.7	53.2	44.3	41.6	42.8	55	45
N4	Karanjade	16.01.2024	54.9	44.6	50.7	44.2	42.1	43.3	55	45
N8	Diwale Koliwada		55.0	51.0	53.8	46.3	43.2	44.4	55	45
N9	Jui		55.1	52.1	53.9	48.5	41.0	44.2	55	45
N10	Panvel		56.5	52.8	54.9	46.2	43.8	44.9	55	45
N4	NMIA Project site	17. 01.2024	63.5	54.0	55.4	55.3	53.8	54.3	75	70
N5	L&T Site Office		62.0	49.2	59.2	59.8	54.1	56.1	75	70
N6	Kille Gaothan		55.2	50.3	53.6	45.8	42.8	43.8	55	45
N1	Owale	12.02.2024	54.9	34.7	44.6	41.9	32.8	35.5	55	45
N2	Pargaon		54.6	42.6	51.4	43.9	41.0	42.4	55	45
N3	Ulwe Node		55.2	52.3	53.7	44.9	42.0	43.2	55	45
N4	Karanjade		54.7	46.1	51.0	44.9	41.0	42.7	55	45
N5	NMIA Project site	13.02.2024	56.3	50.2	52.9	52.7	49.1	51.0	75	70
N6	Kille Gaothan		54.9	51.5	53.5	43.6	40.6	42.1	55	45
N7	L&T Site Office		57.3	52.5	54.4	53.6	52.0	52.7	75	70
N8	Diwale Koliwada	14. 02.2024	54.9	51.2	53.1	48.6	40.1	43.3	55	45
N9	Jui		54.9	40.9	52.4	44.2	42.5	43.4	55	45

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Stn Code	Sampling Location	Sampling Date	Observed Value (Leq) (dB(A))						Limiting Standard (Leq) as per EP Act Schedule II. dB(A)	
			Day Time			Nighttime				
			Max	Min	Avg	Max	Min	Avg	Day Time	Nighttime
N10	Panvel		57.0	46.4	51.5	49.2	42.7	44.5	55	45
N1	Owale	11.03.2024	54.1	35.1	43.1	36.5	33.3	35.1	55	45
N2	Pargaon		54.1	40.5	49.8	42.7	39.6	41.2	55	45
N3	Ulwe Node		62.0	37.0	52.1	35.1	33.8	34.6	55	45
N4	Karanjade		54.2	38.9	48.1	42.6	39.7	40.8	55	45
N5	NMIA Project site	12.03.2024	56.5	45.8	54.0	54.3	53.1	53.8	75	70
N6	Kille Gaothan		57.6	50.9	53.6	46.2	40.2	42.8	55	45
N7	L&T Site Office		56.9	52.9	54.6	54.0	53.1	53.4	75	70
N8	Diwale Koliwada		55.8	48.3	53.2	48.4	41.6	43.9	55	45
N9	Jui	13.03.2024	61.4	41.3	48.9	50.3	41.8	44.2	55	45
N10	Panvel		68.2	36.4	49.8	48.1	33.0	37.5	55	45

4.2.2 Inference of Noise Data

During daytime, the average Noise level was observed in the range of 40.8 -64.2 dB(A) & Nighttime levels were observed at 32 – 56.2 dB(A) during sampling period. Following observations are made about average Noise levels in the monitoring carried out in different months:

- In October 2023 average Noise level exceeded the EP Act Standards during day and nighttime at Ulwe Node (61.5 and 54.8 dBA). Noise level exceeds EP act standards during nighttime at Karanjade (48.8 dBA) due to high vehicular movement.
- In November 2023 average Noise level exceeds EP act standards during daytime and nighttime at Ulwe Node (64.2 and 53.7 dBA) and Diwale Koliwada (56.3 and 51.4 dBA); only during daytime at Kille Gaothan (58.8 dBA) respectively due to vehicular movement.
- In December 2023 average Noise level exceeded during Day and nighttime at Ulwe Node (57.0 and 51.7 dBA). This is due to high vehicular movement.
- In January 2024 average Noise level during daytime and nighttime were under Limiting Standard (Leq) as per EP Act Schedule II.
- In February 2024 average Noise level during daytime and nighttime were under Limiting Standard (Leq) as per EP Act Schedule II.
- In March 2024 average Noise level during daytime as well as nighttime were under Limiting Standard (Leq) as per EP Act Schedule II.

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4.3 SOIL QUALITY MONITORING REPORT

4.3.1 Soil Analysis Data (October 2023 and March 2024)

Data on soil analysis is compiled and presented below for the sampling period:

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Table 4-8: Soil analysis of various stations in study area during December 2023

Sr. No.	Locations / Sampling Date		Chinchpada	Koli	Kopar	Ulwe	NMIA Project site	Kombadbhuje	Pargaon	Owale	Unit
			13.12.2023								
1.	pH		6.92	6.64	6.90	7.48	6.89	7.01	7.28	7.54	--
2.	Texture	Clay	74	76	72	70	74	78	78	74	%
		Silt	12	14	12	16	14	10	12	14	
		Fine Sand	14	10	14	14	12	12	10	12	
3.	Conductivity		820.4	758.4	72.9	154.2	100.2	1502	384.5	920.4	µS/cm
4.	Organic Carbon		1.20	1.98	0.62	1.18	0.84	1.20	1.10	0.78	%
5.	Available Nitrogen		0.0108	0.0220	0.0108	0.0082	0.0092	0.0048	0.0078	0.0042	%
6.	Available Phosphorus		24	120	20	62	<11.0	150	32	48	kg/ha
7.	Available Potassium		60	70	60	70	60	70	50	60	kg/ha
8.	Chloride		22	< 10	18	<10	<10.0	<10	<10	<10	mg/kg
9.	Sulphate as SO_4		56	48	28	38	42	40	36	34	mg/kg
10.	Calcium as Ca		32	38	32	24	24	30	24	20	meq/l
11.	Magnesium as Mg		20	18	12	08	10	2.0	18	08	meq/l
12.	Sodium as Na		90	50	50	60	60	50	70	70	kg/ha
13.	Manganese as Mn		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	mg/kg
14.	Copper as Cu		0.78	< 0.2	< 0.2	0.42	< 0.2	0.24	1.8	<0.2	mg/kg
15.	Cadmium as Cd		< 0.2	< 0.2	< 0.2	<0.2	< 0.2	0.30	< 0.2	<0.2	mg/kg
16.	Cobalt as Co		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	mg/kg
17.	Zinc as Zn		1.2	0.20	1.8	0.58	< 0.2	1.72	2.6	0.28	mg/kg
18.	Nickel as Ni		0.8	< 0.2	< 0.2	0.42	< 0.2	0.38	< 0.2	< 0.2	mg/kg

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Sr. No.	Locations	Chinchpada	Koli	Kopar	Ulwe	NMIA Project site	Kombadbhuje	Pargaon	Owale	Unit
	Sampling Date	**13.12.2023**								
19.	Aluminium as Al	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	mg/kg
20.	Arsenic as As	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	mg/kg
21.	Mercury as Hg	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	mg/kg
22.	Chromium as Cr	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	mg/kg
23.	Iron as Fe	< 0.2	< 0.2	2.0	< 0.2	< 0.2	0.24	2.2	< 0.2	mg/kg
24.	Lead as Pb	< 0.2	< 0.2	0.4	0.44	< 0.2	0.38	0.32	< 0.2	mg/kg

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4.3.2 Soil Data Inference during December 2023:

It has been observed that the pH of the soil ranged from 6.64 to 7.54 indicating that the soils are Acidic to basic in nature. The soil in the study area is mostly clay. The electrical conductivity was observed to be in the range of 72.9 to 1502 µS/cm.

The nitrogen concentrations are in the range of 0.0042 % to 0.0220%. The phosphorous concentrations are in the range of <11 kg/ha to 150 kg/ha indicating that soils have less to more than sufficient quantities of phosphorus. The very less phosphorus recorded at NMIA project site, Kopar and Chichpada; less phosphorus at Chinchpada; medium phosphorus recorded at Pargaon and Owale; Sufficient Phosphorus at Ulwe and more than sufficient Phosphorus at Koli and Kombadbhuje.

The potassium concentrations range between 50 kg/ha to 70 kg/ha, which indicate that the soils have very less quantity of potassium at all sampling locations.

Table 4-9: Soil analysis of various stations in study area during March 2024

Sr. No.	Locations	Chinchpada	Koli	Kopar	Ulwe	NMIA Project site	Kombadbhuje	Pargaon	Owale	Unit
	Sampling Date	13.03.2024								
1.	pH	8.02	7.60	7.52	7.75	7.63	7.86	6.52	7.72	--
2.	Texture	70	72	70	68	73	76	76	70	%
		14	12	16	12	12	12	14	18	
		16	16	14	10	15	12	10	10	
3.	Conductivity	820.4	850	120.2	184.2	207.1	2240	610	1120	µS/cm
4.	Organic Carbon	1.10	0.98	0.72	0.98	0.33	0.98	0.94	0.62	%
5.	Available Nitrogen	0.0112	0.0202	0.0114	0.0094	0.0112	0.0058	0.0074	0.0058	%
6.	Available Phosphorus	28	115	24	57	<11.0	138	30	40	kg/ha
7.	Available Potassium	70	60	70	70	70	70	60	70	kg/ha
8.	Chloride	21	14	20	16	10.6	14.2	17	<10	mg/kg
9.	Sulphate as SO_4	52	40	24	32	42	42	32	30	mg/kg
10.	Calcium as Ca	34	29	28	20	20	27.3	32	37	meq/l
11.	Magnesium as Mg	20	12	10	08	3.3	4.6	10	09	meq/l
12.	Sodium as Na	80	70	60	70	60	60	80	60	kg/ha
13.	Manganese as Mn	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	mg/kg
14.	Copper as Cu	5.4	4.7	5.2	3.1	2.3	6.1	5.5	4.3	mg/kg
15.	Cadmium as Cd	< 0.2	< 0.2	< 0.2	<0.2	< 0.2	< 0.2	< 0.2	<0.2	mg/kg
16.	Cobalt as Co	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	mg/kg
17.	Zinc as Zn	2.88	2.91	3.61	3.63	2.65	8.9	5.64	3.46	mg/kg

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Sr. No.	Locations / Sampling Date	Chinchpada	Koli	Kopar	Ulwe	NMIA Project site	Kombadbhuje	Pargaon	Owale	Unit
		13.03.2024								
18.	Nickel as Ni	4.45	5.23	5.25	2.06	1.92	2.74	4.83	3.88	mg/kg
19.	Aluminium as Al	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	mg/kg
20.	Arsenic as As	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	mg/kg
21.	Mercury as Hg	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	g/kg
22.	Chromium as Cr	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	mg/kg
23.	Iron as Fe	0.25	0.28	0.28	0.24	0.23	0.24	0.29	0.20	mg/kg
24.	Lead as Pb	0.61	1.63	1.63	0.60	1.19	2.76	0.96	0.31	mg/kg

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4.3.3 Soil Data Inference during March 2024:

It has been observed that the pH of the soil ranged from 6.52 to 8.02 indicating that the soils are Moderately acidic to Neutral. The soil in the study area is mostly clay. The electrical conductivity was observed to be in the range of 120.2 to 2240 µS/cm.

The nitrogen concentrations are in the range of 0.0058% to 0.0202%. The phosphorous concentrations are in the range of <11 kg/ha to 138 kg/ha. the phosphorus concentration is very less at NMIA Project site; less at Chichpada, Kopar and Pargaon; medium at Owale and more than sufficient at Koli and Kombadbhuje.

The potassium concentrations range between 60 kg/ha to 90 kg/ha, which indicates that the soils have very less quantity of potassium.

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4.4 GROUND WATER QUALITY ANALYSIS REPORT

4.4.1 GW Analysis Data during October 2023

Ground water samples were collected in October 2023.

Table 4-10: Ground water analysis at various stations during October 2023

Sr. No.	Sampling Locations	Kille Gaothan	Ulwe	Pargaon	Jui	Panvel
	Sampling month	**09.10.2023**				
1.	Colour, Hazen	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
2.	pH@ 25°C	7.10	7.34	7.51	7.40	7.21
3.	Turbidity, NTU	<2.0	<2.0	<2.0	<2.0	<2.0
4.	TDS, mg/l	250	260	280	240	230
5.	NH3(as N), mg/l	< 0.56	< 0.56	< 0.56	< 0.56	< 0.56
6.	Boron, mg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
7.	Calcium as Ca, mg/l	36.8	32.8	33.6	28.8	26.4
8.	Chlorides, mg/l	45	45	40	48	35
9.	Fluoride, mg/l	0.32	0.32	0.32	0.32	0.32
10.	Free Res Cl_2, mg/l	0.56	0.58	0.56	0.58	0.56
11.	Iron, mg/l	0.037	0.037	0.030	0.030	0.037
12.	Magnesium as Mg, g/l	10.7	18.9	18.5	17	13.1
13.	Sulphate, mg/l	42	52	52	35	45
14.	Alkalinity, mg/l	134	140	164	148	124
15.	Hardness, mg/l	136	152	160	142	120
16.	Odour	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
17.	Aluminum, mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
18.	Detergents, mg/l	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
19.	Arsenic As, mg/l	<0.01	<0.01	<0.01	<0.01	<0.01
20.	Barium, mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
21.	Copper, mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
22.	Manganese, mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
23.	Chromium as Cr, mg/l	<0.01	<0.01	<0.01	<0.01	<0.01
24.	Zinc, mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
25.	Nitrate, mg/l	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
26.	Selenium, mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
27.	Lead, mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
28.	Molybdenum, mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
29.	Nickel, mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
30.	Cadmium as Cd, mg/l	<0.003	<0.003	<0.003	<0.003	<0.003
31.	Phenolic comp. mg/l	<0.001	<0.001	<0.001	<0.001	<0.001

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Sr. No.	Sampling Locations	Kille Gaothan	Ulwe	Pargaon	Jui	Panvel
	Sampling month	**09.10.2023**				
32.	Sulphide as S^{2-} mg/l	<0.02	<0.02	<0.02	<0.02	<0.02
33.	Mercury as Hg, mg/l	<0.001	<0.001	<0.001	<0.001	<0.001
34.	Chloramines, mg/l	<2.0	<2.0	<2.0	<2.0	<2.0
35.	Mineral Oils, mg/l	<0.5	<0.5	<0.5	<0.5	<0.5
36.	Silver as Ag, mg/l	<0.1	<0.1	<0.1	<0.1	<0.1
37.	Cyanide as Cn, mg/l	<0.05	<0.05	<0.05	<0.05	<0.05
38.	PCB, mg/l	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
39.	PAH, mg/l	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
40.	Trihalomethanes, mg/l					
a	Bromoform	<0.01	<0.01	<0.01	<0.01	<0.01
b	Dichlorobromomethane	<0.01	<0.01	<0.01	<0.01	<0.01
c	Bromodichloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
d	Chloroform	<0.01	<0.01	<0.01	<0.01	<0.01
41.	Alachlor, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
42.	Atrazine, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
43.	Aldrin, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
44.	Alpha HCH, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
45.	Beta HCH, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
46.	Butachlor, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
47.	Chlorpyriphos, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
48.	Delta HCH, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
49.	2,4 Dichloro PAA, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
50.	DDT, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
51.	Endosulphan, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
52.	Ethion, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
53.	Lindane, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
54.	Isoproturon, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
55.	Malathion, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
56.	Methyl parathion, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
57.	Monocrotophos , µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
58.	Phorate, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
	Microbiology					
59.	Coliform (MPN/100 ml)	>1600	>1600	>1600	>1600	>1600
60.	E. Coli/100 ml	Present	Present	Present	Present	Present

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4.4.2 GW Analysis Inference:

The analysis results indicate the pH range of 7.10 to 7.51 and is observed to be within the desirable limit of 6.5 to 8.5, beyond this range water will affect the mucous membrane and/or water supply system. The total hardness is in the range of 120 to 160 mg/l and is observed to be within the permissible limit of 600 mg/l at all locations. The total hardness beyond the permissible limit causes encrustation in water supply structure and adverse effects on domestic use. The iron concentration is found to be in the range of 0.030 to 0.037 mg/l for all the five samples and is observed to be within the acceptable limit of 1.0 mg/l at all locations. Beyond the desirable limit taste/appearance are affected, has adverse effect on domestic uses and water supply structures, and promotes iron bacteria.

The chlorides concentration is in the range of 35 mg/l to 48 mg/l and is observed to be within the acceptable limit of 250 mg/l at all five locations. Beyond this limit, taste, corrosion and palatability are affected. The fluoride concentration is 0.32 mg/l, observed at all locations to be within the acceptable limit 1.0 mg/l and permissible limit of 1.5 mg/l at all locations, high fluoride may cause fluorosis. The TDS are in the range of 230 to 280 mg/l, and is observed within the acceptable limit of 500 mg/l at all five locations and are also within the permissible limit of 2000 mg/l.

The ground water samples collected from five locations and are analyzed for physical, chemical and biological parameters. The chemical and physical characteristics of the analyzed ground water samples show that the samples are potable as per IS 10500-RA2018. The biological characteristics of the analyzed ground water samples shows that the samples are not potable as per IS 10500-RA2018.

4.4.3 GW Analysis Data during November 2023

Ground water samples were collected in November 2023. Access was not available to predefined locations; hence sampling was done at nearby and other locations within the study area.

Table 4-11: Ground water analysis at various stations during November 2023

Sr. No.	Sampling Locations	Dapoli	Chinchpada	Owale	Kombadbhuje
	Sampling month	08.11.2023			09.11.2023
1.	Colour, Hazen	<5.0	<5.0	<5.0	<5.0
2.	pH@ 25°C	7.48	7.35	7.40	7.28
3.	Turbidity, NTU	<2.0	<2.0	<2.0	<2.0
4.	TDS, mg/l	370	340	340	290

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Sr. No.	Sampling Locations	Dapoli	Chinchpada	Owale	Kombadbhuje
	Sampling month	**08.11.2023**			**09.11.2023**
5.	NH3(as N), mg/l	< 0.56	< 0.56	< 0.56	< 0.56
6.	Boron, mg/l	<0.05	<0.05	<0.05	<0.05
7.	Calcium as Ca, mg/l	55.2	45.6	44.8	40.8
8.	Chlorides, mg/l	74	51	60	42
9.	Fluoride, mg/l	0.32	0.34	0.32	0.34
10.	Free Res Cl_2, mg/l	0.56	0.58	0.58	0.58
11.	Iron, mg/l	0.03	0.30	0.030	0.30
12.	Magnesium as Mg, g/l	29.6	24.3	23.8	21.3
13.	Sulphate, mg/l	59	58	52	48
14.	Alkalinity, mg/l	278	218	222	210
15.	Hardness, mg/l	260	214	210	200
16.	Odour	Agreeable	Agreeable	Agreeable	Agreeable
17.	Aluminum, mg/l	< 0.01	< 0.01	< 0.01	< 0.01
18.	Detergents, mg/l	< 0.04	< 0.04	< 0.04	< 0.04
19.	Arsenic As, mg/l	<0.01	<0.01	<0.01	<0.01
20.	Barium, mg/l	< 0.01	< 0.01	< 0.01	< 0.01
21.	Copper, mg/l	< 0.01	< 0.01	< 0.01	< 0.01
22.	Manganese, mg/l	< 0.01	< 0.01	< 0.01	< 0.01
23.	Chromium as Cr, mg/l	<0.01	<0.01	<0.01	<0.01
24.	Zinc, mg/l	< 0.01	< 0.01	< 0.01	< 0.01
25.	Nitrate, mg/l	< 0.5	< 0.5	< 0.5	< 0.5
26.	Selenium, mg/l	< 0.01	< 0.01	< 0.01	< 0.01
27.	Lead, mg/l	< 0.01	< 0.01	< 0.01	< 0.01
28.	Molybdenum, mg/l	< 0.01	< 0.01	< 0.01	< 0.01
29.	Nickel, mg/l	< 0.01	< 0.01	< 0.01	< 0.01
30.	Cadmium as Cd, mg/l	<0.003	<0.003	<0.003	<0.003
31.	Phenolic comp. mg/l	<0.001	<0.001	<0.001	<0.001
32.	Sulphide as S^{2-} mg/l	<0.02	<0.02	<0.02	<0.02
33.	Mercury as Hg, mg/l	<0.001	<0.001	<0.001	<0.001
34.	Chloramines, mg/l	<2.0	<2.0	<2.0	<2.0
35.	Mineral Oils, mg/l	<0.5	<0.5	<0.5	<0.5
36.	Silver as Ag, mg/l	<0.1	<0.1	<0.1	<0.1
37.	Cyanide as Cn, mg/l	<0.05	<0.05	<0.05	<0.05
38.	PCB, mg/l	< 0.0001	< 0.0001	< 0.0001	< 0.0001
39.	PAH, mg/l	< 0.0001	< 0.0001	< 0.0001	< 0.0001
40.	Trihalomethanes, mg/l				
a	Bromoform	<0.01	<0.01	<0.01	<0.01
b	Dichlorobromomethane	<0.01	<0.01	<0.01	<0.01
c	Bromodichloromethane	<0.01	<0.01	<0.01	<0.01

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Sr. No.	Sampling Locations	Dapoli	Chinchpada	Owale	Kombadbhuje
	Sampling month	**08.11.2023**			**09.11.2023**
d	Chloroform	<0.01	<0.01	<0.01	<0.01
41.	Alachlor, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
42.	Atrazine, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
43.	Aldrin, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
44.	Alpha HCH, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
45.	Beta HCH, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
46.	Butachlor, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
47.	Chlorpyriphos, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
48.	Delta HCH, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0
49.	2,4 Dichloro PAA, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0
50.	DDT, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
51.	Endosulphan, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0
52.	Ethion, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0
53.	Lindane, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0
54.	Isoproturon, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
55.	Malathion, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0
56.	Methyl parathion, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0
57.	Monocrotophos , µg/l	< 1.0	< 1.0	< 1.0	< 1.0
58.	Phorate, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
Microbiology					
59.	Coliform (MPN/100 ml)	>1600	>1600	>1600	>1600
60.	E. Coli/100 ml	Present	Present	Present	Present

4.4.4 GW Analysis Inference:

The analysis results indicate the pH range of 7.28 to 7.48 and is observed to be within the desirable limit of 6.5 to 8.5, beyond this range water will affect the mucous membrane and/or water supply system. The total hardness is in the range of 200 to 260 mg/l and is observed within the permissible limit of 600 mg/l at all four locations. The total hardness beyond the permissible limit causes encrustation in water supply structure and adverse effects on domestic use. The iron concentration is found in the range of 0.03 to 0.30 mg/l and is observed to be within the acceptable limit of 1.0 mg/l at all locations. Beyond the desirable limit taste/appearance are affected, has adverse effect on domestic uses and water supply structures, and promotes iron bacteria.

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The chlorides concentration is in the range of 42 mg/l to 74 mg/l and is observed within the acceptable limit of 250 mg/l at all five locations. Beyond this limit, taste, corrosion and palatability are affected. The fluoride concentration observed ranged from 0.30 to 0.34 mg/l, within the Acceptable and permissible limit of 1.0 mg/l and 1.5 mg/l respectively at all locations, high fluoride may cause fluorosis. The TDS are in the range of 290 to 370 mg/l and is observed within the desirable limit of 500 mg/l at all five locations and are also within the permissible limit of 2000 mg/l.

The ground water samples collected from all locations and are analyzed for physical, chemical and biological parameters. The chemical and physical characteristics of the analyzed ground water samples show that the samples are potable as per IS 10500-RA2018. The biological characteristics of the analyzed ground water samples shows that the samples are not potable as per IS 10500- RA2018.

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4.4.5 GW Analysis Data during December 2023

Ground water samples were collected in December 2023.

Table 4-12: Ground water analysis at various stations during December 2023

Sr. No.	Sampling Locations	Ulwe	Kille Gaothan	Jui	Panvel	Pargaon
	Sampling month	**11.12.2023**				**13.12.2023**
1.	Colour, Hazen	5.0	5.0	5.0	5.0	5.0
2.	pH@ 25°C	7.51	7.10	7.12	7.06	7.28
3.	Turbidity, NTU	<2.0	<2.0	<2.0	2.8	<2.0
4.	TDS, mg/l	270	250	230	220	290
5.	NH3(as N), mg/l	< 0.56	< 0.56	< 0.56	< 0.56	< 0.56
6.	Boron, mg/l	<0.05	<0.05	<0.05	<0.05	<0.05
7.	Calcium as Ca, mg/l	32	36.8	38.4	28.8	40.8
8.	Chlorides, mg/l	40	45	38	38	42
9.	Fluoride, mg/l	0.32	0.32	0.32	0.32	0.34
10.	Free Res Cl_2, mg/l	0.56	0.56	0.58	0.56	0.58
11.	Iron, mg/l	0.03	0.033	0.030	0.04	0.03
12.	Magnesium as Mg, g/l	18.4	10.7	9.7	10.2	21.3
13.	Sulphate, mg/l	48	42	38	40	48
14.	Alkalinity, mg/l	160	134	148	120	210
15.	Hardness, mg/l	156	136	136	114	200
16.	Odour	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
17.	Aluminum, mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
18.	Detergents, mg/l	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
19.	Arsenic As, mg/l	<0.01	<0.01	<0.01	<0.01	<0.01
20.	Barium, mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
21.	Copper, mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
22.	Manganese, mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
23.	Chromium as Cr, mg/l	<0.01	<0.01	<0.01	<0.01	<0.01
24.	Zinc, mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
25.	Nitrate, mg/l	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
26.	Selenium, mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
27.	Lead, mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
28.	Molybdenum, mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
29.	Nickel, mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
30.	Cadmium as Cd, mg/l	<0.003	<0.003	<0.003	<0.003	<0.003
31.	Phenolic comp. mg/l	<0.001	<0.001	<0.001	<0.001	<0.001
32.	Sulphide as S^{2-} mg/l	<0.02	<0.02	<0.02	<0.02	<0.02
33.	Mercury as Hg, mg/l	<0.001	<0.001	<0.001	<0.001	<0.001
34.	Chloramines, mg/l	<2.0	<2.0	<2.0	<2.0	<2.0
35.	Mineral Oils, mg/l	<0.5	<0.5	<0.5	<0.5	<0.5
36.	Silver as Ag, mg/l	<0.1	<0.1	<0.1	<0.1	<0.1
37.	Cyanide as Cn, mg/l	<0.05	<0.05	<0.05	<0.05	<0.05

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Sr. No.	Sampling Locations	Ulwe	Kille Gaothan	Jui	Panvel	Pargaon
	Sampling month	**11.12.2023**				**13.12.2023**
38.	PCB, mg/l	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
39.	PAH, mg/l	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
40.	Trihalomethanes, mg/l					
a	Bromoform	<0.01	<0.01	<0.01	<0.01	<0.01
b	Dichlorobromomethane	<0.01	<0.01	<0.01	<0.01	<0.01
c	Bromodichloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
d	Chloroform	<0.01	<0.01	<0.01	<0.01	<0.01
41.	Alachlor, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
42.	Atrazine, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
43.	Aldrin, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
44.	Alpha HCH, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
45.	Beta HCH, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
46.	Butachlor, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
47.	Chlorpyriphos, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
48.	Delta HCH, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
49.	2,4 Dichloro PAA, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
50.	DDT, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
51.	Endosulphan, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
52.	Ethion, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
53.	Lindane, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
54.	Isoproturon, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
55.	Malathion, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
56.	Methyl parathion, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
57.	Monocrotophos , µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
58.	Phorate, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
	Microbiology					
59.	Coliform (MPN/100 ml)	>1600	>1600	>1600	>1600	>1600
60.	E. Coli/100 ml	Present	Present	Present	Present	Present

4.4.6 GW Analysis Inference:

The analysis results indicate the pH range of 7.06 to 7.51 and is observed within the desirable limit of 6.5 to 8.5, beyond this range water will affect the mucous membrane and/or water supply system. The total hardness is in the range of 114 to 200 mg/l and is observed within the permissible limit of 600 mg/l at all locations. The total hardness beyond the permissible limit causes encrustation in water supply structure and adverse effects on domestic use. The iron concentration is found in the range of 0.030 to 0.04 mg/l for all samples and is observed to be within the acceptable limit of 1.0 mg/l at all locations. Beyond

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the desirable limit taste/appearance are affected, has adverse effect on domestic uses and water supply structures, and promotes iron bacteria.

The chlorides concentration is in the range of 38 mg/l to 45 mg/l and is observed within the acceptable limit of 250 mg/l at all five locations. Beyond this limit, taste, corrosion and palatability are affected. The fluoride concentration is in the range of 0.32 to 0.34 mg/l and is observed within the acceptable and permissible limit of 1.0 mg/l and 1.5 mg/l respectively at all locations, high fluoride may cause fluorosis. The TDS are in the range of 220 to 290 mg/l, and is observed within the desirable limit of 500 mg/l at all five locations and are also within the permissible limit of 2000 mg/l.

The ground water samples collected from five locations and are analyzed for physical, chemical and biological parameters. The chemical and physical characteristics of the analyzed ground water samples show that the samples are potable as per IS 10500-RA2018. The biological characteristics of the analyzed ground water samples show that the samples are not potable as per IS 10500- RA2018.

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4.4.7 GW Analysis Data during January 2024

Ground water samples were collected in July 2023. No access was available to Kopar, Koli, Chinchpada, Pargaon during collection period, hence sampling was done in nearby and other villages within study area.

Table 4-13: Ground water analysis at various stations during January 2024

Sr. No.	Sampling Locations	Kombadbhuje	Owale	Dapoli	Chinchpada
	Sampling month	15.01.2024			
1.	Colour, Hazen	5.0	5.0	5.0	5.0
2.	pH@ 25°C	7.25	7.30	7.20	7.24
3.	Turbidity, NTU	<2.0	<2.0	<2.0	<2.0
4.	TDS, mg/l	310	400	300	270
5.	NH3(as N), mg/l	< 0.56	< 0.56	< 0.56	< 0.56
6.	Boron, mg/l	<0.05	<0.05	<0.05	<0.05
7.	Calcium as Ca, mg/l	46.6	54.4	42.4	40.8
8.	Chlorides, mg/l	58	75	52	45
9.	Fluoride, mg/l	0.34	0.32	0.34	0.34
10.	Free Res Cl_2, mg/l	0.58	0.58	0.58	0.58
11.	Iron, mg/l	0.40	0.03	0.03	0.03
12.	Magnesium as Mg, g/l	24.3	37	25.3	21.3
13.	Sulphate, mg/l	48	78	58	50
14.	Alkalinity, mg/l	220	288	216	202
15.	Hardness, mg/l	214	290	210	210
16.	Odour	Agreeable	Agreeable	Agreeable	Agreeable
17.	Aluminum, mg/l	< 0.1	< 0.1	< 0.1	< 0.01
18.	Detergents, mg/l	< 0.04	< 0.04	< 0.04	< 0.04
19.	Arsenic As, mg/l	<0.1	<0.1	<0.1	<0.1
20.	Barium, mg/l	< 0.1	< 0.1	< 0.1	< 0.1
21.	Copper, mg/l	< 0.1	< 0.1	< 0.1	< 0.1
22.	Manganese, mg/l	< 0.1	< 0.1	< 0.1	< 0.1
23.	Chromium as Cr, mg/l	<0.1	<0.1	<0.1	<0.1
24.	Zinc, mg/l	< 0.1	< 0.1	< 0.1	< 0.1
25.	Nitrate, mg/l	< 0.5	< 0.5	< 0.5	< 0.5
26.	Selenium, mg/l	< 0.1	< 0.1	< 0.1	< 0.1
27.	Lead, mg/l	< 0.1	< 0.1	< 0.1	< 0.1
28.	Molybdenum, mg/l	< 0.1	< 0.1	< 0.1	< 0.1
29.	Nickel, mg/l	< 0.1	< 0.1	< 0.1	< 0.1
30.	Cadmium as Cd, mg/l	<0.1	<0.1	<0.1	<0.1
31.	Phenolic comp. mg/l	<0.005	<0.005	<0.005	<0.005
32.	Sulphide as S^{2-} mg/l	<0.02	<0.02	<0.02	<0.02
33.	Mercury as Hg, mg/l	<0.1	<0.1	<0.1	<0.1
34.	Chloramines, mg/l	<2.0	<2.0	<2.0	<2.0

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(October 2023– March 2024)

Sr. No.	Sampling Locations	Kombadbhuje	Owale	Dapoli	Chinchpada
	Sampling month	15.01.2024			
35.	Mineral Oils, mg/l	<0.5	<0.5	<0.5	<0.5
36.	Silver as Ag, mg/l	<0.1	<0.1	<0.1	<0.1
37.	Cyanide as Cn, mg/l	<0.05	<0.05	<0.05	<0.05
38.	PCB, mg/l	< 0.0001	< 0.0001	< 0.0001	< 0.0001
39.	PAH, mg/l	< 0.0001	< 0.0001	< 0.0001	< 0.0001
40.	Trihalomethane, mg/l				
a	Bromoform	<0.01	<0.01	<0.01	<0.01
b	Dichlorobromomethane	<0.01	<0.01	<0.01	<0.01
c	Bromodichloromethane	<0.01	<0.01	<0.01	<0.01
d	Chloroform	<0.01	<0.01	<0.01	<0.01
41.	Alachlor, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
42.	Atrazine, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
43.	Aldrin, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
44.	Alpha HCH, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
45.	Beta HCH, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
46.	Butachlor, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
47.	Chlorpyriphos, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
48.	Delta HCH, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0
49.	2,4 Dichloro PAA, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0
50.	DDT, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
51.	Endosulphan, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0
52.	Ethion, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0
53.	Lindane, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0
54.	Isoproturon, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
55.	Malathion, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0
56.	Methyl parathion, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0
57.	Monocrotophos , µg/l	< 1.0	< 1.0	< 1.0	< 1.0
58.	Phorate, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
	Microbiology				
59.	Coliform (MPN/100 ml)	>1600	>1600	>1600	>1600
60.	E. Coli/100 ml	Present	Present	Present	Present

4.4.8 GW Analysis Inference:

The analysis results indicate the pH range of 7.20 to 7.30 and is observed within the desirable limit of 6.5 to 8.5, beyond this range water will affect the mucous membrane and/or water supply system. The total hardness is in the range of 210 to 290 mg/l and is observed within the permissible limit of 600 mg/l at all four locations. The total hardness beyond the permissible limit causes encrustation in water supply structure and adverse effects on domestic use. The iron concentration is found to be in the range of 0.03 to 0.40

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mg/l, and is observed to be within the acceptable limit of 1.0 mg/l at all locations. Beyond the desirable limit taste/appearance are affected, has adverse effect on domestic uses and water supply structures, and promotes iron bacteria.

The chlorides concentration is in the range of 45 to 75 mg/l and is observed within the acceptable limit of 250 mg/l at all locations. Beyond this limit, taste, corrosion and palatability are affected. The fluoride concentration is 0.32 to 0.34 mg/l and is observed within the acceptable and permissible limit of 1.0 mg/l and 1.5 mg/l respectively at all locations, high fluoride may cause fluorosis. The TDS are in the range of 270 to 400 mg/l, and is observed within the acceptable limit of 500 mg/l at all locations and are also within the permissible limit of 2000 mg/l.

The ground water samples collected from all locations and are analyzed for physical, chemical and biological parameters. The chemical and physical characteristics of the analyzed ground water samples show that the samples are potable as per IS 10500-RA2018. The biological characteristics of the analyzed ground water samples show that the samples are not potable as per IS 10500- RA2018.

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4.4. 9 GW Analysis Data during February 2024

Ground water samples were collected in February 2024.

Table 4-14: Ground water analysis at various stations during February 2024

Sr. No.	Sampling Locations	Kille Gaothan	Ulwe	Pargaon	Jui	Panvel
	Sampling month	12.02.2024			13.02.2024	
1.	Colour, Hazen	5.0	5.0	5.0	5.0	5.0
2.	pH@ 25°C	7.35	7.45	7.5	7.22	7.37
3.	Turbidity, NTU	<2.0	<2.0	<2.0	<2.0	<2.0
4.	TDS, mg/l	270	290	280	250	250
5.	NH3(as N), mg/l	< 0.56	< 0.56	<0.56	< 0.56	< 0.56
6.	Boron, mg/l	<0.05	<0.05	<0.05	<0.05	<0.05
7.	Calcium as Ca, mg/l	34.4	38.4	41.6	38.4	32
8.	Chlorides, mg/l	40	42	45	36	40
9.	Fluoride, mg/l	0.32	0.32	0.34	0.32	0.32
10.	Free Res Cl_2, mg/l	0.58	0.56	0.58	0.56	0.56
11.	Iron, mg/l	0.033	0.04	0.030	0.03	0.04
12.	Magnesium as Mg, g/l	15.5	16	20.4	11.2	14
13.	Sulphate, mg/l	50	55	48	48	35
14.	Alkalinity, mg/l	154	168	194	150	144
15.	Hardness, mg/l	150	162	188	142	138
16.	Odour	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
17.	Aluminum, mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
18.	Detergents, mg/l	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
19.	Arsenic As, mg/l	<0.01	<0.01	<0.01	<0.01	<0.01
20.	Barium, mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
21.	Copper, mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
22.	Manganese, mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
23.	Chromium as Cr, mg/l	<0.01	<0.01	<0.01	<0.01	<0.01
24.	Zinc, mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
25.	Nitrate, mg/l	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
26.	Selenium, mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
27.	Lead, mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
28.	Molybdenum, mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
29.	Nickel, mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
30.	Cadmium as Cd, mg/l	<0.003	<0.003	<0.003	<0.003	<0.003
31.	Phenolic comp. mg/l	<0.001	<0.001	<0.001	<0.001	<0.001
32.	Sulphide as S^{2-} mg/l	<0.02	<0.02	<0.02	<0.02	<0.02
33.	Mercury as Hg, mg/l	<0.001	<0.001	<0.001	<0.001	<0.001
34.	Chloramines, mg/l	<2.0	<2.0	<2.0	<2.0	<2.0
35.	Mineral Oils, mg/l	<0.5	<0.5	<0.5	<0.5	<0.5
36.	Silver as Ag, mg/l	<0.1	<0.1	<0.1	<0.1	<0.1
37.	Cyanide as Cn, mg/l	<0.05	<0.05	<0.05	<0.05	<0.05

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Sr. No.	Sampling Locations	Kille Gaothan	Ulwe	Pargaon	Jui	Panvel
	Sampling month	12.02.2024			13.02.2024	
38.	PCB, mg/l	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
39.	PAH, mg/l	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
40.	Trihalomethane, mg/l					
a	Bromoform	<0.01	<0.01	<0.01	<0.01	<0.01
b	Dichlorobromomethane	<0.01	<0.01	<0.01	<0.01	<0.01
c	Bromodichloromethane	<0.01	<0.01	<0.01	<0.01	<0.01
d	Chloroform	<0.01	<0.01	<0.01	<0.01	<0.01
41.	Alachlor, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
42.	Atrazine, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
43.	Aldrin, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
44.	Alpha HCH, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
45.	Beta HCH, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
46.	Butachlor, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
47.	Chlorpyriphos, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
48.	Delta HCH, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
49.	2,4 Dichloro PAA, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
50.	DDT, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
51.	Endosulphan, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
52.	Ethion, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
53.	Lindane, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
54.	Isoproturon, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
55.	Malathion, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
56.	Methyl parathion, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
57.	Monocrotophos , µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
58.	Phorate, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
	Microbiology					
59.	Coliform (MPN/100 ml)	>1600	>1600	>1600	>1600	>1600
60.	E. Coli/100 ml	Present	Present	Present	Present	Present

4.4.10 GW Analysis Inference:

The analysis results indicate the pH range of 7.22 to 7.45 and is observed within the desirable limit of 6.5 to 8.5, beyond this range water will affect the mucous membrane and/or water supply system. The total hardness is in the range of 138 to 188 mg/l and is observed within the acceptable and permissible limit of 200 mg/l and 600 mg/l respectively at all locations. The total hardness beyond the permissible limit causes encrustation in water supply structure and adverse effects on domestic use. The iron concentration is found to be in the range of 0.03 to 0.04 mg/l and is observed to be within the acceptable limit of 1.0 mg/l

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at all locations. Beyond the acceptable limit taste/appearance are affected, has adverse effect on domestic uses and water supply structures, and promotes iron bacteria.

The chlorides concentration is in the range of 36 mg/l to 45 mg/l and is observed within the acceptable limit of 250 mg/l at all 5 locations. Beyond this limit, taste, corrosion and palatability are affected. The fluoride concentration is 0.32 to 0.34 mg/l, and is observed to be within the acceptable limit of 1.0 mg/l at all locations, high fluoride may cause fluorosis. The TDS are in the range of 250 to 290 mg/l and is observed within the acceptable limit of 500 mg/l at all five locations and are also within the permissible limit of 2000 mg/l.

The ground water samples collected from all locations and are analyzed for physical, chemical and biological parameters. The chemical and physical characteristics of the analyzed ground water samples show that the samples are potable as per IS 10500-RA2018. The biological characteristics of the analyzed ground water samples show that the samples are not potable as per IS 10500- RA2018.

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4.4. 11 GW Analysis Data during March 2024

Ground water samples were collected in March 2024.

Table 4-15: Ground water analysis at various stations during March 2024

Sr. No.	Sampling Locations	Kombadbhuje	Owale	Dapoli	Chinchpada
	Sampling month	11.03.2024			
1.	Colour, Hazen	5.0	5.0	5.0	5.0
2.	pH@ 25°C	7.15	7.09	7.20	7.12
3.	Turbidity, NTU	<2.0	<2.0	<2.0	<2.0
4.	TDS, mg/l	330	370	290	320
5.	NH3(as N), mg/l	< 0.56	< 0.56	< 0.56	< 0.56
6.	Boron, mg/l	<0.05	<0.05	<0.05	<0.05
7.	Calcium as Ca, mg/l	48	49.6	45.6	44.8
8.	Chlorides, mg/l	58	48	52	45
9.	Fluoride, mg/l	0.34	0.32	0.33	0.34
10.	Free Res Cl_2, mg/l	0.58	0.58	0.58	0.58
11.	Iron, mg/l	0.40	0.03	0.03	0.03
12.	Magnesium as Mg, g/l	22.8	21.9	24.3	23.8
13.	Sulphate, mg/l	48	58	50	52
14.	Alkalinity, mg/l	220	238	224	200
15.	Hardness, mg/l	214	214	214	210
16.	Odour	Agreeable	Agreeable	Agreeable	Agreeable
17.	Aluminum, mg/l	< 0.01	< 0.01	< 0.01	< 0.01
18.	Detergents, mg/l	< 0.04	< 0.04	< 0.04	< 0.04
19.	Arsenic As, mg/l	<0.01	<0.01	<0.01	<0.01
20.	Barium, mg/l	< 0.01	< 0.01	< 0.01	< 0.01
21.	Copper, mg/l	< 0.01	< 0.01	< 0.01	< 0.01
22.	Manganese, mg/l	< 0.01	< 0.01	< 0.01	< 0.01
23.	Chromium as Cr, mg/l	<0.01	<0.01	<0.01	<0.01
24.	Zinc, mg/l	< 0.01	< 0.01	< 0.01	< 0.01
25.	Nitrate, mg/l	< 0.5	< 0.5	< 0.5	< 0.5
26.	Selenium, mg/l	< 0.01	< 0.01	< 0.01	< 0.01
27.	Lead, mg/l	< 0.01	< 0.01	< 0.01	< 0.01
28.	Molybdenum, mg/l	< 0.01	< 0.01	< 0.01	< 0.01
29.	Nickel, mg/l	< 0.01	< 0.01	< 0.01	< 0.01
30.	Cadmium as Cd, mg/l	<0.003	<0.003	<0.003	<0.003
31.	Phenolic comp. mg/l	<0.001	<0.001	<0.001	<0.001
32.	Sulphide as S^{2-} mg/l	<0.02	<0.02	<0.02	<0.02

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Sr. No.	Sampling Locations	Kombadbhuje	Owale	Dapoli	Chinchpada
	Sampling month	11.03.2024			
33.	Mercury as Hg, mg/l	<0.001	<0.001	<0.001	<0.001
34.	Chloramines, mg/l	<2.0	<2.0	<2.0	<2.0
35.	Mineral Oils, mg/l	<0.5	<0.5	<0.5	<0.5
36.	Silver as Ag, mg/l	<0.1	<0.1	<0.1	<0.1
37.	Cyanide as Cn, mg/l	<0.05	<0.05	<0.05	<0.05
38.	PCB, mg/l	< 0.0001	< 0.0001	< 0.0001	< 0.0001
39.	PAH, mg/l	< 0.0001	< 0.0001	< 0.0001	< 0.0001
40.	Trihalomethane, mg/l				
a	Bromoform	<0.01	<0.01	<0.01	<0.01
b	Dichlorobromomethane	<0.01	<0.01	<0.01	<0.01
c	Bromodichloromethane	<0.01	<0.01	<0.01	<0.01
d	Chloroform	<0.01	<0.01	<0.01	<0.01
41.	Alachlor, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
42.	Atrazine, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
43.	Aldrin, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
44.	Alpha HCH, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
45.	Beta HCH, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
46.	Butachlor, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
47.	Chlorpyriphos, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
48.	Delta HCH, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0
49.	2,4 Dichloro PAA, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0
50.	DDT, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
51.	Endosulphan, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0
52.	Ethion, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0
53.	Lindane, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0
54.	Isoproturon, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
55.	Malathion, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0
56.	Methyl parathion, , µg/l	< 1.0	< 1.0	< 1.0	< 1.0
57.	Monocrotophos , µg/l	< 1.0	< 1.0	< 1.0	< 1.0
58.	Phorate, µg/l	< 1.0	< 1.0	< 1.0	< 1.0
	Microbiology				
59.	Coliform (MPN/100 ml)	>1600	>1600	>1600	>1600
60.	E. Coli/100 ml	Present	Present	Present	Present

4.4.12 GW Analysis Inference:

The analysis results indicate the pH range of 7.09 to 7.20 and is observed within the desirable limit of 6.5 to 8.5, beyond this range water will affect the mucous membrane

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and/or water supply system. The total hardness is in the range of 210 to 214 mg/l and is observed within the permissible limit of 600 mg/l at all four locations. The total hardness beyond the permissible limit causes encrustation in water supply structure and adverse effects on domestic use. The iron concentration is found to be in the range of 0.03 to 0.40 mg/l and is observed within the acceptable limit of 1.0 mg/l at all locations. Beyond the desirable limit taste/appearance are affected, has adverse effect on domestic uses and water supply structures, and promotes iron bacteria.

The chlorides concentration is in the range of 45 mg/l to 58 mg/l and is observed to be within the acceptable limit of 250 mg/l at all locations. Beyond this limit, taste, corrosion and palatability are affected. The fluoride concentration is 0.32 to 0.34 mg/l and is observed within the acceptable limit of 1.0 mg/l at all locations, high fluoride may cause fluorosis. The TDS are in the range of 290 to 370 mg/l and is observed within the desirable limit of 500 mg/l at all locations and are also within the permissible limit of 2000 mg/l.

The ground water samples collected from four locations and are analyzed for physical, chemical and biological parameters. The chemical and physical characteristics of the analyzed ground water samples shows that the samples are potable as per IS 10500-RA2018. The biological characteristics of the analyzed ground water samples shows that the samples are not potable as per IS 10500- RA2018.

4.5 DRINKING WATER QUALITY ANALYSIS REPORT

NMIA project site and V Time Office were selected for analysis of drinking water during November 2023 and March 2024.

Table 4-16: Drinking water analysis during November 2023 and March 2024

Sr. No.	Sampling Locations	NMIA Project site	V-Time Office
	Sampling month	10.11.2023	11.03.2024
1.	Colour, Hazen	<5.0	<5.0
2.	pH@ 25°C	6.85	7.10
3.	Turbidity, NTU	<2.0	<2.0
4.	TDS, mg/l	70	70
5.	NH3(as N), mg/l	< 0.56	< 0.56
6.	Boron, mg/l	<0.05	<0.05
7.	Calcium as Ca, mg/l	10.4	8.8
8.	Chlorides, mg/l	18	9.0
9.	Fluoride, mg/l	0.30	0.32
10.	Free Res Cl_2, mg/l	<0.56	<0.56

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Sr. No.	Sampling Locations	NMIA Project site	V-Time Office
	Sampling month	10.11.2023	11.03.2024
11.	Iron, mg/l	0.030	0.03
12.	Magnesium as Mg, g/l	2.91	6.3
13.	Sulphate, mg/l	6.8	15
14.	Alkalinity, mg/l	34	54
15.	Hardness, mg/l	38	48
16.	Odour	Agreeable	Agreeable
17.	Aluminum, mg/l	< 0.01	< 0.01
18.	Detergents, mg/l	< 0.04	< 0.04
19.	Arsenic As, mg/l	<0.01	<0.01
20.	Barium, mg/l	< 0.01	< 0.01
21.	Copper, mg/l	< 0.01	< 0.01
22.	Manganese, mg/l	< 0.01	< 0.01
23.	Chromium as Cr, mg/l	<0.01	<0.01
24.	Zinc, mg/l	< 0.01	< 0.01
25.	Nitrate, mg/l	< 0.5	< 0.5
26.	Selenium, mg/l	< 0.01	< 0.01
27.	Lead, mg/l	< 0.01	< 0.01
28.	Molybdenum, mg/l	< 0.01	< 0.01
29.	Nickel, mg/l	< 0.01	< 0.01
30.	Cadmium as Cd, mg/l	<0.003	<0.003
31.	Phenolic comp. mg/l	<0.001	<0.001
32.	Sulphide as S^{2-} mg/l	<0.02	<0.02
33.	Mercury as Hg, mg/l	<0.001	<0.001
34.	Chloramines, mg/l	<2.0	<2.0
35.	Mineral Oils, mg/l	<0.5	<0.5
36.	Silver as Ag, mg/l	<0.1	<0.1
37.	Cyanide as Cn, mg/l	<0.05	<0.05
38.	PCB, mg/l	< 0.0001	< 0.0001
39.	PAH, mg/l	< 0.0001	< 0.0001
40.	Trihalomethanes, mg/l		
a	Bromoform	<0.01	<0.01
b	Dichlorobromomethane	<0.01	<0.01
c	Bromodichloromethane	<0.01	<0.01
d	Chloroform	<0.01	<0.01
41.	Alachlor, µg/l	< 1.0	< 1.0
42.	Atrazine, µg/l	< 1.0	< 1.0
43.	Aldrin, µg/l	< 1.0	< 1.0
44.	Alpha HCH, µg/l	< 1.0	< 1.0
45.	Beta HCH, µg/l	< 1.0	< 1.0

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Sr. No.	Sampling Locations	NMIA Project site	V-Time Office
	Sampling month	10.11.2023	11.03.2024
46.	Butachlor, µg/l	< 1.0	< 1.0
47.	Chlorpyriphos, µg/l	< 1.0	< 1.0
48.	Delta HCH, , µg/l	< 1.0	< 1.0
49.	2,4 Dichloro PAA, , µg/l	< 1.0	< 1.0
50.	DDT, µg/l	< 1.0	< 1.0
51.	Endosulphan, , µg/l	< 1.0	< 1.0
52.	Ethion, , µg/l	< 1.0	< 1.0
53.	Lindane, , µg/l	< 1.0	< 1.0
54.	Isoproturon, µg/l	< 1.0	< 1.0
55.	Malathion, , µg/l	< 1.0	< 1.0
56.	Methyl parathion, , µg/l	< 1.0	< 1.0
57.	Monocrotophos , µg/l	< 1.0	< 1.0
58.	Phorate, µg/l	< 1.0	< 1.0
Microbiology			
59.	Coliform (MPN/100 ml)	>1600	>1600
60.	E. Coli/100 ml	Absent	Absent

4.5.1 GW Analysis Inference:

The analysis results indicate the pH range of 6.85 to 7.10 and is observed within the desirable limit of 6.5 to 8.5, beyond this range water will affect the mucous membrane and/or water supply system. The total hardness is in the range of 38 to mg/l 48 and is observed within the permissible limit of 600 mg/l. The total hardness beyond the permissible limit causes encrustation in water supply structure and adverse effects on domestic use. The iron concentration is found 0.03 mg/l and is observed within the acceptable limit of 1.0 mg/l. Beyond the desirable limit taste/appearance are affected, has adverse effect on domestic uses and water supply structures, and promotes iron bacteria.
The chlorides concentration is in the range of 9 mg/l to 18 mg/l and is observed to be within the acceptable limit of 250 mg/l. Beyond this limit, taste, corrosion and palatability are affected. The fluoride concentration is 0.320 to 0.32 mg/l and is observed within the acceptable limit of 1.0 mg/l at all locations, high fluoride may cause fluorosis. The value of TDS is 70 mg/l and is observed within the desirable limit of 500 mg/l at all locations and are also within the permissible limit of 2000 mg/l. The ground water samples were collected from two locations and analyzed for physical, chemical and biological parameters. Which shows that the samples are potable as per IS 10500-RA2018.

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4.6 QUARTERLY MARINE WATER QUALITY ANALYSIS REPORT DURING DECEMBER 2023

Surface Marine water samples were collected for different Physiochemical and Biological parameters from 10 stations on 14th and 15th December 2023. Analysis part is mentioned in subsequent sections below.

Figure 4-1 Collection of Marine Water and sediment samples during December 2023

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4.6.1 Analytical Data - Physicochemical Parameters during December 2023

Table 4-17: Marine water physicochemical analysis at various stations during December 2023

Sr. No.	Parameter	MW 1 S	MW 2 S	MW 3 S	MW 4 S	MW 5 S	MW 6 S	MW7 S	MW 8 S	MW9 S	MW 10 S	Unit
1.	pH	7.68	7.34	7.28	6.92	6.86	6.80	6.75	6.82	7.04	7.75	--
2.	Temperature	27.1	27.2	27.1	27	27	27	27	27.1	27.1	27.2	°C
3.	Turbidity	7.4	7.2	7.8	7.6	6.2	7.4	7.8	6.8	7.8	7.2	NTU
4.	Conductivity	280	690	6.12	14.10	15.90	14.20	16.20	28.50	27.86	550	mS/Cm
5.	Salinity	10.58	9.6	12.90	12.90	13.20	15.20	27.5	32.90	31.10	9.8	ppt
6.	Iron as Fe,	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/l
7.	Magnesium as Mg	6.2	38	108.5	180	123.4	148	220.8	560	310	20	mg/l
8.	Manganese as Mn	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/l
9.	Fluoride	1.22	1.30	1.28	1.28	1.20	1.28	1.28	1.34	1.28	1.28	mg/l
10.	Sulphate	18	35	1590	725	725	1211.5	1860	23.50	2480	55	mg/l
11.	Phenolic compound	35.8	35.9	37.5	33.8	33.5	33.2	34.5	35.2	35.6	36.8	µg/l
12.	Alkalinity	90	110	134	138	142	140	130	140	142	148	mg/l
13.	Hardness as CaCO3	68	100	520	1240	900	1190	1680	2760	2560	132	mg/l
14.	Zinc as Zn	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/l
15.	Cadmium as Cd	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/l
16.	BOD	2.8	1.4	4.4	0.4	0.8	0.6	0.8	0.6	0.8	3.1	mg/l
17.	Chloride	17	130	2870	5680	7650	7980	9850	13850	14890	48	mg/l
18.	DO	3.2	2.6	5.4	1.6	1.6	1.4	1.2	1.2	1.8	3.4	mg/l
19.	Total Nitrogen as N	3.6	6.2	5.8	4.8	6.1	4.8	5.6	5.4	5.6	6.2	µmol/l
20.	Phosphorus as P	1.8	2.0	1.4	1.8	1.9	1.2	1.8	2.1	21.8	2.2	µmol/l
21.	Sodium as Na	90	95	120	9.8	90	90	110	110	100	90	mg/l
22.	Potassium as K	85	90	90	100	135	120	115	98	125	85	mg/l
23.	Lead as Pb	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/l
24.	Mercury as Hg	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	mg/l
25.	Chromium as Cr	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/l

4.6.2 Inference - Physicochemical Parameters during December 2023

The pH value ranged from 6.75 to 7.75 at surface represents Acidic to basic nature of water. Salinity was low only at MW1,MW2 and MW10 due to influx of fresh water and in increasing trends in Creek waters during collection Period of sampling as proceedings from Gadhi River to Panvel Creek.

Dissolved Oxygen level was observed low except at MW1 and MW3 during collection of time due to seasonal variation. BOD value suggests the presence of organic matter present in water body which comes as domestic sewage discharge from surrounding areas (villages, STPs of NMMC in Nerul) and effluents from CETP at MIDC Taloja.

The concentration of Magnesium was high at all locations except MW, MW2 and MW10 and Iron were low at all stations (Refer Table 4.16).

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4.6.3 Analytical Data - Biological Parameters during December 2023

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

Table 4-18: Marine Water biological analysis of stations (MW1 to MW5) during December 2023

Parameter	MW 1	MW 2	MW3	MW4	MW5
	S	S	S	S	S
Phytoplankton					
Chlorophyll (mg/m³)	37.42	44.91	47.04	26.73	9.62
Pheophytin (mg/m³)	110.47	34.05	6.25	23.04	7.00
Population (nox10³/L)	3880.8	3942.4	1720.0	1449.6	72.0
Total Genera (No)	23	21	19	16	13
Major Genera	*Thalassiosira (92.80%) Scenedesmus (3.90%) Navicula (0.80%), Pandorina (0.50%)*	*Thalassiosira (96.39%) Navicula (1.4%) Nitzschia (0.57%) Scenedesmus (0.30%)*	*Thalassiosira (94.50%) Leptocylindrus (4.27%) Pleurosigma (0.63%) Chaetoceros (0.42%)*	*Thalassiosira (91.06%) Skeletonema (3.26%) Nitzschia (1.82%), Chaetoceros (0.99%)*	*Thalassiosira (56.7 %), Navicula (22.2 %) Skeletonema (4.4 %), Gyrosigma (3.3 %)*
Diversity Index	0.39	0.23	0.28	0.47	1.46
Zooplankton					
Population (no x 10³/100m³)	20	52	98	53	10
Total Group (No)	1	2	1	1	8
Major Groups	Copepods (100%)	Copepods (98.39%) Decapods (1.61%)	Copepods (100%)	Copepods (100%)	Copepod (97.46%), Decapod (0.89%), Medusae (0.50%), Lucifer (0.43%)
Biomass (ml/100m³)	83.3	83.3	125.0	133.33	3.9
Diversity Index	0.0	0.08	0.00	0.00	0.16
Macrobenthos					
Population (no x 10²/m²)	417	208	3906	868	243
Total Group (No)	1	2	1	1	1
Major Groups	Polychaete (100%)	Polychaete (91.67%) Amphipod (8.33%)	Polychaete(100%)	Polychaete (100%)	Polychaete (100%)
Biomass (gm/m²)	18.70	2.68	54.61	2.21	3.34
Diversity Index	0.00	0.29	0.0	0.97	0.00
Microbiology					
Total Coliform (MPN/100 ml)	>1600	>1600	>1600	>1600	>1600

Table 4-19: Marine Water biological analysis of stations (MW6 to MW10) during December 2023

Parameter	MW 6	MW 7	MW8	MW9	MW10
	S	S	S	S	S
Phytoplankton					

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Parameter	MW 6	MW 7	MW8	MW9	MW10
	S	S	S	S	S
Chlorophyll (mg/m³)	3.31	18.18	4.28	3.74	9.62
Pheophytin (mg/m³)	2.83	5.45	3.15	2.62	4.01
Population (nox10⁴/L)	44.8	44.0	23.2	30.4	89.6
Total Genera (No	14	13	13	12	13
Major Genera	*Thalassiosira(48.20%) Nitzschia (10.70%) Skeletonema(10.70%), Navicula (8.90%)*	*Thalassiosira(49.10%), Peridinium (10.90%) Leptocylindrus(10.9%) Skeletonema (9.10%)*	*Thalassiosira (37.9%), Nitzschia (17.20%) Navicula (6.90%), Pleurosigma (6.90%)*	*Skeletonema (44.7%), Pleurosigma (15.8%) Cyclotella (7.90%), Thalassiosira(5.30%)*	*Nitzschia (41.96%), Navicula (19.64%) Bactreistrum (8.93%), Leptocylindrus (6.25%)*
Diversity Index	1.85	1.79	2.08	1.89	1.94
Zooplankton					
Population (no x 10³/100m³)	13	22	13	5	21
Total Group (No)	13	10	9	10	1
Major Groups	Copepods (95.65%), Medusae (1.50%) Chaetognaths (0.83%), Gastropods (0.57%)	Copepods (95.06%), Decapods (2.64%) Lamellibranch(0.58%), Chaetognaths (0.48%)	Copepods (91.21%), Decapod Larvae (3.50%), Lamellibranch (1.80%) Chaetognaths (1.07%)	Copepods(46.21%) Comp jelly (44.11%), Decapods(4.02%), Ctenophora (2.86%)	Copepods(100%)
Biomass (ml/100m³)	4.8	8.2	2.6	67	133.3
Diversity Index	0.26	0.27	0.45	1.08	0.00
Macrobenthos					
Population (no x 10²/m²)	242	4213	625	503	290
Total Group (No)	1	1	1	1	1
Major Groups	Polychaete (100%)	Polychaete (100%)	Polychaete(100%)	Polychaete (100%)	Polychaete (100%)
Biomass (gm/m²)	2.54	33.92	7.49	4.96	6.26
Diversity Index	0.0	0.00	0.0	0.00	0.0
Microbiology					
Total Coliform (MPN/100 ml)	>1600	>1600	>1600	>1600	>1600

4.6.4 Inferences - Biological Parameters during December 2023

4.6.4.1 Phytoplankton

In December 2023, Chlorophyll ranged from 1.60 to 57.54 mg/m³ and pheophytin ranged 0.8 to 30.2 mg/m³; at surface water of all 10 stations. Figure **4.2** below shows graphical representation of phytopigments in different stations.

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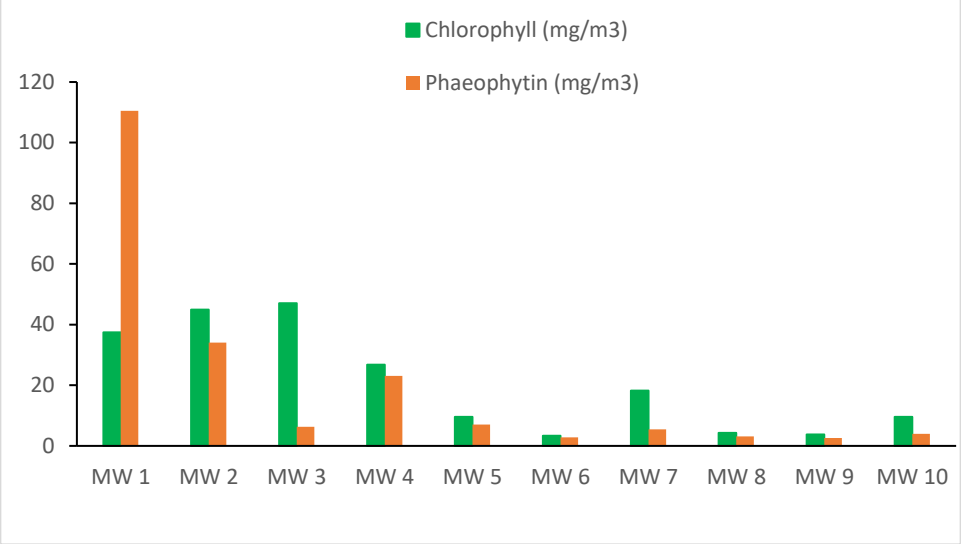

Figure 4-2: Representation of phytopigments for December 2023

Phytoplankton population density ranges from 22.3-3942.4 x 10^3/l at surface water of all 10 stations. Highest phytoplankton population at surface water of MW2 may be due to influx of domestic water from surrounding villages; total generic groups ranges from 12-23 nos. at surface water of all 10 stations. Maximum generic diversity 23 no. is observed at surface water of Station MW1 and lowest at MW9 respectively during December 2023 (Refer Table 4.17 and 4.18).

Thalassiosira, Leptocylindrus, Nitzschia, and *Skeletonema* are most common ones, followed by rest of observed genera like *Pleurosigma*, *Navicula* and *Gyrosigma*. The other freshwater phytoplankton genera found are *Scenedesmus*, *Anabaena, Oscillatoria and Pediastrum* in Gadhi River (MW1) and Ulwe River (MW10) respectively. Graphical representations of phytoplankton population and total genera is represented in **Figure 4.3**.

The graph below represents the population of phytoplankton is more at MW2; and less at station MW8, which represents there is discharge of sewage and domestic waste. The phytoplankton trend with respect to total number of genera is high at Station MW1 and lowest at MW9. Some of the major genera seen were photographed and shown in **Figure 4.4.**

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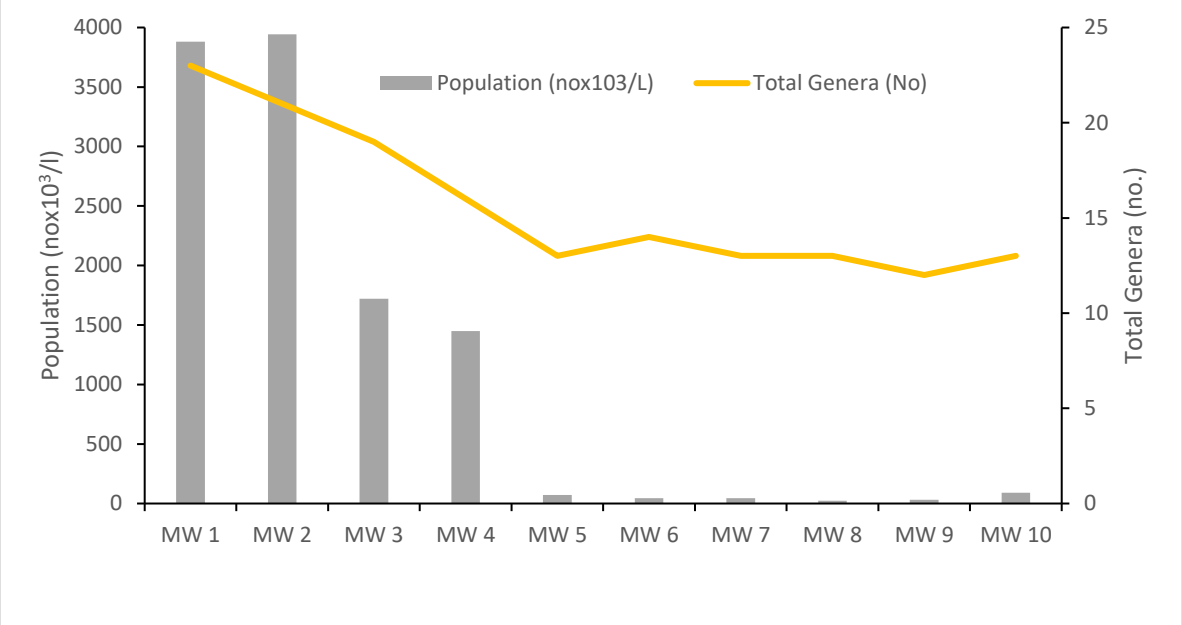

Figure 4-3: Representation of phytoplankton population & Total genera December 2023

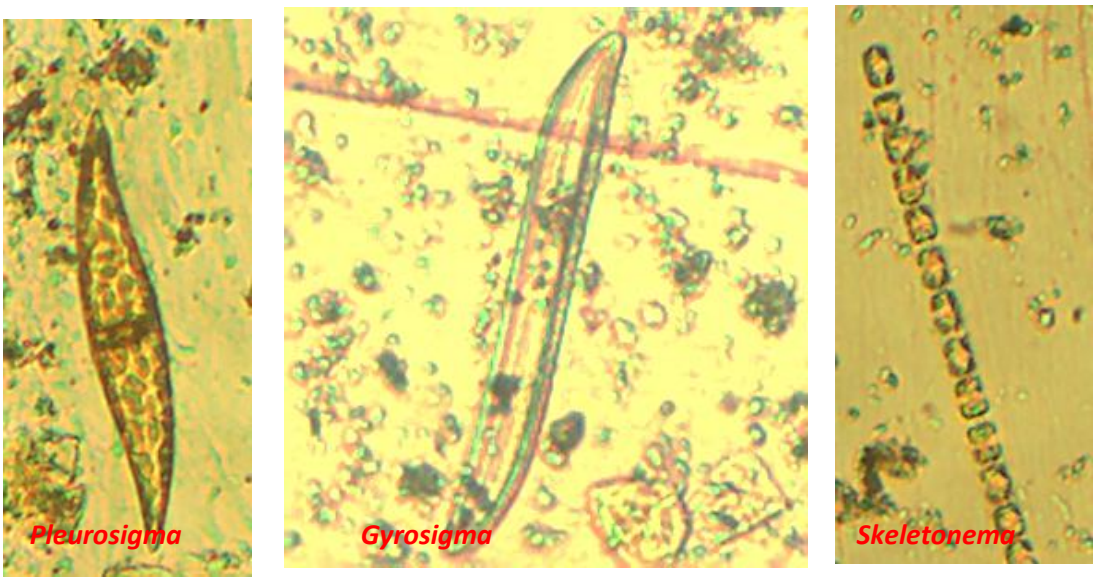

Figure 4-4: Phytoplankton found in samples for December 2023

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4.5.4.2 Zooplankton

In December 2024, the zooplankton biomass ranged from 2.6 to 133.33 ml/100 m^3 with population density of 5 to 98 x 10^3/100 m^3 while having faunal group ranging from 1-13 nos. The zooplankton was noted with good population and group diversity. Copepods, Decapods and Medusa were common groups observed, **Figure 4.5** represents zooplankton standing stock graphically and **Figure 4.6** represents photos of peculiar zooplankton genera.

The graph below represents that standing stock reported from all stations; MW9 shows lowest population as compared to MW3 with highest population; and MW8 shows lowest biomass and MW10 shows highest biomass, respectively.

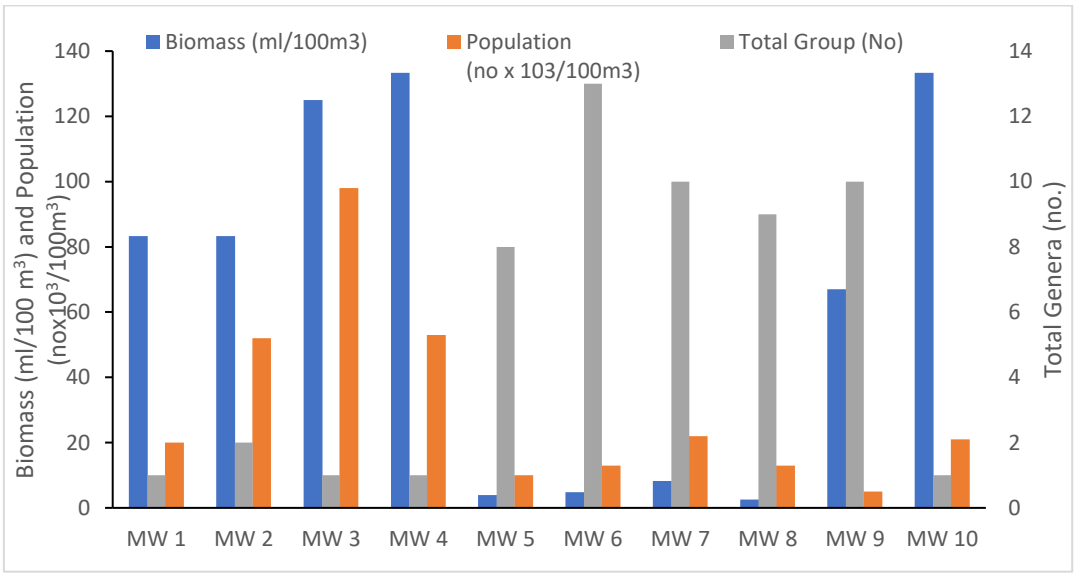

Figure 4-5: Representation of Zooplankton Biomass, Population & Total group for December 2023

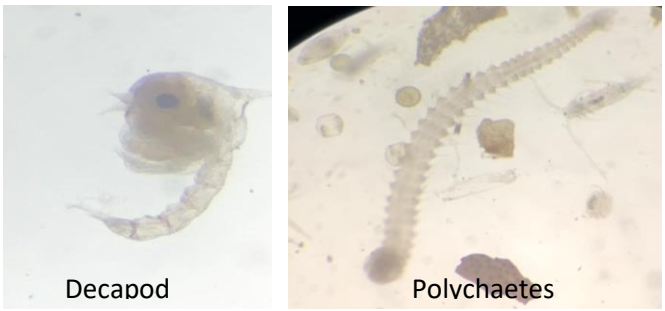

Figure 4-6 Zooplankton found in samples for December 2023

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4.6.4.3 Macrofauna

In December 2023, macro-benthic biomass ranged from 2.21 to 54.61 gm/ m^2 with population ranging from 208 to 4213 (no x $10^2/m^2$). Total group ranges from 1 to 2. Low biomass noted at MW10 and high biomass at MW8. Low population were noted at MW4 and high population observed at MW3. The faunal group found were majorly Polychaete. The Figure 4.7 shows the % composition of benthic organisms for study period. Figure 4.8 shows peculiar organisms found.

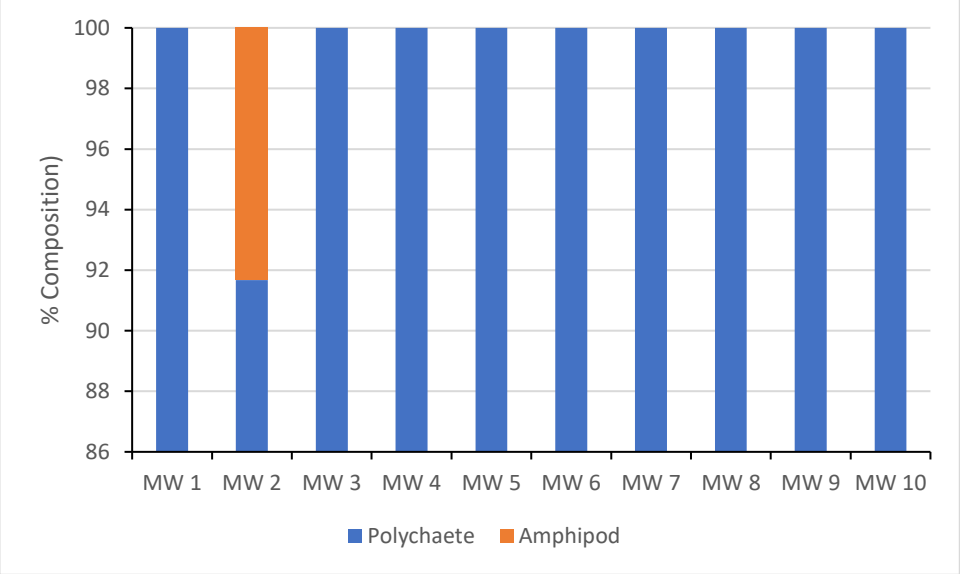

Figure 4-7 % Composition of Benthic organisms for December 2023

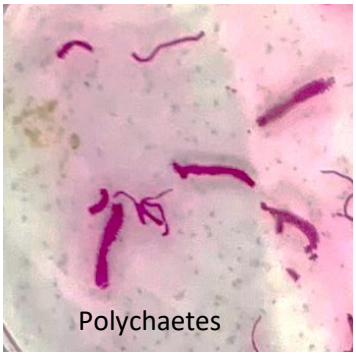

Figure 4-8 Benthic organism Found in samples for December 2023

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4.6.4.5 Microbiology

Coliform microbes were present at all stations in surface level. No specific trend was observed.

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4.7 QUARTERLY MARINE WATER QUALITY ANALYSIS REPORT DURING March 2024

Surface Marine water samples were collected for different Physiochemical and Biological parameters for 10 stations on 15th and 16th March 2024. Analysis part is mentioned in subsequent sections below.

Figure 4-9 Collection of Marine Water samples during March 2024

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4.7.1 Analytical Data - Physicochemical Parameters during March 2024

Table 4-20: Marine water physicochemical analysis at various stations during March 2024

Sr. No.	Parameter	MW 1 S	MW 2 S	MW 3 S	MW 4 S	MW 5 S	MW 6 S	MW 7 S	MW 8 S	MW9 S	MW 10 S	Unit
1.	pH	6.48	6.41	6.47	6.44	6.41	6.43	6.46	6.40	6.41	7.74	--
2.	Temperature	27.1	27.2	27.1	27.1	28	27	27	27.1	27.1	27.2	°C
3.	Turbidity	7.4	3.4	4.6	3.2	6.4	4.3	7.8	5.4	6.8	4.2	NTU
4.	Conductivity	280	690	6.12	14.10	15.90	14.20	16.20	28.50	27.86	550	mS/Cm
5.	Salinity,	10.54	20.5	20.5	20.40	26.45	24.5	25.77	30.2	30.28	4.6	ppt
6.	Iron as Fe,	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/l
7.	Magnesium as Mg	204	435	454	515	1123	1180	1081	1150	310	20	mg/l
8.	Manganese as Mn	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/l
9.	Fluoride	1.22	1.30	1.28	1.28	1.56	1.28	1.50	1.40	1.40	1.28	mg/l
10.	Sulphate	15.2	39.4	1612.5	701.4	701.4	1347.7	1294	2478.3	2558.4	56.4	mg/l
11.	Phenolic compound	120	45.2	34.5	33.8	33.5	40.3	60.54	40.5	50.44	34.4	µg/l
12.	Alkalinity	184	196	120	108	194	180	180	180	184	118	mg/l
13.	Hardness as CaCO3	1660	2100	2550	2560	5500	1560	4600	4400	3600	560	mg/l
14.	Zinc as Zn	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/l
15.	Cadmium as Cd	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/l
16.	BOD	2.6	0.5	0.6	0.6	0.74	0.74	1.28	1.57	1.8	0.8	mg/l
17.	Chloride	3260	7295	12254	23451	16564	24551	18564	14550	25245	1345	mg/l
18.	DO	3.3	1.0	1.0	1.6	1.14	1.14	1.57	2.14	2.8	2.0	mg/l
19.	Total Nitrogen as N	6.4	6.2	5.8	4.8	6.1	4.8	6.4	5.4	7.2	6.2	µmol/l
20.	Phosphorus as P	4.4	2.4	3.4	1.6	1.9	1.8	2.3	1.4	1.8	0.8	µmol/l
21.	Sodium as Na	90	95	120	98	90	90	90	110	100	90	mg/l
22.	Potassium as K	85	90	90	100	80	120	60	98	125	85	mg/l
23.	Lead as Pb	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/l
24.	Mercury as Hg	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	mg/l
25.	Chromium as Cr	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/l

4.7.2 Inference - Physicochemical Parameters during March 2024

The pH value ranged from 6.40 to 7.74 at surface, which shows acidic to basic nature of water. The salinity was observed low at station MW1 and MW10 due to influx of fresh water during collection Period of sampling.

Dissolved Oxygen level was observed low during collection of time due to seasonal variation at all locations except at MW. BOD value suggests the presence of organic matter in water body which comes as domestic sewage discharge from surrounding areas (villages, STPs of NMMC in Nerul) and effluents from CETP at MIDC Taloja.

The concentration of Magnesium was high except at MW10 and Iron was low at all stations (Refer Table 4.19).

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4.7.3 Analytical Data - Biological Parameters during March 2024

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

Table 4-21: Marine Water biological analysis of stations (MW1 to MW5) during March 2024

Parameter	MW 1	MW 2	MW 3	MW 4	MW 5
	S	S	S	S	S
Phytoplankton					
Chlorophyll (mg/m^3)	10.16	9.62	6.42	1.60	4.81
Pheophytin (mg/m^3)	9.30	4.60	12.67	2.14	1.24
Population ($nox10^3/L$)	3595.2	14460.8	3636.8	4808.8	195.2
Total Genera (No)	15	13	14	15	13
Major Genera	*Thalassiosira (97.9%), Scenedesmus (0.8%) Navicula (0.4%), Actinastrum (0.3%)*	*Thalassiosira (99.6%) Navicula (0.2%) Skeletonema (0.1%) Oscillatoria (0.02%)*	*Thalassiosira (97.9%) Navicula (1.4%) Chaetoceros (0.3%) Melosira (0.1%)*	*Thalassiosira (51.6%) Navicula (46.6%), Chaetoceros (1.0%), Skeletonema (0.5%)*	*Thalassiosira(75.41%), Skeletonema (17.21 %) Navicula (2.46 %), Gyrosigma (0.82 %)*
Diversity Index	0.14	0.03	0.13	0.80	0.87
Zooplankton					
Population (no x $10^3/100m^3$)	3	5	55	16	17
Total Group (No)	1	1	7	3	9
Major Groups	Copepods (100%)	Copepods (100%)	Copepods (81.82%), Medusae (6.06%), Decapoda larvae (6.06%), Appendicularians (1.52%)	Copepods (57.89%), Gastropods (36.84%) Medusae (5.26%)	Copepods (98.72%), Medusae (0.83%), Gastropods (0.27%), Decapods (0.11%)
Biomass ($ml/100m^3$)	16.7	16.7	41.7	65.67	0.9
Diversity Index	0.00	0.0	0.76	0.84	0.08
Macrobenthos					
Population (no x $10^2/m^2$)	556	1337	9931	1337	156
Total Group (No)	1	1	1	1	1
Major Groups	Polychaete (100%)	Polychaete (100%)	Polychaete (100%)	Polychaete (100%)	Polychaete(100%)
Biomass (gm/m^2)	7.99	4.38	168.72	4.38	1.24
Diversity Index	0.0	0.0	0.0	0.00	0.00
Microbiology					

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Parameter	MW 1	MW 2	MW 3	MW 4	MW 5
	S	S	S	S	S
Total Coliform (MPN/100 ml)	>1600	>1600	>1600	>1600	>1600

Table 4-22: Marine Water biological analysis of stations (MW6 to MW10) during March 2024

Parameter	MW 6	MW 7	MW 8	MW 9	MW 10
	S	S	S	S	S
Phytoplankton					
Chlorophyll (mg/m^3)	1.07	3.74	0.53	2.14	0.53
Pheophytin (mg/m^3)	0.69	2.25	0.16	1.76	0.21
Population ($nox10^3/L$)	93.6	131.2	238.4	152	103.2
Total Genera (No)	9	13	11	16	23.2
Major Genera	*Thalassiosira (56.41%), Skeletonema (34.19%), Navicula (2.56%), Oscillatoria (1.71%)*	*Thalassiosira (67.1%), Skeletonema (22.0%) Pleurosigma (1.8%), Navicula (1.8%)*	*Thalassiosira (40.6%), Navicula (33.2%) Skeletonema (18.5%), Nitzschia (3.0%)*	*Skeletonema (88.54%), Thalassionema (4.17%) Navicula (2.08%), Thalassiosira (1.04%)*	*Thalassiosira (17.2%), Navicula (17.2%) Oscillatoria (13.8%), Pleurosigma (10.3%)*
Diversity Index	1.09	1.09	1.37	1.32	2.35
Zooplankton					
Population (no x $0^3/100m^3$)	9	0.5	1	0.81	11441
Total Group (No)	11	1	4	5	3
Major Groups	Copepods (95.4%), Medusae (2.0%) Gastropods (1.2%), Decapod larvae (0.7%)	Copepods (100%)	Acetes (79.47%), Copepods (9.27%) Decapoda larvae (5.96%) Lucifer (5.29%)	Acetes (91.72%), Copepods (4.88%), Decapod larvae (2.22%), Lucifer (1.04%)	Copepods (99.93%), Fish Larvae (0.04%) Decapod larvae(0.03%)
Biomass ($ml/100m^3$)	1.7	0.01	33.1	54.4	1583.3
Diversity Index	0.26	0.0	0.73	0.37	0.01
Macrobenthos					
Population (no x $10^2/m^2$)	6024	174	4653	174	Nil
Total Group (No	2	1	2	2	
Major Groups	Polychaete (98.58 %) Crabs (1.42%)	Polychaete (100%)	Polychaete (86.19%) Bivalve (13.81%)	Polychaete (50%) Bivalve (50%)	
Biomass (gm/m^2)	1.7	3.56	580.81	161.17	
Diversity Index	0.26	0.00	0.40	0.69	
Microbiology					
Total Coliform (MPN/100 ml)	>1600	>1600	>1600	>1600	>1600

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4.7.3 Inferences - Biological Parameters during March 2024

4.7.3.1 Phytoplankton

In March 2024, Chlorophyll ranged from 0.53 to 10.16 mg/m^3 and pheophytin ranged 0.16 to 12.67 mg/m^3 at surface water of all 10 stations. The **Figure 4.10** below shows graphical representation of phytopigments at different stations.

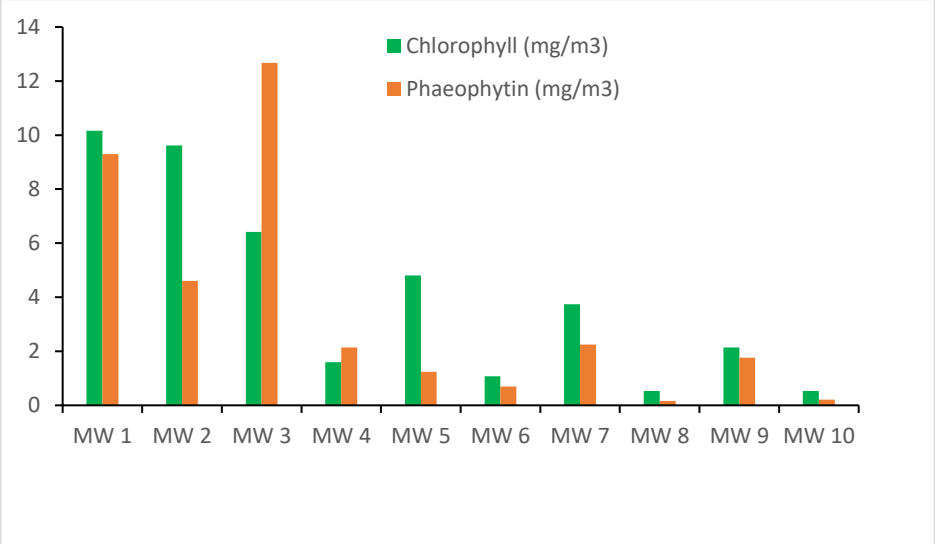

Figure 4-10: Representation of phytopigments for March 2024

The phytoplankton population ranged from 93.6 to 14460.8 (no x 10^3/l) with highest population noted at Station MW2 and Lowest at Station MW6. Total generic groups range from 9-23 nos. at surface water of all 10 stations. Maximum generic diversity 23 no. is observed at surface water of Station MW10 during March 2024 (Refer Table 4.20 and 4.21).

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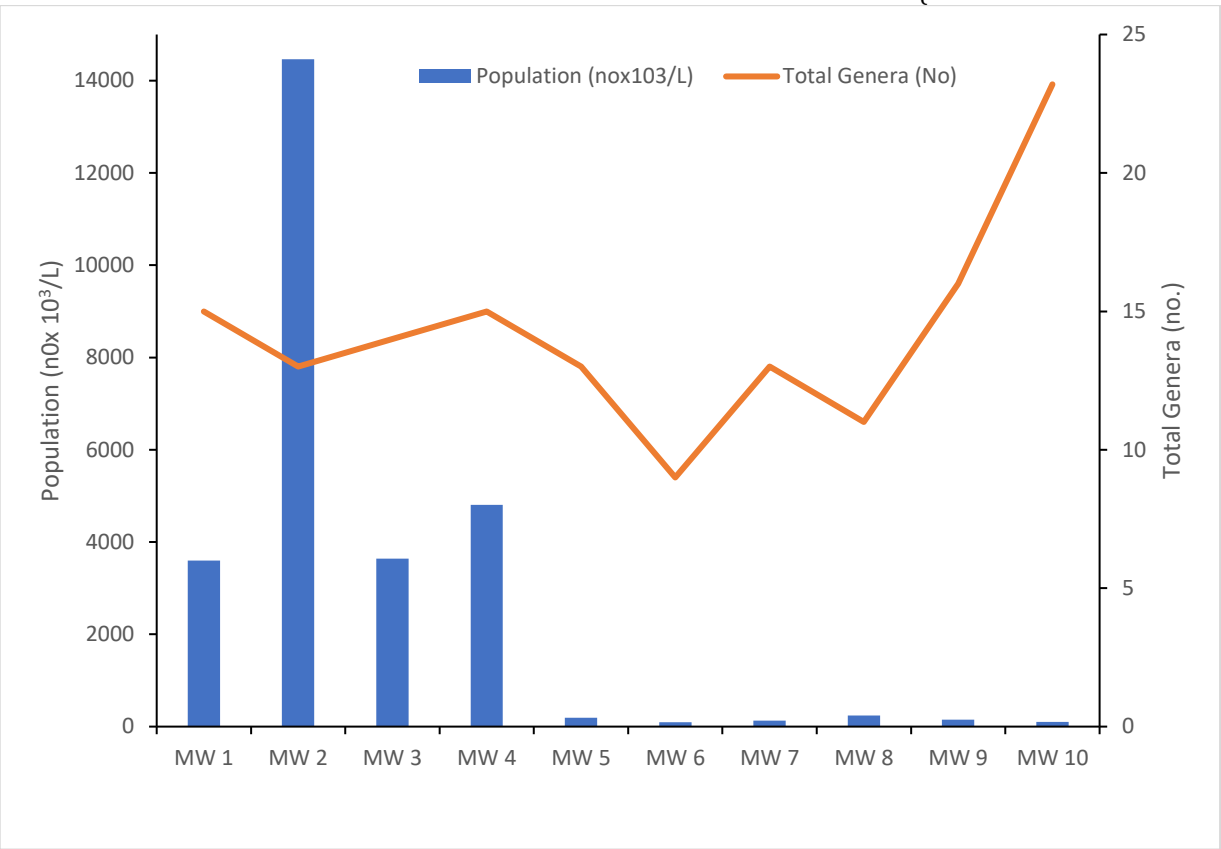

Figure 4-11: Representation of phytoplankton population & Total genera for March 2023

Thalassiosira, Skeletonema, Navicula and Nitzschia are most common ones, followed by rest of observed genera like *Oscillatoria, Gyrosigma and Pleurosigma*. The other freshwater phytoplankton genera found are *Scenedesmus*, *Agmenellum, Oscillatoria and Pediastrum* in Gadhi River (MW1) and Ulwe River (MW10) respectively. *Pleurosigma*. Graphical representations of phytoplankton population and total genera are represented in **Figure 4.11**. The graph below represents the population of phytoplankton is maximum at MW2; and less at station MW6 probably due discharge of sewage and domestic waste. The phytoplankton trend with respect to total number of genera is high at Station MW10 and low at station MW6 respectively. Some of the major genera seen were photographed and shown in **Figure 4.12**.

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Agmenellum *Thalassiosira* *Pediastrum*

Figure 4-12: Phytoplankton found in samples for March 2024

4.7.3.2 Zooplankton

In March 2024, the zooplankton biomass ranged from 0.01 to 1583.3 ml/100 m^3 with population density of 0.5 to 11441 x 10^3/100m^3 while having faunal group ranging from 1-11 nos. The zooplankton was noted with good population and group diversity. Copepods, Gastropods & Medusae were common groups observed, **Figure 4.13** represents zooplankton standing stock graphically and **Figure 4.14** represents photos of peculiar zooplankton found in marine water body.

The graph below represents that average standing stock reported from all stations; Station MW7 show lowest population as compared to Station MW10 with highest population; and Station MW7 show lowest biomass and Station MW10 shows highest biomass, respectively.

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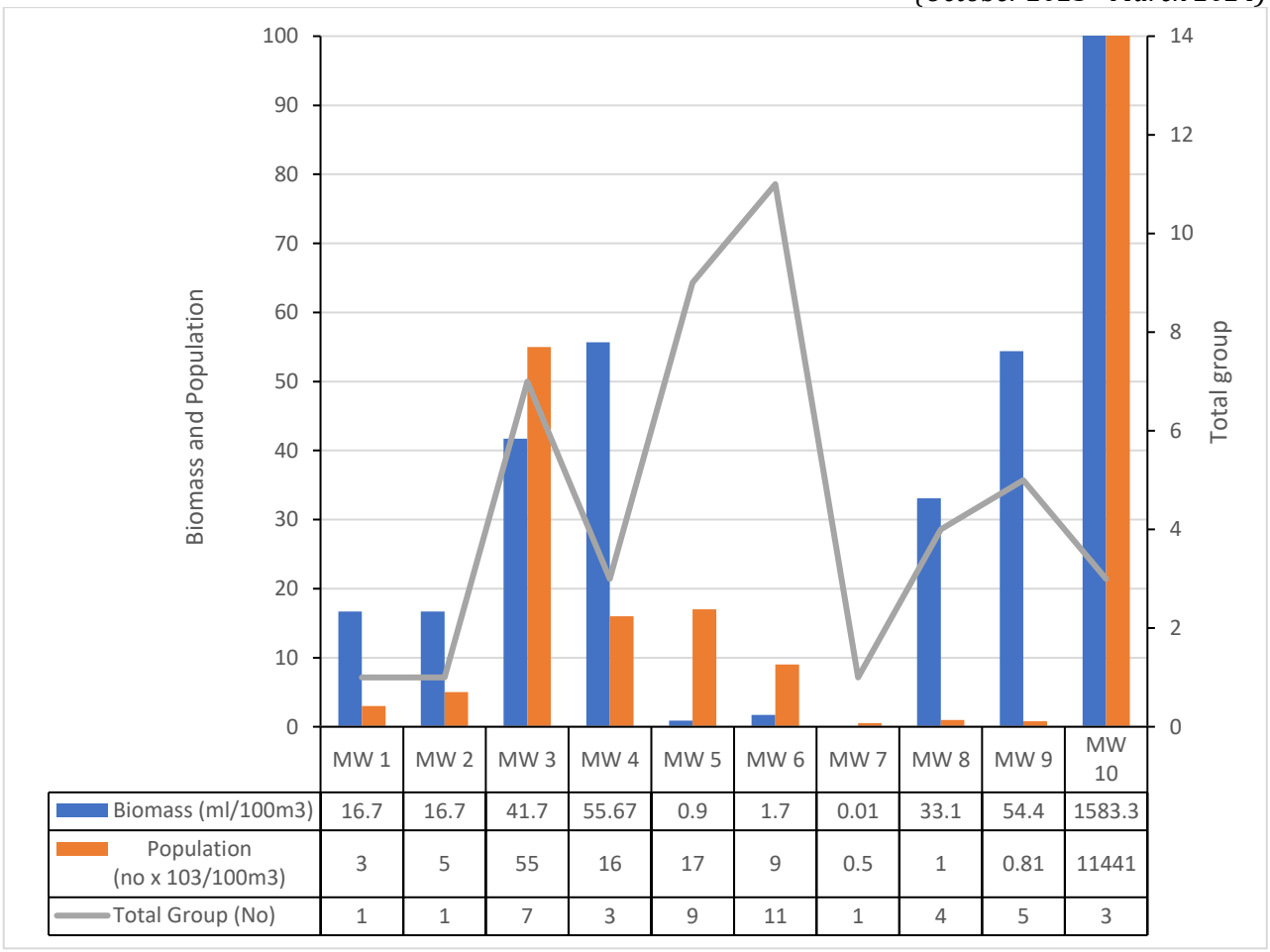

	MW 1	MW 2	MW 3	MW 4	MW 5	MW 6	MW 7	MW 8	MW 9	MW 10
Biomass (ml/100m3)	16.7	16.7	41.7	55.67	0.9	1.7	0.01	33.1	54.4	1583.3
Population (no x 103/100m3)	3	5	55	16	17	9	0.5	1	0.81	11441
Total Group (No)	1	1	7	3	9	11	1	4	5	3

Figure 4-13: Representations of Zooplankton Biomass, Population & Total group for March 2023

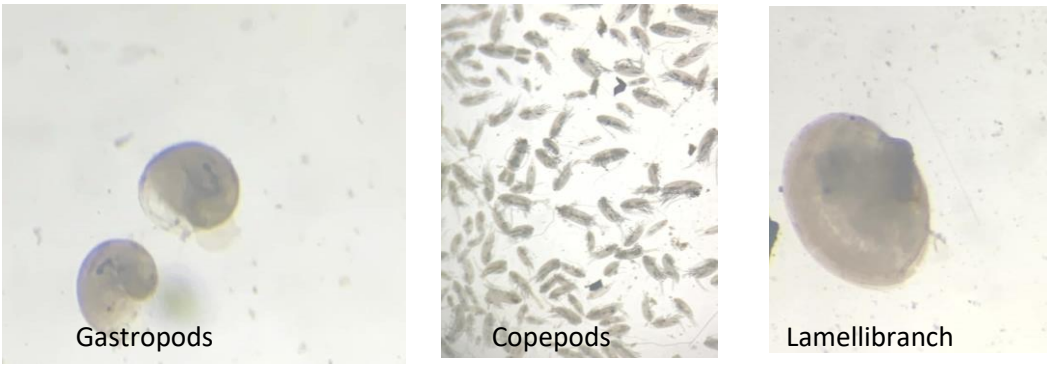

Figure 4-14: Zooplankton found in samples for March 2024

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4.7.3.3 Macrofauna

In March2023, macro-benthic biomass ranged from 1.24 to 580.81 gm/ m^2 with population ranging from 156 to 9931 (no x $10^2/m^2$). The total group ranges from 1 to 2. The lowest biomass was noted at MW5 and high biomass at MW8. The lowest population were noted at MW5 and high population observed at MW8. The faunal group found were majorly Polychaetes. The % composition and peculiar Benthic organism is shown in Figure 4.15 and 4.16 respectively.

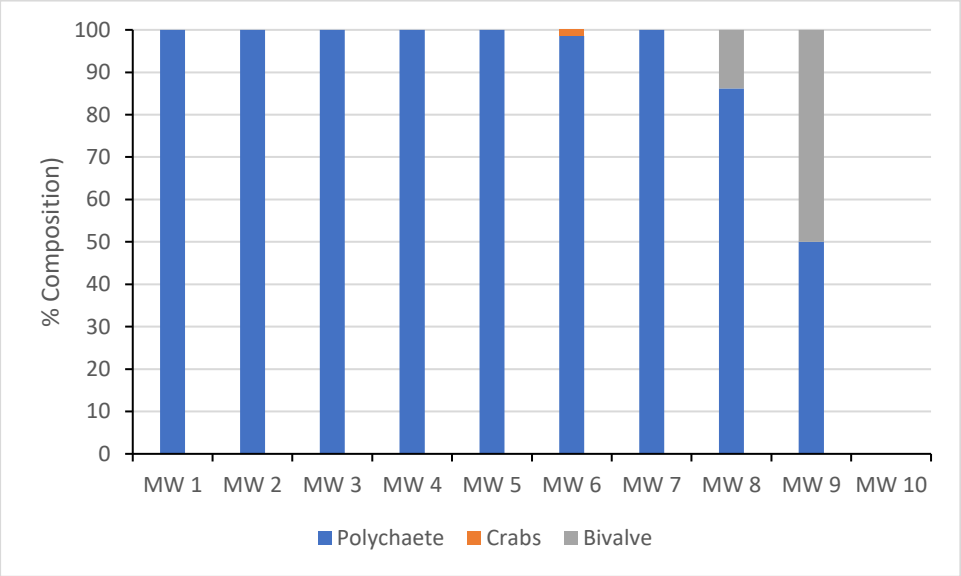

Figure 4-15: % composition of Benthic organisms for March 2024

Polychaetes

Figure 4-16: Benthic organism found in samples for March 2024

4.7.3.5 Microbiology

Coliform microbes were present at all stations in surface level. No specific trend was observed.

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4.8 DG SET Monitoring

4.8.1 Stack Monitoring

The stack monitoring was done at NMIA project Site. The table below represent results of Gaseous emission for the month of November 2023 and February 2024.

Table 4-23 Stack Monitoring of DG Set

Sampling Locations	DG 1		MPCB Limit	Unit
Sampling Date	**09.11.2023**	**13.02.2024**		
Gas Temperature	105	89	-	(°C)
Gas Velocity	5.70	5.6	-	(m/s)
Gas Flow Rate	1676	733	-	(Nm^3/hr.)
Particulate Matter	41.38	47.16	150	(mg/Nm^3)
Sulphur Dioxide	29.95	32.80		(mg/Nm^3)
Sulphur Dioxide	1.20	0.58	-	(Kg/Day)
Oxides of Nitrogen	57.94	56.35	-	(mg/Nm^3)
NMHC	9.03	7.38	-	(mg/Nm^3)

Figure 4-17 DG Stack Sampling

The monitoring undertaken indicates the stack Air Quality Values for Particulate matter is under limit set by MPCB.

4.8.2 Noise monitoring

The Noise generated from DG Set was monitored at NMIA project Site. The tables below represent results of noise generated for the month of November 2023 and February 2024.

ADITYA ENVIRONMENTAL SERVICES PVT. LTD. MUMBAI

Prepared By:
Dhan Thapa

Checked By:
Kalpita Pathare

Table 4-24 Noise Quality of DG Set

Reading from 0.5 m away from DG Set				
Direction	DG 1			
	09.11.2023		**13.02.2024**	
	Door Closed	**Door Closed**	**Door Closed**	**Door Closed**
East	73.7	99.9	73.7	99.8
West	73.5	98.9	73.2	98.7
South	73.4	99	74.1	99.2
North	73.2	99.5	75.6	99.9
Avg.	73.5	99.3	74.2	99.9
Difference	25.9		25.3	

Figure 4-18 Noise monitoring for DG Set

The monitoring undertaken indicates the DG Noise Quality value for insertion loss is within consent limit.

Prepared By:
Dhan Thapa

Checked By:
Kalpita Pathare

Annexure-III

Consent to Establish (CTE) granted to NMIA by MPCB dated June 15, 2022.

for

Phase I & II (20 MPPA & Cargo Capacity 0.57 MTPA)

MAHARASHTRA POLLUTION CONTROL BOARD

Tel: 24010706/24010437
Fax: 24023516
Website: http://mpcb.gov.in
Email: cac-cell@mpcb.gov.in

Kalpataru Point, 2nd and 4th floor, Opp. Cine Planet Cinema, Near Sion Circle, Sion (E), Mumbai-400022

RED/L.S.I (R23)
No:- Format1.0/CAC/UAN No.MPCB-CONSENT-0000128221/CE/2206000673

Date: 15/06/2022

To,
Navi Mumbai International Airport Pvt. Ltd., Villages Vadghar (Chinchpada), Kopar, Pargaon (Kohli), Pargaon-Dungi, Owale (Upper and Lower Owale + Waghivali Wada), Ulwe (Ulwe + Ganeshpuri), Targhar (Targhar + Kombadbhuje), Waghivali-Khar, Tal. Panvel, Dist. Raigad.

Your Service is Our Duty

Sub: Grant consent to establish for revised construction built up area, under RED category.

Ref:
1. Previous Environment & CRZ Clearance accorded vide dated 22.11.2010.
2. Previous Consent to Establish granted by Board vide dated 05.10.2021.
3. Revalidation of Environment & CRZ Clearance accorded vide dated 20.12.2017 which is transferred vide dated 17.08.2020.
4. Revalidation of Environment & CRZ Clearance accorded vide 28.11.2021
5. Minutes of 3rd CAC meeting held on 24.05.2022.

Your application No.MPCB-CONSENT-0000128221 Dated 23.12.2021

For: grant of Consent to Establish under Section 25 of the Water (Prevention & Control of Pollution) Act, 1974 & under Section 21 of the Air (Prevention & Control of Pollution) Act, 1981 and Authorization under Rule 6 of the Hazardous & Other Wastes (Management & Transboundary Movement) Rules 2016 is considered and the consent is hereby granted subject to the following terms and conditions and as detailed in the schedule I, II, III & IV annexed to this order:

1. **The consent to establish is granted for a period up to 05/10/2026**
2. **The capital investment of the project is Rs.19647 Crs. (As per undertaking submitted by pp Existing - 16250 + Expansion - 3397. Total CI - 19647)**
3. Construction of Airport of Phase-I & II with passenger capacity of 20 MPPA and cargo capacity of 0.57 MTPA., on total plot area of 1,16,00,000 Sq. Mtr., i.e. 1160 Ha & Construction BUA 6,27,335.678 Sq. mtr., for land development of Terminal Building, Terminal Hotel, Reserved housing & Apartments for staff of AAI, CISF Barracks, Control Tower ATC Building, South runway (3.7 Kms), Air Cargo Building, access roads, associated apron, taxi way, parking area, MLCP, Fuel Farm, area. Drainage system, Airport maintenance hangers, Compound wall, Security fence & Utilities such as power supply, water supply & sanitation STP, Solid waste management facility.

4. **Conditions under Water (P&CP), 1974 Act for discharge of effluent:**

Sr No	Description	Permitted (in CMD)	Standards to	Disposal Path
1.	Trade effluent	400	As per Schedule-I	The overflow of ETP outlet will be further treated in STP
2.	Domestic effluent	4210	As per Schedule-I	60% Recycle for secondary purposes & remaining on land for gardening

5. **Conditions under Air (P& CP) Act, 1981 for air emissions:**

Sr No.	Stack No.	Description of stack / source	Number of Stack	Standards to be achieved
1	S-1 to S-2	DG Set (14 x 880 KVA)-12,320 KVA	2	As per Schedule -II

6. **Non-Hazardous Wastes:**

Sr No	Type of Waste	Quantity	UoM	Treatment	Disposal
1	Food Waste & Garbage from Terminal & PTB	7.671	Ton/D	Bio-gas plant for Bio-gas generation followed by composting facility	The waste generated from Biogas will be used as manure
2	Waste from Flight Catering Facilities	2.192	Ton/D	Bio-gas plant for Bio-gas generation followed by composting facility	The waste generated from Biogas will be used as manure
3	Cargo Handling Waste	5.000	Ton/D	Segregation	Sale to authorized vendor for further treatment & disposal
4	Waste from Aircraft Maintenance	3.557	Ton/D	Segregation	Sale to authorized vendor for further treatment & disposal
5	Waste from GSE Workshop	0.356	Ton/D	Segregation	Sale to authorized vendor for further treatment & disposal
6	STP Sludge	3.335	Ton/D	Drying	Used as manure for gardening
7	Other Solid Waste	5.750	Ton/D	Segregation	Sale to authorized vendor for further treatment & disposal

7. **Conditions under Hazardous & Other Wastes (M & T M) Rules 2016 for treatment and disposal of hazardous waste:**

Sr No	Category No./ Type	Quantity	UoM	Treatment	Disposal
1	5.1 Used or spent oil	10	Ton/Y	Recycle	Sale to authorised party
2	3.3 Sludge and filters contaminated with oil	2	Ton/Y	Incineration	CHWTSDF
3	5.2 Wastes or residues containing oil	310	Ton/D	Incineration	CHWTSDF
4	21.1 Process wastes, residues and sludges	47	Ton/Y	Recycle	CHWTSDF
5	33.1 Empty barrels /containers /liners contaminated with hazardous chemicals /wastes	5	Ton/Y	Recycle	CHWTSDF

8. **Conditions under Batteries (Management & Handling) Rules, 2001:**

Sr No	Type of Waste	Quantity	UoM	Disposal Path
1	Battery Waste	10.00	Ton/Y	Authorized Re-processer.

Specific Conditions for used Batteries:

i. The applicant shall ensure that used batteries are not disposed of in any manner other than by depositing with the authorized dealer/ manufacturer/ registered recycler/ importer/ re-conditioner or at the designated collection center.

ii. The applicant shall file half-yearly return in Form VIII to the M.P.C. Board.

iii. Bulk consumers to their user units may auction used batteries to registered recyclers only.

9. **Conditions under E-Waste Management:**

Sr No	Type of Waste	Quantity	UoM	Disposal Path
1	E-waste	25.00	Ton/Y	Authorized Re-processer.

10. **Treatment and Disposal of Biomedical Waste generated to CBMWTSDF:**

Sr.No	Category	Type of Waste	Quantity not to exceed (Kg/M)	Segregation Color coding	Treatment & Disposal
1	Yellow	a) Soiled Waste	500.00	Yellow colored non-chlorinated plastic bags or containers	CBMWTSDF

11. The Board reserves the right to review, amend, suspend, revoke this consent and the same shall be binding on the industry.

12. This consent should not be construed as exemption from obtaining necessary NOC/ permission from any other Government authorities.

13. PP shall comply with the conditions stipulated in EC/CRZ clearance & consent.

14. PP shall provided STP of adequate capacity to achieve the consented parameter BOD - 10 mg/l.

15. PP shall provide separate treatment facility for the treatment of wastewater generated from the aircraft maintenance hangers including for the contaminated surface runoff from the airport area containing oils, grease, etc.
16. The treated effluent shall be 60% recycled for secondary purposes such as toilet flushing, air conditioning, cooling tower makeup, firefighting, etc., and remaining shall be utilized on land for gardening with water metering system.
17. PP shall provide organic waste digester followed by composting facility/bio-digester followed by composting facility for the treatment of biodegradable waste.
18. PP shall carryout carbon audit & submit the report.
19. PP shall submit the plan for plastic recycling before 1st Operate.
20. PP shall submit the management plan towards the disposal of cargo waste disposal.
21. PP shall submit the plan/commitment towards adoption of E-Vehicle policy.
22. PP shall submit BG of Rs. 25.0 Lakh towards compliance of EC & consent conditions.
23. PP shall comply with revalidation of Environment Clearance conditions obtained on 28.11.2021
24. This consent is issued with the overriding effect to earlier consider isssued vide No.:-Format1.0/CAC/UAN No.0000100222/CE-2110000162 dated 05.10.2021
25. This consent is issued pursuant to the decision of the 3rd Consent Appraisal Committee Meeting held on 24.05.2022.
26. The applicant shall obtain Consent to Operate from Maharashtra Pollution Control Board before actual commencement of the Unit/Activity.

Received Consent fee of -

Sr.No	Amount(Rs.)	Transaction/DR.No.	Date	Transaction Type
1	6794000.00	MPCB-DR-9776	13/01/2022	RTGS

Copy to:

1. Regional Officer, MPCB, Raigad and Sub-Regional Officer, MPCB, Raigad I

- They are directed to ensure the compliance of the consent conditions.

2. Chief Accounts Officer, MPCB,Sion, Mumbai
3. CAC Desk - for record & updation purposes.

SCHEDULE-I

Terms & conditions for compliance of Water Pollution Control:

1. A] As per your application, you have proposed to provide ETP comprising primary treatment of capacity 400 CMD to treat the effluent generated to the tune of 400 CMD. This primary treated effluent further treated in STP of combine capacity 5500 CMD.

   B] The Applicant shall operate the effluent treatment plant (ETP) to treat the trade effluent so as to achieve the following standards prescribed by the Board or under EP Act, 1986 and Rules made there under from time to time, whichever is stringent:

Sr.No	*Parameters*	*Limiting concentration not to exceed in mg/l, except for pH*
(1)	pH	6.0 -8.5
(2)	BOD (3 days 27°C)	10
(3)	COD	50
(4)	TSS	20
(5)	Oil & Grease	10
(6)	TDS	2100
(7)	Chloride	600
(8)	Sulphate	1000

   C] The treated effluent shall be 60% recycled for secondary purposes such as toilet flushing, air conditioning, cooling tower makeup, firefighting, etc., and remaining shall be discharged on land for gardening within premise after confirming above standards. In no case, effluent shall find its way outside premises.

2. A] As per your application, you have proposed to provide 2 Nos of Sewage Treatment Plants of designed capacity 4500 CMD & 1000 CMD with SBR technology for the treatment of 4210 CMD of sewage.

   B] Industry shall comply prescribed standards & disposal path as prescribed at Sr. No. 1 B & C of schedule I.

3. The Board reserves its rights to review plans, specifications or other data relating to plant setup for the treatment of waterworks for the purification there of & the system for the disposal of sewage or trade effluent or in connection with the grant of any consent conditions. The Applicant shall obtain prior consent of the Board to take steps to establish the unit or establish any treatment and disposal system or an extension or addition thereto.

4. The industry shall ensure replacement of pollution control system or its parts after expiry of its expected life as defined by manufacturer so as to ensure the compliance of standards and safety of the operation thereof.
5. The Applicant shall comply with the provisions of the Water (Prevention & Control of Pollution) Act, 1974 and as amended, by installing water meters and other provisions as contained in the said act:

Sr. No.	Purpose for water consumed	Water consumption quantity (CMD)
1.	Industrial Cooling, spraying in mine pits or boiler feed	1972.00
2.	Domestic purpose	4880.00
3.	Processing whereby water gets polluted & pollutants are easily biodegradable	430.00
4.	Processing whereby water gets polluted & pollutants are not easily biodegradable and are toxic	0.00
5.	Gardening	0

6. The Applicant shall provide Specific Water Pollution control system as per the conditions of EP Act, 1986 and rule made there under from time to time/ Environmental Clearance/ CREP guidelines.

SCHEDULE-II

Terms & conditions for compliance of Air Pollution Control:

1. As per your application, you have proposed to provide the Air pollution control (APC) system and also to erect following stack (s) to observe the following fuel pattern:

Stack No.	Source	APC System provided/proposed	Stack Height(in mtr)	Type of Fuel	Sulphur Content(in %)	Pollutant	Standard
S-1 to S-2	DG Set (14 x 880 KVA)	Stack	6.00	HSD 135 Kg/Hr	1.0	SO2	64.8 Kg/Day

2. The Applicant shall provide Specific Air Pollution control equipments as per the conditions of EP Act, 1986 and rule made there under from time to time/ Environmental Clearance / CREP guidelines.
3. The Applicant shall obtain necessary prior permission for providing additional control equipment with necessary specifications and operation thereof or alteration or replacement/alteration well before its life come to an end or erection of new pollution control equipment.
4. The Board reserves its rights to vary all or any of the condition in the consent, if due to any technological improvement or otherwise such variation (including the change of any control equipment, other in whole or in part is necessary).

SCHEDULE-III

Details of Bank Guarantees:

Sr. No.	Consent (C2E/ C2O /C2R)	Amt of BG Imposed	Submission Period	Purpose of BG	Compliance Period	Validity Date
1	C2E	Rs. 25.0 Lakh	15 days/To be extended	Towards compliance of EC & consent conditions	31.05.2026	30.11.2026

The above Bank Guarantee(s) shall be submitted by the applicant in favour of Regional Officer at the respective Regional Office within 15 days from the date of issue of Consent.

BG Forfeiture History

Srno.	Consent (C2E/C2O/C2R)	Amount of BG imposed	Submission Period	Purpose of BG	Amount of BG Forfeiture	Reason of BG Forfeiture
NA						

BG Return details

Srno.	Consent (C2E/C2O/C2R)	BG imposed	Purpose of BG	Amount of BG Returned
NA				

SCHEDULE-IV

General Conditions:

1. Consumers or bulk consumers of electrical and electronic equipment listed in Schedule I shall ensure that e-waste generated by them is channelised through collection centre or dealer of authorised producer or dismantler or recycler or through the designated take back service provider of the producer to authorised dismantler or recycler
2. Bulk consumers of electrical and electronic equipment listed in Schedule I shall maintain records of e-waste generated by them in Form-2 and make such records available for scrutiny by the concerned State Pollution Control Board
3. Consumers or bulk consumers of electrical and electronic equipment listed in Schedule I shall ensure that such end-of-life electrical and electronic equipment are not admixed with e-waste containing radioactive material as covered under the provisions of the Atomic Energy Act, 1962 (33 of 1962) and rules made there under;
4. Bulk consumers of electrical and electronic equipment listed in Schedule I shall file annual returns in Form-3, to the concerned State Pollution Control Board on or before the 30th day of June following the financial year to which that return relates. In case of the bulk consumer with multiple offices in a State, one annual return combining information from all the offices shall be filed to the concerned State Pollution Control Board on or before the 30th day of June following the financial year to which that return relates.

5. Specific Conditions for storage, Handling and Disposal of Waste from Electrical & Electronic equipment (WEEE):
    1. **Collection of WEEE** - The applicant must provide appropriate and dedicated vehicles duly identified as per the norms for transportation of Hazardous Waste. The applicant shall obtain all the required permits for transportation of WEEE from competent authority. The applicant shall ensure the safe transport of the WEEE without any spillage during transportation.

       Storage for disassembled parts: The applicant must provide appropriate storage for disassembled spare parts from WEEE. Some spare parts (e.g. motors and compressors) will contain oil and/or other fluids. Such part must be appropriately segregated and stored in containers that are secured such that oil and other fluids cannot escape from them. These containers must be stored on an area with an area with an impermeable surface and a sealed drainage system.
    2. **Storage for other components and residues:**Other components and residues arising from the treatment of WEEE will need to be contained following their removal for disposal or recovery. Where they contain hazardous substances they should be stored on impermeable surface and in appropriate containers or bays with weatherproof covering. Containers should be clearly labelled to identify their contents and must be secured so that liquids, including rain water cannot enter them. Components should be segregated having regard to their eventual destinations and the compatibility of the component types. All batteries should be handled and stored having regard to the potential fire risk associated with team.
    3. **Balances :** WEEE Guidelines also requires that sites for handling of WEEE have “balances to measure the weight of the segregated waste’. The objective is to ensure that a record of weights can be maintained of WEEE entering a facility and components and materials leaving each site (together with their destinations). The nature of the weighing equipment should be appropriate for the type and quantity of WEEE being processed.
    4. Plastic, which cannot be recycled and is hazardous in nature, is recommended to be land filled in nearby CHWTSDF.
    5. Ferrous and nonferrous metal recycling facilities fall under the purview of existing environmental regulations for air, water, noise, land and soil pollution and generation of hazardous waste and the same should be followed.
    6. CFCS should be either reused or incinerated in common hazardous waste Incineration facilities at CHWTSDF.
    7. Waste Oil should be either reused or incinerated in common hazardous waste incineration facilities.
    8. PCB's containing capacitors shall be incinerated in common hazardous waste incineration facilities at CHWTSDF.
    9. Mercury recovery and lead recycling facilities from batteries fall under the Hazardous & Other Wastes (M & TM) Rules, 2016.
    10. Existing environmental regulations for air; water; noise, land and soil pollution and generation of hazardous waste and the same should be followed. In case Mercury or lead recovery is very low, they can be temporarily stored at e-waste recycling facility and later disposed in TSDF.
    11. The industry shall maintain records of the e-waste purchased, processed in Form-2 and shall file annual returns of its activities of previous year in Form-3 as per Rules 11(9) & 13(3)(vii) of the E-Waste(M) Rules, 2016; on or before 30th day of June of every year.
6. The Energy source for lighting purpose shall preferably be LED based

7. The PP shall harvest rainwater from roof tops of the buildings and storm water drains to recharge the ground water and utilize the same for different industrial applications within the plant
8. Conditions for D.G. Set
   a) Noise from the D.G. Set should be controlled by providing an acoustic enclosure or by treating the room acoustically.
   b) Industry should provide acoustic enclosure for control of noise. The acoustic enclosure/ acoustic treatment of the room should be designed for minimum 25 dB (A) insertion loss or for meeting the ambient noise standards, whichever is on higher side. A suitable exhaust muffler with insertion loss of 25 dB (A) shall also be provided. The measurement of insertion loss will be done at different points at 0.5 meters from acoustic enclosure/room and then average.
   c) Industry should make efforts to bring down noise level due to DG set, outside industrial premises, within ambient noise requirements by proper sitting and control measures.
   d) Installation of DG Set must be strictly in compliance with recommendations of DG Set manufacturer.
   e) A proper routine and preventive maintenance procedure for DG set should be set and followed in consultation with the DG manufacturer which would help to prevent noise levels of DG set from deteriorating with use.
   f) D.G. Set shall be operated only in case of power failure.
   g) The applicant should not cause any nuisance in the surrounding area due to operation of D.G. Set.
   h) The applicant shall comply with the notification of MoEFCC, India on Environment (Protection) second Amendment Rules vide GSR 371(E) dated 17.05.2002 and its amendments regarding noise limit for generator sets run with diesel.
9. The applicant shall maintain good housekeeping.
10. The non-hazardous solid waste arising in the factory premises, sweepings, etc. be disposed of scientifically so as not to cause any nuisance / pollution. The applicant shall take necessary permissions from civic authorities for disposal of solid waste.
11. The applicant shall not change or alter the quantity, quality, the rate of discharge, temperature or the mode of the effluent/emissions or hazardous wastes or control equipments provided for without previous written permission of the Board. The industry will not carry out any activity, for which this consent has not been granted/without prior consent of the Board.
12. The industry shall ensure that fugitive emissions from the activity are controlled so as to maintain clean and safe environment in and around the factory premises.
13. The industry shall submit quarterly statement in respect of industries obligation towards consent and pollution control compliance's duly supported with documentary evidences (format can downloaded from MPCB official site).
14. The industry shall submit official e-mail address and any change will be duly informed to the MPCB.
15. The industry shall achieve the National Ambient Air Quality standards prescribed vide Government of India, Notification No. B-29016/20/90/PCI-L dated. 18.11.2009 as amended.
16. The Board reserves its rights to review plans, specifications or other data relating to plant setup for the treatment of waterworks for the purification thereof & the system for the disposal of sewage or trade effluent or in connection with the grant of any consent conditions. The Applicant shall obtain prior consent of the Board to take steps to establish the unit or establish any treatment and disposal system or an extension or addition thereto.
17. The industry shall ensure replacement of pollution control system or its parts after expiry of its expected life as defined by manufacturer so as to ensure the compliance of standards and safety of the operation thereof.
18. The PP shall provide personal protection equipment as per norms of Factory Act

19. Industry should monitor effluent quality, stack emissions and ambient air quality monthly/quarterly.
20. Whenever due to any accident or other unforeseen act or even, such emissions occur or is apprehended to occur in excess of standards laid down, such information shall be forthwith Reported to Board, concerned Police Station, office of Directorate of Health Services, Department of Explosives, Inspectorate of Factories and Local Body. In case of failure of pollution control equipments, the production process connected to it shall be stopped.
21. The applicant shall provide an alternate electric power source sufficient to operate all pollution control facilities installed to maintain compliance with the terms and conditions of the consent. In the absence, the applicant shall stop, reduce or otherwise, control production to abide by terms and conditions of this consent.
22. The industry shall recycle/reprocess/reuse/recover Hazardous Waste as per the provision contain in the Hazardous and Other Wastes (M & TM) Rules 2016, which can be recycled /processed /reused /recovered and only waste which has to be incinerated shall go to incineration and waste which can be used for land filling and cannot be recycled/reprocessed etc. should go for that purpose, in order to reduce load on incineration and landfill site/environment.
23. An inspection book shall be opened and made available to the Board's officers during their visit to the applicant.
24. Industry shall strictly comply with the Water (P&CP) Act, 1974, Air (P&CP) Act, 1981 and Environmental Protection Act, 1986 and industry specific standard under EP Rules 1986 which are available on MPCB website (www.mpcb.gov.in).
25. Separate drainage system shall be provided for collection of trade and sewage effluents. Terminal manholes shall be provided at the end of the collection system with arrangement for measuring the flow. No effluent shall be admitted in the pipes/sewers downstream of the terminal manholes. No effluent shall find its way other than in designed and provided collection system.
26. Neither storm water nor discharge from other premises shall be allowed to mix with the effluents from the factory.
27. The industry should not cause any nuisance in surrounding area.
28. The industry shall take adequate measures for control of noise levels from its own sources within the premises so as to maintain ambient air quality standard in respect of noise to less than 75 dB (A) during day time and 70 dB (A) during night time. Day time is reckoned in between 6 a.m. and 10 p.m. and night time is reckoned between 10 p.m. and 6 a.m.
29. The industry shall create the Environmental Cell by appointing an Environmental Engineer, Chemist and Agriculture expert for looking after day to day activities related to Environment and irrigation field where treated effluent is used for irrigation.
30. The applicant shall provide ports in the chimney/(s) and facilities such as ladder, platform etc. for monitoring the air emissions and the same shall be open for inspection to/and for use of the Board's Staff. The chimney(s) vents attached to various sources of emission shall be designated by numbers such as S-1, S-2, etc. and these shall be painted/ displayed to facilitate identification.
31. The industry should comply with the Hazardous and Other Wastes (M & TM) Rules, 2016 and submit the Annual Returns as per Rule 6(5) & 20(2) of Hazardous and Other Wastes (M & TM) Rules, 2016 for the preceding year April to March in Form-IV by 30th June of every year.

32. The applicant shall install a separate meter showing the consumption of energy for operation of domestic and industrial effluent treatment plants and air pollution control system. A register showing consumption of chemicals used for treatment shall be maintained.
33. The applicant shall bring minimum 33% of the available open land under green coverage/ plantation. The applicant shall submit a yearly statement by 30th September every year on available open plot area, number of trees surviving as on 31st March of the year and number of trees planted by September end.
34. The Board reserves its rights to review plans, specifications or other data relating to plant setup for the treatment of waterworks for the purification thereof & the system for the disposal of sewage or trade effluent or in connection with the grant of any consent conditions.
35. The firm shall submit to this office, the 30th day of September every year, the Environment Statement Report for the financial year ending 31st March in the prescribed FORM-V as per the provisions of Rule 14 of the Environment (Protection) (second Amendment) Rules, 1992.
36. The Applicant shall obtain necessary prior permission for providing additional control equipment with necessary specifications and operation thereof or alteration or replacement/alteration well before its life come to an end or erection of new pollution control equipment.
37. The Board reserves its rights to vary all or any of the condition in the consent, if due to any technological improvement or otherwise such variation (including the change of any control equipment, other in whole or in part is necessary).
38. The applicant shall provide facility for collection of environmental samples and samples of trade and sewage effluents, air emissions and hazardous waste to the Board staff at the terminal or designated points and shall pay to the Board for the services rendered in this behalf.

This certificate is digitally & electronically signed.

Annexure-IV

Bombay Natural History Society (BNHS)- Annual Report 2022-2023 on Long-Term Bird Monitoring Programme of Navi Mumbai International Airport (NMIA) Area and its Surroundings during Construction and Operational Phases

Long-Term Bird Monitoring Programme of Navi Mumbai International Airport (NMIA) Area and its Surroundings during Construction and Operational Phases

Annual Report 2022-2023

Submitted to

The City and Industrial Development Corporation of Maharashtra (CIDCO) Ltd.

Submitted by

Bombay Natural History Society (BNHS)

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2023

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Acknowledgement

We are thankful to Vice Chairman and Managing Director of CIDCO, Mrs. Geetha Ajith Pillai, Chief General Manager (Transport &Airport) and Mr. Devendra B. Mokal, TE (NMIA) for their support and cooperation to execute the project. We thank Mr Kishor Rithe, Director BNHS for his constant support and encouragement. We want to extend our thanks to Mr Ashok Pisal for on-field assistance as well as Mr Harshal Jitkar for GIS assistance. We thank the Administration and Accounts departments of BNHS for their constant support and assistance during the fieldwork and day-to-day functioning of the project work. We thank the Publications Department and BNHS Library Staff, respectively, for their editorial support and providing help during literature review.

Layout and Design: V. Gopi Naidu

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Note: The findings are a summary of annual observations only. The final analysis will only be performed after completion of the project tenure. Thus, the findings of the report cannot be used as a standalone piece of information.

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Table 1: List of Abbreviations	
BASH	Bird Aircraft Strike Hazard
BNHS	Bombay Natural History Society
CIDCO	City and Industrial Development Corporation of Maharashtra Ltd.
GIS	Geographic Information System
GPS	Global Positioning System
LULC	Land Use Land Cover
MoEFCC	Ministry of Environment, Forest and Climate Change
NMIA	Navi Mumbai International Airport
PCS	Point Count Station
R	Resident
M	Migrant

Table 2: Team Information	
Position	**Name**
Principal Investigator	Rahul Khot
JRF	Sarbasis Dutta
Driver	Ashok Pisal

Chapter 1

Progress Report and Current Status

The brief from NMIA proposal and background:

BNHS took the offer of conducting five years pre-construction phase study (2012-2015)on the ecology of the birds in and around the proposed airport site. This study was primarily focused on shorebirds, most of which are migratory because of their exceptional flight abilities and massive abundance, which was a real concern for aviation. BNHS conducted a pilot study in order to determine sites for long-term monitoring of birds at Navi Mumbai and shortlisted elevensites based on their locations, habitat, bird species diversity and abundance of which eight were wetlands – Training Ship Chanakya (TSC), Non-residential Indian (NRI) Complex, Delhi Public School (DPS), Kharghar Creek, Kalundre River, Sonari-Belpada, Dastan Phata Jasai, Uran and three were forested areas i.e., Karnala Bird Sanctuary, Chinar, and Mosare.

The study indicated the local movement of birds is driven by tide height and water depthin high-tide roosting sites (inland wetlands) which highlighted the importance of these wetlandsin the conservation and management of the birds in these areas. Apart from observational examination we also conducted ringing studies around Mumbai for investigating the migratory ecology of shorebirds. Mumbai has been identified as one of the important areas in the Central Asian Flyways, which plays a vital role in maintaining the fragile group of wader population wintering in India. (Balachandran *et al.*).

Impacts of construction and post-construction phases of the airport on birds (if any) need to be investigated. In addition to this, while looking at the key site for migratory birds ringing studies coupled with cutting-edge techniques such as stable isotope and population genetics will be used for understanding the migratory ecology of birds for their effective conservation and management.

The long-term objectives of this study include: A) Assessing the impact of construction and post-construction activities on birds through changes in their behavior before, during, and after construction and examining spatial and temporal (within and between years) patterns in population and communities' dynamics of the birds and factor affecting it in addition to construction activities. B) Monitoring the movement of waders and land birds between the roosting and foraging sites and identifying species-wise flock composition and preferential habitats C) To determine the carrying capacity of existing wetlands in terms of biomass/current population of bird's Benthic composition of wetlands in the study area and to explore migration pattern and population dynamics of migratory birds in Mumbai Bay. D) To standardize the stable isotopes method for analyzing regional and global scale population movement and feeding ecology of migratory and resident birds in Mumbai. E) To develop a genetic library for precise identification of bird hazard cases and to standardize the DNA barcoding techniques for accurate identification of the birds involved in aircraft strikes. F) To explore the possibility of bird strike events in Navi Mumbai aerodromes alongwith its conservation and management plan G) To provide the measures to reduce the risk of birdstrikes. H) To suggest a practical solution to reduce the impact of developmental activities on birds and their long-term conservation.

The executive summary of 1st and 2nd NMIA annual reports:

The Navi Mumbai region with its diverse habitat types such as mangroves, mudflats, creeks, grasslands, and agricultural fields amongst others is home to various bird species. To assess the impacts of the upcoming Navi Mumbai International Airport (NMIA) on the avian fauna in the region BNHS started pilot surveys in a 10km radius around the Airport. We stratified the study area based on habitat. Grid sampling was carried out habitat wise and point count surveys were undertaken in the grids. Along with data on bird species, other covariates, both physical and environmental were noted down. The data thus obtained was used to understand the diversity of birds in the various habitat types and the influence of these habitats on bird ecology. The diversity of birds was found to be highest in mangroves**.** The abundance of house crows was highest in agricultural areas, rock doves were highest in urban, red-vented bulbul in green spaces, oriental magpie-robin in degraded areas, and little cormorant in mangroves. Post the pilot surveys we intend to start the first phase of surveys which will aim at understanding the occupancy and density of birds in the area and the factors that impact them.

After completing our pilot survey, we started our seasonal intensive surveys on birdsand their habitat covariates. Grid sampling was carried out habitat-wise, and fixed-radius point count surveys were undertaken in the grids. Along with the data on bird species, other covariates, both physical and habitat, were noted down. We also surveyed wetlands in the study area and noted the water bird species and their abundance. In addition to this, we carried outa pilot survey in Panvel Creek to determine the species present and to fix a methodology for creek surveys. The species richness was highest in green spaces in post monsoon season whilein the winter season it was highest in mangroves. We found the average abundance across the different habitat types in both survey seasons. We found the average abundance of Rock Dove *Columba livia* to be highest across all habitat types except green spaces and at the airport sitein the post-monsoon survey. In the winter survey, the average abundance of Lesser Flamingo *Phoeniconaias minor* was highest compared to other species. Amongst the synanthropic species, the abundance of Rock Dove was the highest. We also used diversity indices to determine the character of a community. The various indices calculated to decipher the community structure include Pielou's Evenness Index-to determine species evenness, Shannon-Wiener, and Simpson's Dominance Index to determine richness and abundance patterns, and Bray-Curtis Dissimilarity Index to measure distance between habitat types depending on their composition.

Executive Summary of the 3rd and 4th NMIA annual report:

After the initial two consecutive year of intensive bird sampling in the NMIA construction site andits 10 km surroundings, the 3rd and 4th Annual Report brought a prompter understanding of bird communities and their associated habitat types. The main objectives of the study included a) the habitat- wise seasonal patterns in the bird species richness and abundance of the terrestrial and water bird species in the 10 km radius in and around the NMIA site.b) Data collection on garbage dumps and meat shops in the various habitats and also the associations of bird species in them. We had also extendedour study area beyond 10km radius based on the presence of potential habitats like Morbe Dam,Gadeshwar Dam, Hetanwe Dam, and Pen Grasslands. Till then, we observed a total of 229 species from the study area where we recorded 80species from the NMIA airport construction site. Additionally, we have updated the checklist of birds present in

garbage dumps and meat shops in the study points mentioned in our previous annual report.

Executive Summary of the 5th (current) NMIA annual report:

After four consecutive year of intensive bird sampling in and around NMIA site, this report brings a more rigorous and replicated ideas of bird communities and their associated habitat types. The main objectives of the current study included 1) continuation of habitat- wise seasonal patterns in the bird species richness and abundance of the bird species in the 10kmradius around the NMIA site. 2) Observations on the bird species and their season-wise abundance accounted in the NMIA construction site and its adjacent creek and mangrove habitat. 3) Checklist of overall bird diversity along their family classification and IUCN status in the study area. 4) Data collection on meat shops in the various habitats and also the associations of bird species in them.5) Study on water bird species presence and abundance in all the selected wetlands of our study area. We have also analyzed the species richnessof birds in all the habitat types where we observed Mangrove habitat has the highest species richness whereas Urban habitat has the lowest species richness across all the seasons. We have also analyzed and presented the ten 'most represented' species based on their higher abundancefor all the habitat types including NMIA site. Same analysis has been performed for the monthly surveys in the studied wetlands and Belapur-Panvel Creek area. Till now, we have observed a total of 231 species from the study area although the species recorded from the NMIA airport construction site has decreased from 80 to 60 species. Additionally, we have updated the checklist of birds present in relevant meat locations along with bird association in the study points.

Way Forward:

More intensive sampling will be performed season-wise and monthly on terrestrial and water birds respectively to understand their changing patterns based on species abundance and richness. We will also try to understand the changes in Land Use-Land Cover (LULC) for the last ten years to understand the alteration of habitat types and the shaping of bird community structure in these habitats. Behavioural surveys, Radio Telemetry and Ringing studies have been planned in the NMIA site and associated areas

Chapter 2

Introduction

Bird-aircraft collisions pose a serious threat to aviation safety worldwide. As urban areas expand and airports become more integrated into urban landscapes, the risk of such collisions has increased. Birds, often drawn to airports due to open spaces and food resources, come into direct conflict with aircraft during takeoff and landing (Brown & Johnson 2021).In India, including Mumbai, the increasing frequency of these incidents necessitates a comprehensive understanding of the factors contributing to such collisions. Rapid urbanization near airports and the lack of effective bird control measures exacerbates the risk. The country's diverse bird species add complexity to the issue, as different species exhibit varying behaviors and pose distinct challenges in terms of collision avoidance (Kumar & Singh 2020).

Factors Contributing to Bird-Aircraft Collisions:

Bird strikes are influenced by various factors, including bird species, aircraft speed, altitude, and environmental conditions. Urbanization exacerbates these risks as it brings birds into close proximity to airports, creating potential conflict zones.

Table 3: Common bird species and their collision characteristics

Bird Species	Urbanization Effects	Collision Characteristics
Common Sparrow	Nesting site loss, reduced green spaces	Low risk, primarily affected by urbanization
Indian Cormorant	Habitat alteration, pollution	Limited risk, potential for collisions near water bodies
Asian Koel	Noise disruption during breeding	Low risk, behavioral changes due to noise pollution
Black Kite	Collisions with structures	Moderate risk during navigation through urban landscapes
House Crow	Adaptation to urban environment	Low risk, may contribute to competition for resources
Raptors (e.g., Eagles)	Scavenging near airports, soaring flight	High risk during takeoff and landing phases
Waterfowl	Vulnerable during migration	High risk due to large size and flocking behavior
Gulls and Terns	Coastal attraction, proximity to runways	High risk, especially in coastal airports
Migratory Songbirds	Seasonal and altitude-specific risk	Variable risk depending on timing and altitude during migration

Bird species Involved in Bird-Aircraft Collisions:

1. **Black Kites and Eagles**:
   Behavioral Risks: Large raptors, including Black Kites and Eagles, are at risk during takeoff and landing due to their soaring flight patterns. The risk is heightened when they scavenge near airports. (Brown & Johnson 2021).
2. **Waterfowl (Ducks, Geese)**:
   Risk During Migration: Waterfowl, especially during migration, are vulnerable to collisions at various altitudes. Their large size and flocking behavior increase the likelihood of impacting aircraft (Brown & Johnson 2021).
3. **Gulls and Terns**:
   Proximity to Coastal Areas: Coastal airports face challenges with gulls and terns, attracted to coastal habitats. The birds' presence near runways poses a significant risk during critical flight phases (Kumar & Singh 2020).
4. **Migratory Songbirds**:
   Timing and Altitude Factors: Some songbirds, particularly during migration, are at risk during specific times of the year and at various altitudes.

Bird strikes need to be accessed using standardized, scientific process to improve flight safety and reduce economic losses (Hu et al. 2020). Multiple bird risk factors affect the aircraft safety and various research results have shown different sets of risk factors system (Qiao et al. 2019). Bird management can be divided into long term and short-term actions, each airport has its own specific bird hazard problems and hence a single management plan applied to all airports is not possible (Sodhi 2002). A sound ornithological understanding is needed for long term management solutions of this problem. As birds provide the inspiration to build aircrafts, a detailed understanding of their biology is needed to reduce bird-aircraft collisions (Sodhi 2002).

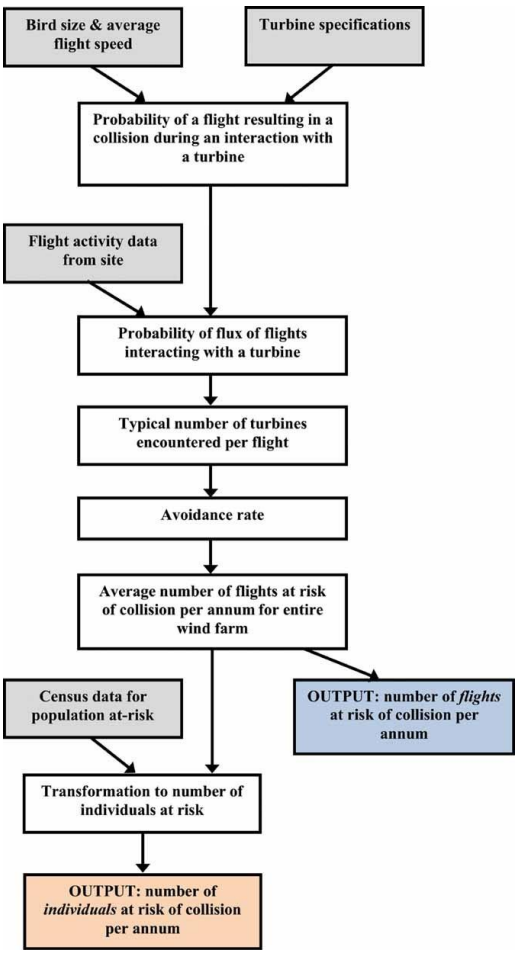


Figure 1: Overview of the collision risk model that quantifies risk to birds of colliding with wind turbines by Smales *et al.* 2013

Urbanization, characterized by rapid population growth and infrastructure development, has profound consequences on biodiversity and ecosystems. This explores the effects of urbanization on bird populations in Mumbai and Navi Mumbai, focusing on the potential hazards posed by bird-aircraft collisions in these urban environments. Urbanization in Mumbai Metropolitan Region in past few decades led to alterations in the natural landscape, resulting in habitat fragmentation. As green spaces shrink and concrete expanses expand, the avian inhabitants face multiple challenges.

1. **Habitat Fragmentation and Loss**:
Urbanization often leads to the fragmentation and loss of natural habitats for birds. This disrupts breeding and nesting patterns, forcing birds to adapt to new environments or migrate, putting additional stress on their populations (Smith et al. 2019).

2. **Pollution and Climate Change**:
Urban areas are notorious for high levels of pollution, including air and noise pollution. Birds are highly sensitive to these environmental changes, and exposure can lead to respiratory issues and altered reproductive behaviors. Additionally, the urban heat island effect exacerbates climate change impacts, affecting bird migration patterns and food availability success (Gupta et al. 2018).

3. **Altered Food Sources**:
Urbanization results in changes to the availability and distribution of food sources for birds. Natural habitats are replaced by built structures, leading to the decline of insect populations and altering the foraging behavior of birds. This can have cascading effects on the entire ecosystem (Gupta et al. 2018).

4. **Light and Noise Pollution**:
Urban environments are characterized by excessive artificial lighting and noise, which can disrupt avian behavior. Birds rely on natural light cues for navigation, and excessive artificial lighting can lead to disorientation, affecting their migratory patterns and daily activities. Noise pollution can interfere with bird communication, breeding, and feeding behaviors (Smith et al. 2019).

The Navi Mumbai region has diverse habitat types such as mangroves, mudflats, creek, grasslands, and agricultural fields and is home to various bird species, including several migrant species that visit the area. As the Chhatrapati Shivaji Maharaj International Airport has reached its saturation, there is a need for the construction of a second international airport to ensure availability of airport capacity for the population of MMR. The urbanization in MMR is generating tremendous pressure upon the already declining natural habitats, especially on the mangroves, wetlands and remnant patches of the natural forests which would eventually impact the biodiversity (Nagendra et al. 2012).The current phase of assessment involves grid sampling of habitat and fixed-radius point count surveys to study the habitat wise bird abundance and richness within 10 KM of NMIA site. Wetland and Creek Total Count surveys within the study area is also conducted to note the water birds and their abundance. To get an overall idea regarding the modification of birds and their habitation in and around NMIA site during its construction and operational phase, we will investigate the spatial and temporal (within and between year) patterns in the population and community dynamics of the bird species and the habitat covariates that are affecting them.

Chapter 3

Aim

Long-term terrestrial and aquatic bird monitoring, supervision and conservation with reference to Navi Mumbai International Airport (NMIA) and associated regions. The present study aims to study the abundance, richness, and diversity of terrestrial and aquatic avian fauna in and around the NMIA construction site along with the habitat and anthropocentric factors affecting them, during its construction phase.

Objective

Ongoing Study

- The continuation of intensive seasonal terrestrial bird survey in and around Navi Mumbai Airport Site (NMIA) across different habitat types: human settlement, secondary forests, degraded areas, mangroves, agriculture, inland waterbodies, and creek to assess the impact of ongoing massive construction activities on birds and their habitats.
- Monthly water bird surveys are executed such that they can be replicated to get a clear insight regarding the spatial and temporal pattern of the species assemblages in that area.
- A sampling of habitat covariates like ground cover and anthropogenic interference are considered in all the habitat types to understand their correlation with bird species.
- Data collection on meat shops in the various habitats and the associations of bird species in them.

Long-term Objectives

- Investigating the spatial and temporal (within and between years) patterns in the population and community dynamics of the bird species and the habitat covariates that are affecting them.
- Evaluating the impact of construction activities on birds through changes in their behavior before, during and after construction.
- Monitoring the movement of waders and terrestrial birds between the roosting and foraging sites.
- Categorizing species-wise flock composition and favored habitats.
- Shaping the carrying capacity of prevailing wetlands in terms of biomass/current population of birds.
- Reconnoitering the migration patterns and population dynamics of migratory birds in Mumbai Bay through the stable isotope method to analyze the regional and global scale population movement and feeding ecology of the birds.
- Developing genetic library for precise identification of bird hazard cases by DNA barcoding techniques for precise identification of the birds involved in aircraft strikes and for analyzing the pattern of bird strike events in Navi Mumbai aerodromes.
- Chalking out a conservation and management plan to reduce the risk of bird strikes and make available a practical solution to diminish the impact of developmental activities on birds through long-term conservation.

Chapter 4

Methodology

Land Use - Land Cover (LULC) Classification at QGIS

The main habitat types are urban areas, agriculture, degraded habitats, green spaces, mangroves, creek and inland water-bodies. The land use/land cover classification of NMIA (Navi Mumbai International Airport) was carried out using Sentinel – 2 satellite data and reference with Bhuvan Thematic services, base map and Google Earth then digitized given area. An imagery of 10 m resolution obtained from this dataset was digitized in ArcGIS (Version 10.7) by identifying the spectral features of different land use types.

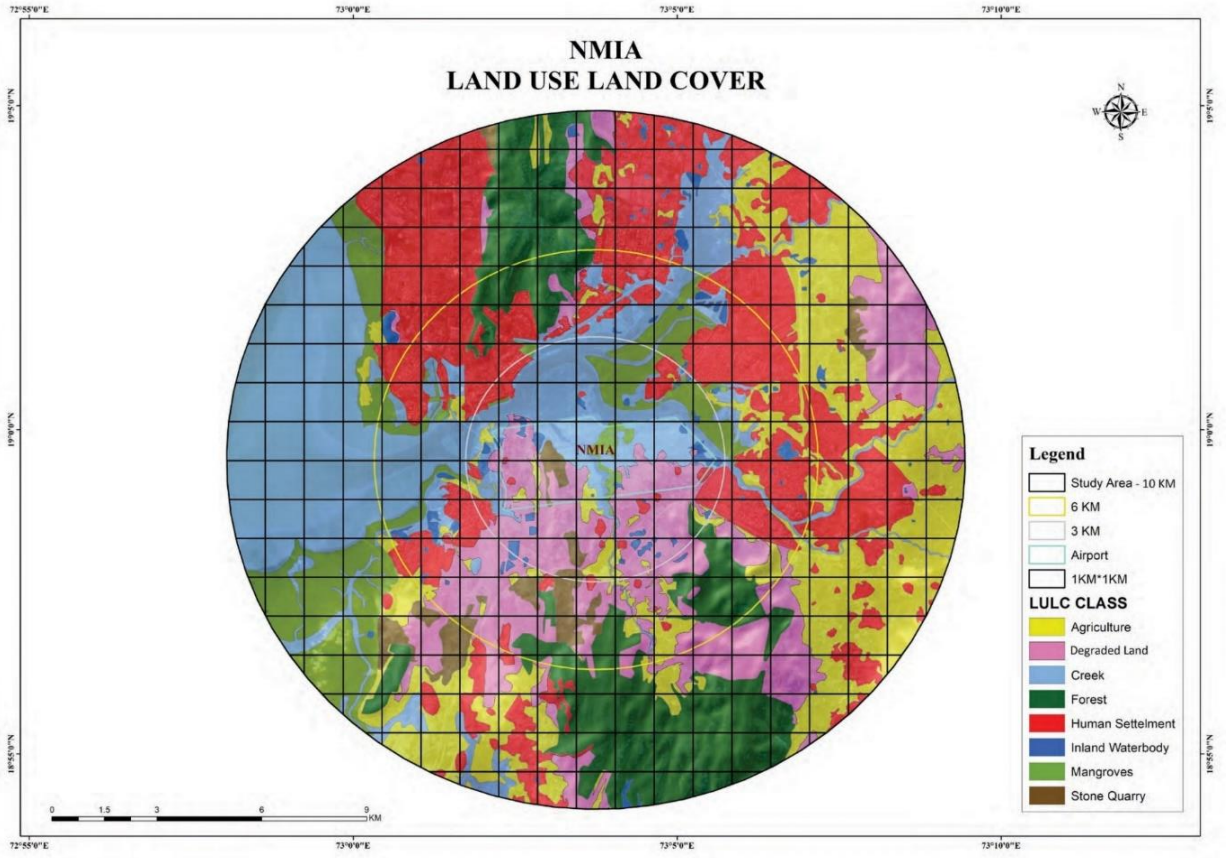


Figure 2 : Land Use- Land Cover Classified Map showing all the habitat types at NMIA and surroundings

Habitat Type	Percentage of Habitat Type in Study Area	Habitat description considering all the microhabitat types
Human Settlements	23.68	Urban settlements associated rural areas and peri-urban areas.
Inland Water bodies	1.40	Lakes, ponds, dams and wetlands, both perennial and annual bodies as well as natural and artificial bodies.
Creek	20.50	An inlet that flows into the land from the sea. Our study area covered a part of the Thane creek, the Panvel creek and its smaller inlets.
Agricultural Area	17.31	Agricultural fields under cultivation and fallow lands.
Mangrove	7.24	Trees or shrubs that largely belong to the genus Avicennea. Mangroves have special root systems that help them to adapt to the dynamic creek ecosystem, especially the changing water levels and the brackish waters.
Degraded Habitat	16.66	Habitats that have been altered extensively from their original state. Such habitats included small patchy growth of scrubs and grasses, stone quarries and land that has been altered for infrastructural projects.
Green spaces	13.21	Secondary growth forests, continuous scrublands and grasslands. Patches of moist deciduous forest and scrub forest were also included in this category.

Table 4: The percentage and description of each habitat type

Chapter 5

Terrestrial Bird Survey

Study Sites

The study was conducted in parts of Navi Mumbai and Raigad districts in Western Maharashtra, India. The upcoming Navi Mumbai International Airport (NMIA) is being constructed at Ulwe-Kopar- Panvel in Maharashtra and the study area covers a 314 sq.km with the NMIA airport at its center. The study area stretches to the north with the area of Turbhe as its northern border, and the Mosare Forest Range marks the southern border. The Thane Creek marks the western border, and the village of Nere in Raigad District marks the eastern border. Additionally, we have extended our study site considering the potential habitat types in some areas of Raigad District like Pen grasslands, Hetanwe Dam area, Vashi Sagar Vihar area, Taloja area.

The study area is a heterogeneous landscape with varied habitat types as mentioned: 1) Mangrove 2) Green Space 3) Urban Areas 4) Agriculture 5) Creek and Inland Water bodies 6) Degraded Habitats.

The study area experiences four distinct seasons: Summer (March–May), Monsoon (June–September), Post Monsoon (October-December), Winter (January-March starting). The temperature in this region ranges from a minimum of 17° C to a maximum of 34° C. The average maximum rainfall received by the region is 3000mm. The region experiences high humidity throughout the year.

Methodology

A thorough and systematic literature review is consistently been carried out which helped us to advance the methodology for the present study and also effectively plan for implementing methods for our new objectives.

Post Monsoon Survey 2021, Winter Survey 2021-2022, Summer Survey 2022 could be performed in various sampling points. The entire area was divided into 1km X 1km grids through stratified random sampling. We carried out the fixed-radius point count methodology at each of the three PCS in the grid. To carry out bird point count, we recorded birds in a 100-m radius from the point. Each point count was conducted for ten minutes. In the ten minutes time frame, all the birds that were seen or heard were noted down, and their numbers were also recorded. An ocular estimate of the distance of the birds from the observation point was noted.

Other site covariates such as temperature, wind speed, visibility, noise and cloud cover were recorded. The locality and time of the survey were also noted. The birds were identified by referring to Ali & Ripley 1983, Grimmett et al. 1998 and Rasmussen & Anderton 2012. Fly in, fly out and fly away birds are also taken into consideration while doing our regular surveys.

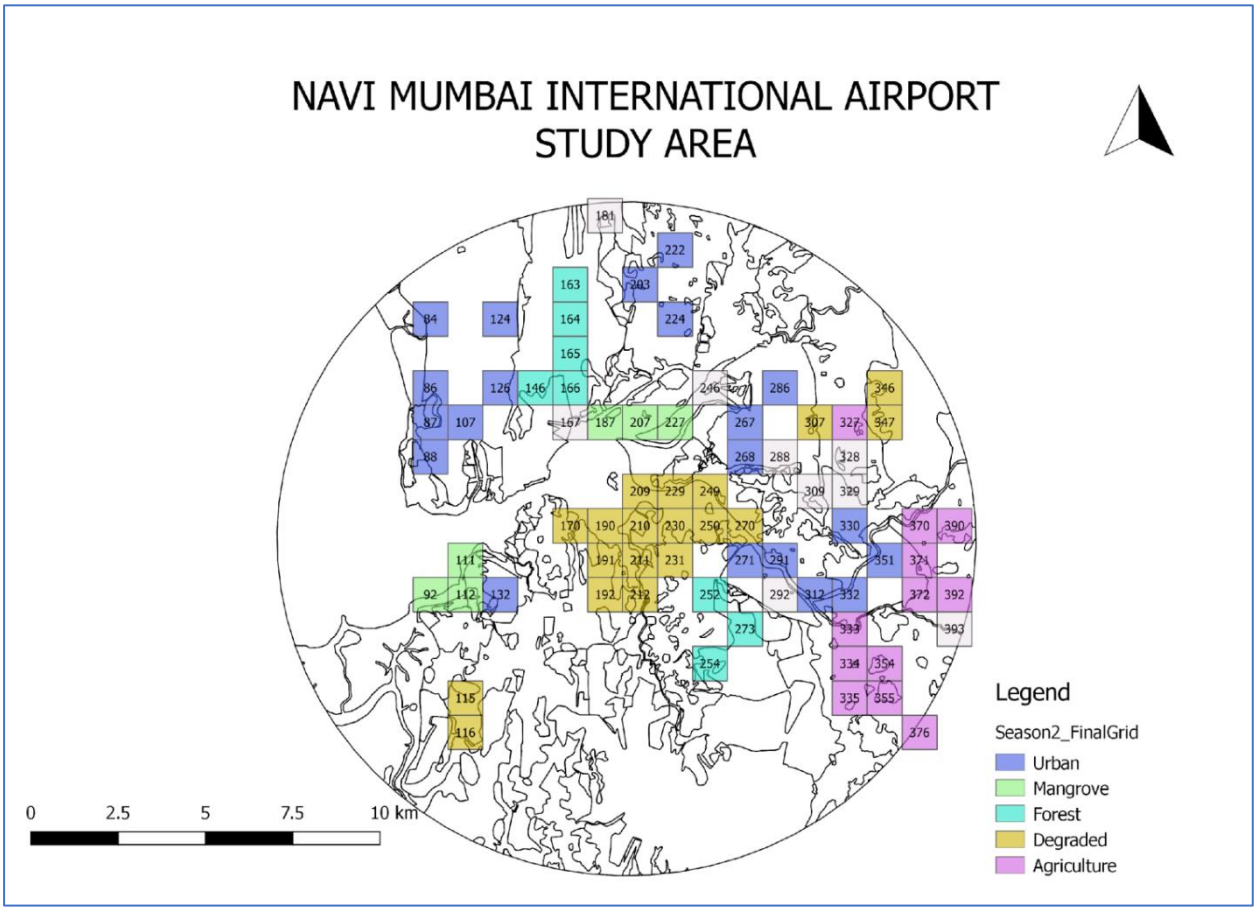


Figure 3 : grid-wise habitat classification for the Fixed-radius Point Count survey

Methodology for Habitat Assessment in the study area

In our present study, at each point count station, a circular plot was demarcated with a radius of around 20m for the habitat assessment.

For each plot, various parameters were recorded to understand the ground cover and anthropogenic influences. Four transacts were taken from the central point in cardinal directions, that is north, south, east and west, on which at ten-meters and twenty-meters, a scale of one meter was laid and, at every 25 cm, the ground cover was recorded.

It is especially essential to understand the factors affecting the occurrence of birds in urban habitats in order to maintain or even increase the diversity of birds in these fragments. Several other studies also indicate that at moderate levels of urbanization, species density and richness peaked and decreased respectively as urbanization increased (Blair 2004). To assess the human interference in our study area, we planned our methodology to include various potential anthropogenic indicators affecting the bird diversity and abundance.

Tree cutting & Lopping: The number of vertically cut trunks in a particular tree was counted to understand the extent of tree cutting (Brack 2003). The number of longitudinally cut stems were also counted along with branches to assess the degree of lopping.

Presence of Fire: Periodic burning of grasslands and scrublands are very common anthropogenic stressors in some habitat types in our study area like degraded lands and forested patches. From conversations with local people, we learnt that this is mostly done by tribal communities to increase the fertility of the soil which helps to make the particular area suitable for farming. Signs of fire were noted at the survey sites. We intend to interact with local people to get more explicit narratives about the fire history of the area.

Signs of Domestic Intervention: As domestic intervention is considered to be primary anthropogenic stress in a particular area, we assessed this parameter grid-wise in our study area, also taking into consideration the number of hoof marks, and dung cakes along with the number of dogs, cats, and cattle.

Percentage of Invasive Species: A significant process of success of invasive speciesis mainly dependent on the extent of disturbance in the recipient ecosystem (Tamburello *etal.* 2014). If disturbance, either biotic or abiotic, is prevalent in an ecosystem, it can promote invasion by increasing the availability of limited resources (space, light, and nutrients) and by reducing competition with natives (Tamburello *et al.* 2014). At each PCS, we considered a 20m circular plot within which we estimated the percentage of invasive weeds through the ocular method. Percentage of invasive species at a given plot can broadly help us to determine the condition of soil texture, which can indicate the extent of habitat fragmentation.

Human Trails/Pathways: In each grid of our study area, specifically in forested and mangrove patches, we considered the presence of human trails whenever encountered and also noted down the human activities around, whenever relevant.

Canopy Cover: Canopy is one of the chief determinants of microhabitat. It affects the plant growth and survival, hence determining the nature of vegetation and wildlife habitat. There are various techniques invented to measure the canopy cover (Jennings *et al.* 1999). Canopy coveris the area of ground covered by the vertical projection of the canopy. In our study area, after selecting random grids, we measured canopy cover in four cardinal directions in each point using spherical densitometer.

Urban Indicators: With the increasing number of human populations in an area, the need for buildings and infrastructure, traffic-related air pollution, noise pollution, and artificial light atnight, has also been increased (Isaksson 2018). Thus, human population size is a relatively good indicator of city-level impact on birds (Isaksson 2018). In each grid, after selecting random points, we measured some relevant parameters in a 20-metre radius:

- Number of market places
- Number of meat shops
- Number of grocery shops
- Number of garbage dumps
- Type and number of urban structures: kutcha, one storey, two storeys, multi-storeys
- Number of vehicles passing per minute
- Number of slaughter houses

Terrestrial Survey Preliminary Observations

Richness of bird species across all the habitat types

Species richness is the number of species within the defined range at per unit time. We have recorded the species richness of all the bird species observed across various types in the three (3) consecutive seasons: Post Monsoon (October 2022- November 2022), Winter (December 2022- February 2023), Summer (March 2023 - June 2023) in our study grids.

The highest bird species richness is observed in- 1) Mangrove habitat followed by Greenspace in the Post Monsoon Season 2) Mangrove habitat followed by Agricultural habitat in the Winter Season 3) Mangrove habitat followed by Degraded habitat in the Summer Season. The lowest bird species rich ness is observed consistently in Urban habitat for all the consecutive seasons.

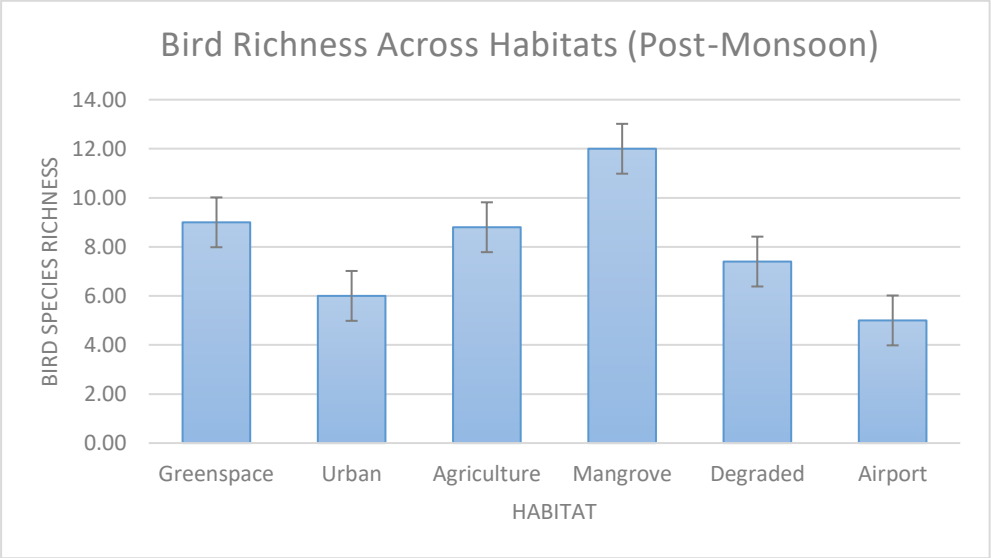


Figure 4: Bird richness in Post- Monsoon Season

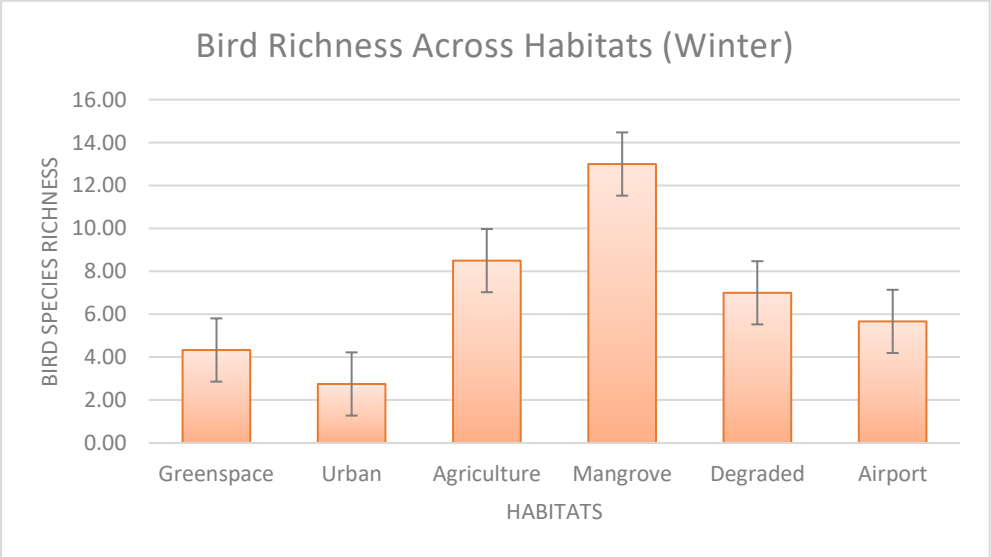


Figure 5: Bird richness in Winter Season

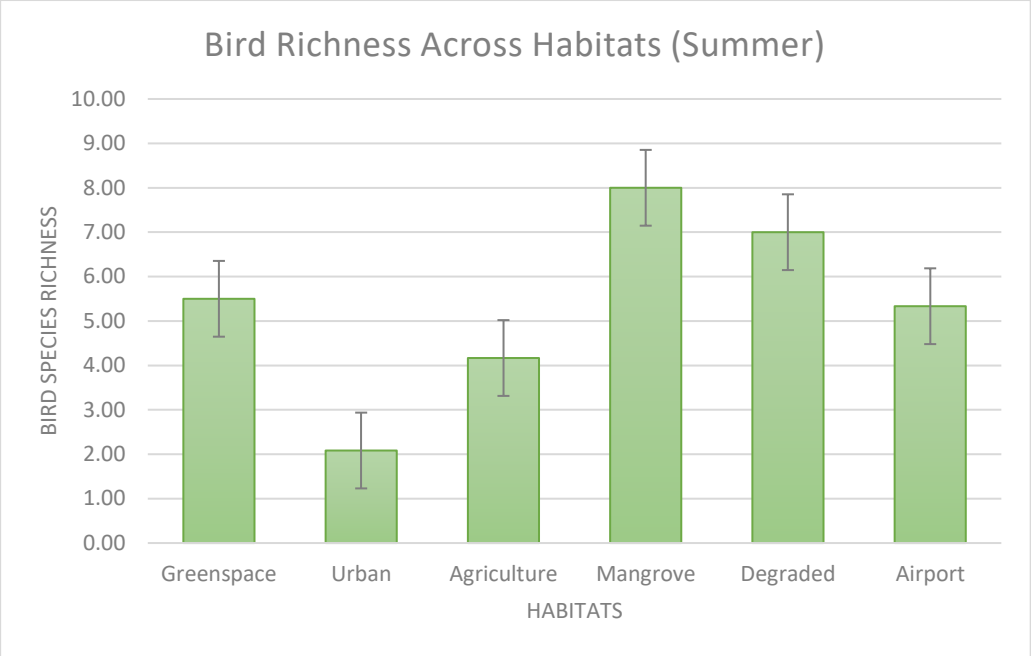


Figure 6: Bird richness in Summer Season

Abundance of bird species across all habitat types

Species abundance is the number of individuals per species. Species abundance provides clear insights regarding the bird community assembly, stability and community functions. We have calculated the species abundance across all the habitat types in all three consecutive seasons namely Post Monsoon (October 2022- November 2022), Winter (December 2022- February 2023), Summer (March 2023- June 2023) in our study grids. We have represented ten (10) most represented species based on their season-wise higher abundance in various habitats. We have also collated the data habitat- wise for all three consecutive seasons for a better representation.

Agricultural Habitat

In the Agricultural Habitat, the highest abundance of Oriental Magpie-robin followed by Rock Dove is observed in the Post-Monsoon Season, highest abundance of Black Kite followed by Cattle Egret in the Winter Season & highest abundance of House Crow followed by Rock Dove in the Summer Season.

Degraded habitat

In the Degraded habitat, the highest abundance of Ashy Prinia followed by Rock Dove isobserved in Post-Monsoon season, the highest abundance of Common Stonechat followed by Ashy Prinia in Winter season, & highest abundance of Red-vented Bulbul followed by Rock Dove in Summer season.

Mangrove habitat

In the Mangrove habitat, the highest abundance of White-eared Bulbul followed by Rock Dove is observed in Post-Monsoon season, highest abundance of Blue-tailed Bee-eater followed by Black Drongo in Winter season, & highest abundance of Rock Dove followed by Rosy Starling in Summer Season.

Greenspaces

In the Greenspaces, the highest abundance of Asian Green Bee-eater followed by Red-vented Bulbul is observed in Post-Monsoon season, highest abundance of Red-vented Bulbul followed by Purple Sunbirdin Winter season, & highest abundance of Red-vented Bulbul followed by Rose-ringed Parakeet in Summer season.

Urban habitat

In Urban areas, the highest abundance of Rock Dove followed by House Crow is observed in the Post-Monsoon and Summer Season. The highest abundance of Rock Dove followed by House Sparrow is observed in the Winter season.

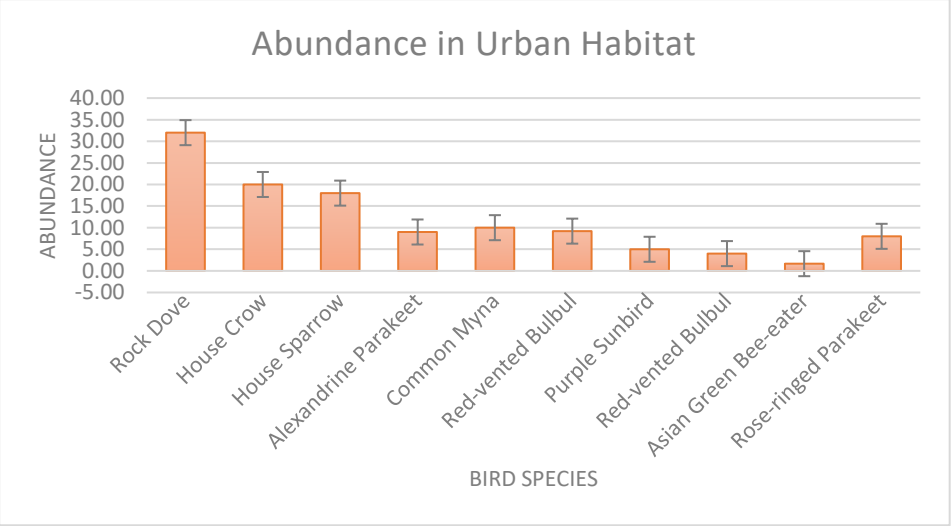


Figure 7: Bird abundance in Urban habitat – Post-Monsoon Season

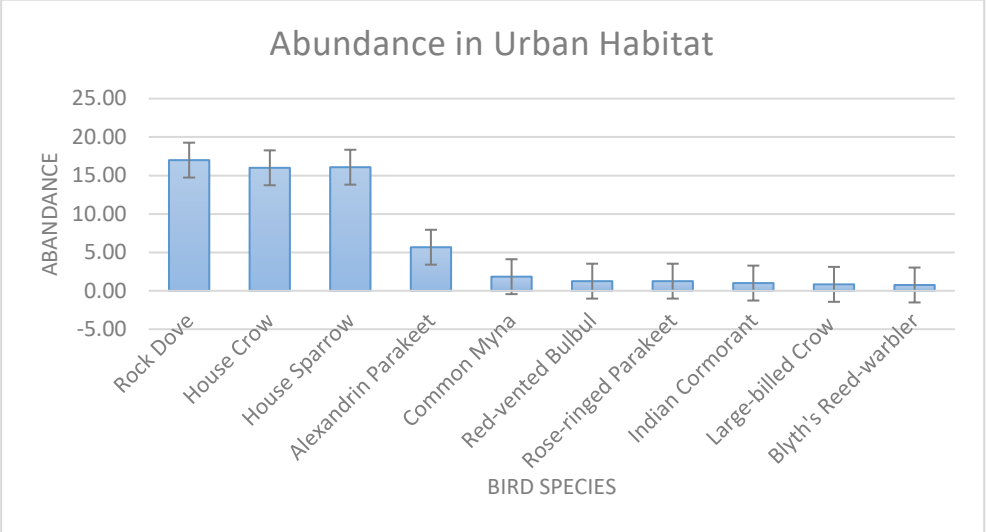


Figure 8: Bird abundance in Urban habitat – Winter Season

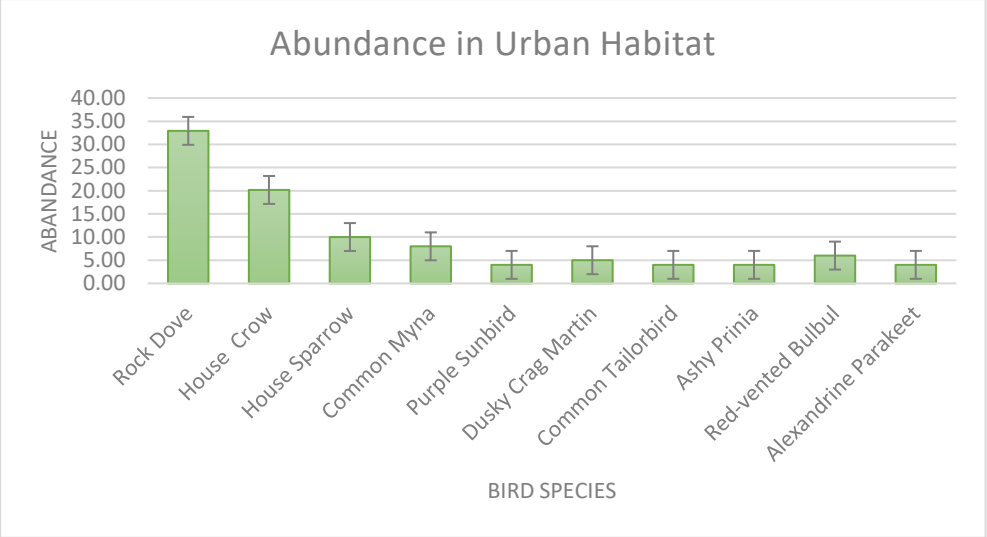


Figure 9: Bird abundance in Urban habitat – Summer Season

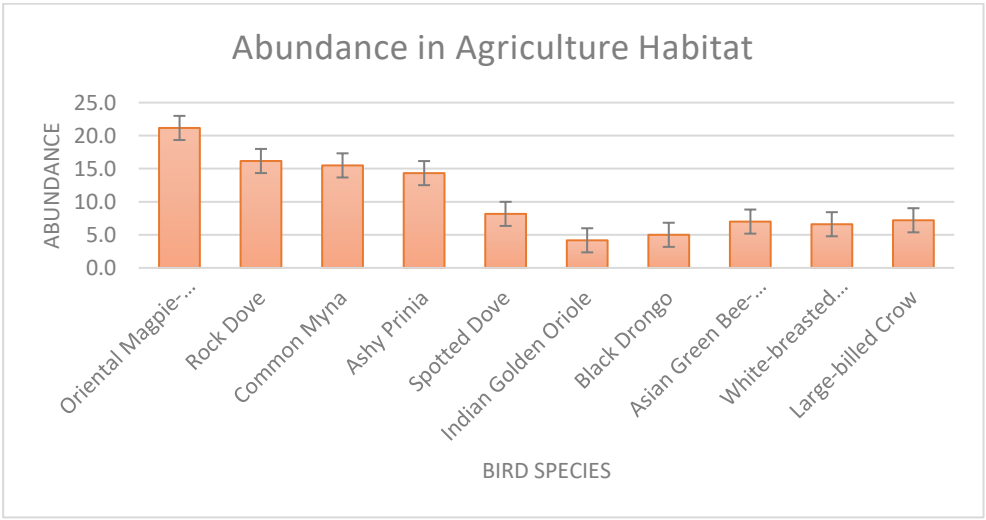


Figure 10: Bird abundance of Agricultural habitat – Post-Monsoon Season

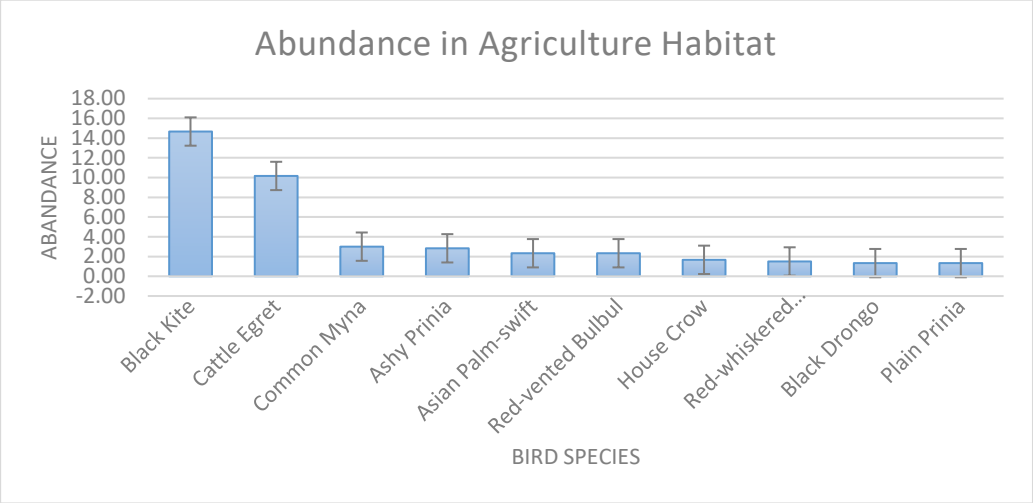


Figure 11: Bird abundance in Agricultural habitat- Winter Season

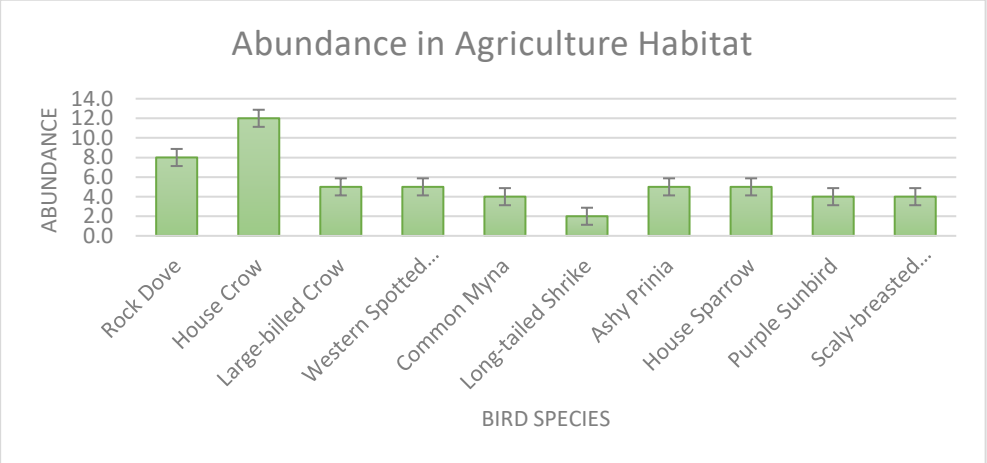


Figure 12: Bird abundance in Agricultural habitat – Summer Season

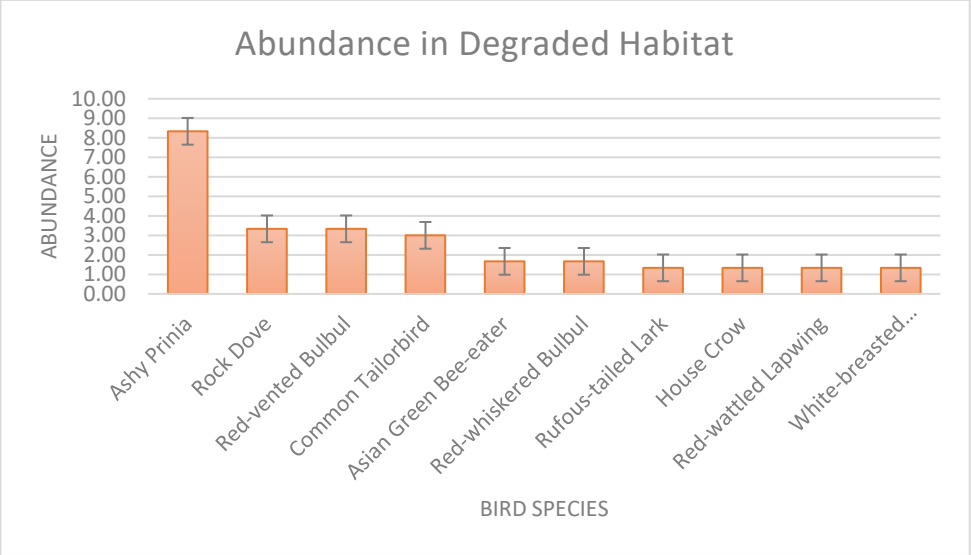


Figure 13: Bird abundance in Degraded habitat – Post-Monsoon Season

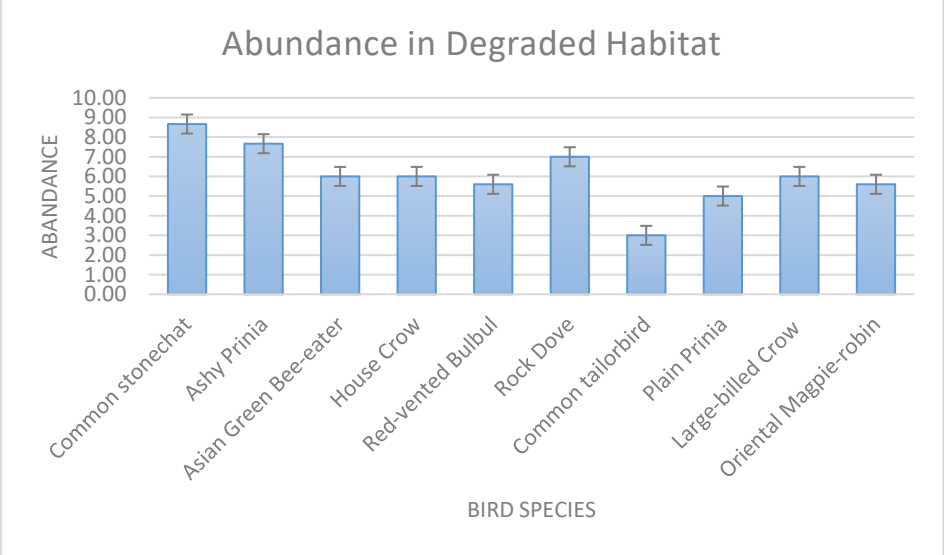


Figure 14: Bird abundance in Degraded habitat – Winter Season

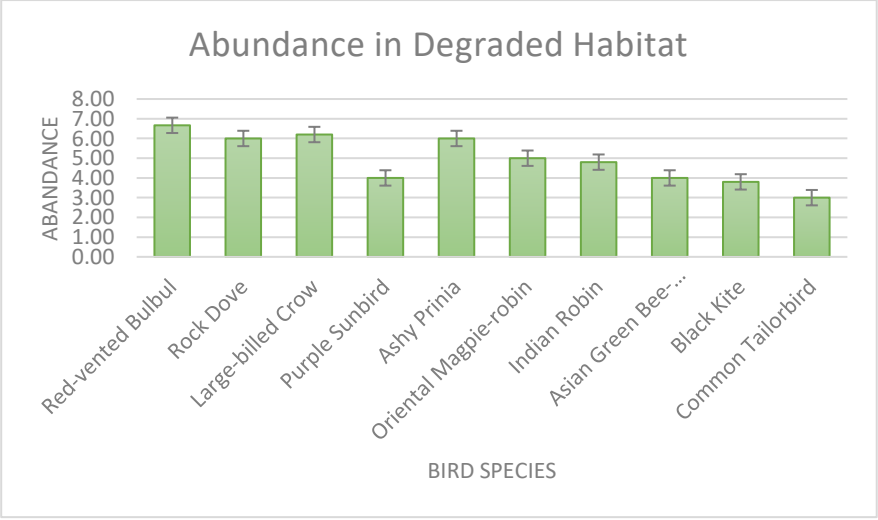


Figure 15: Bird abundance in Degraded habitat – Summer Season

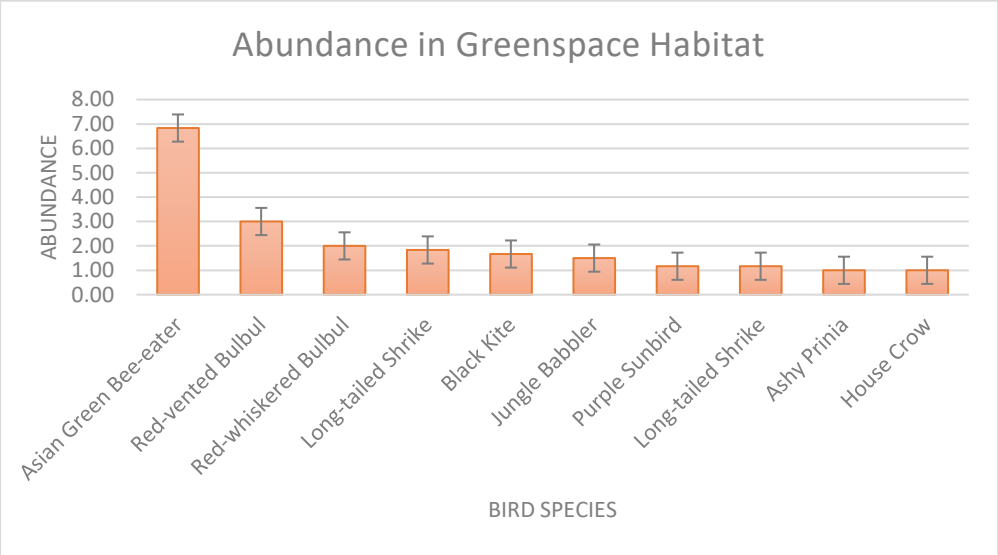


Figure 16: Bird abundance in Greenspaces – Post-Monsoon Season

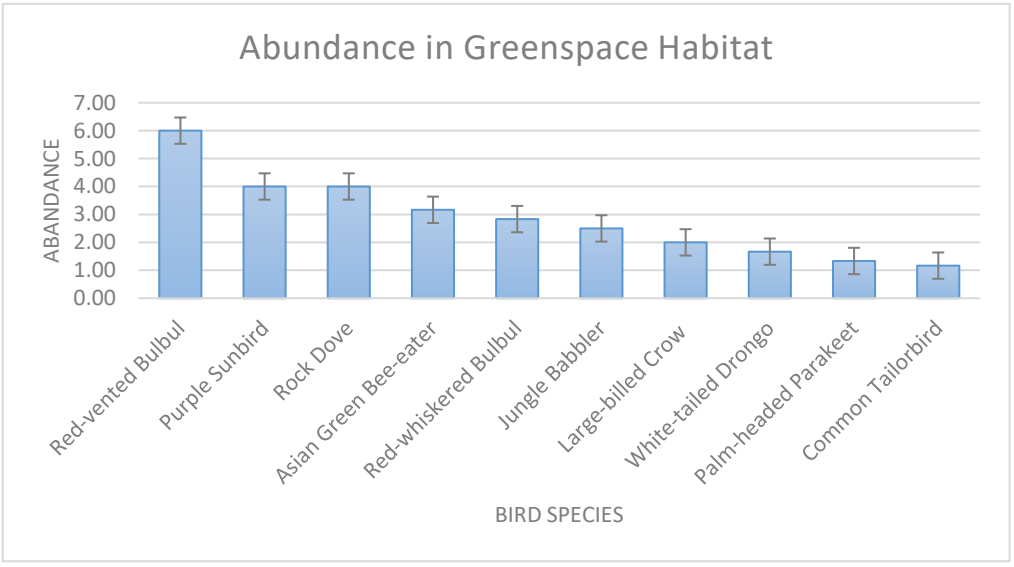


Figure 17: Bird abundance in Greenspaces – Winter Season

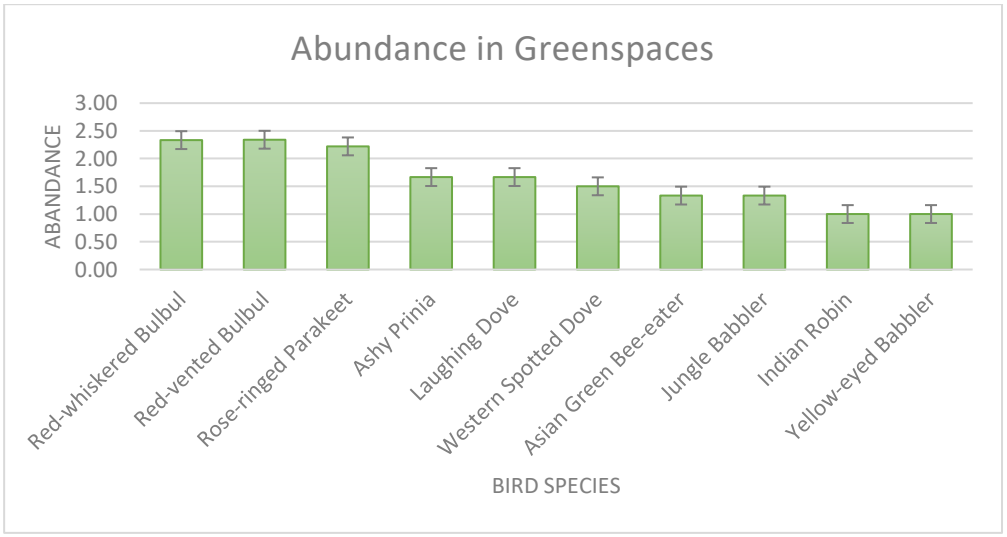


Figure 18: Bird abundance in Greenspaces- Summer Season

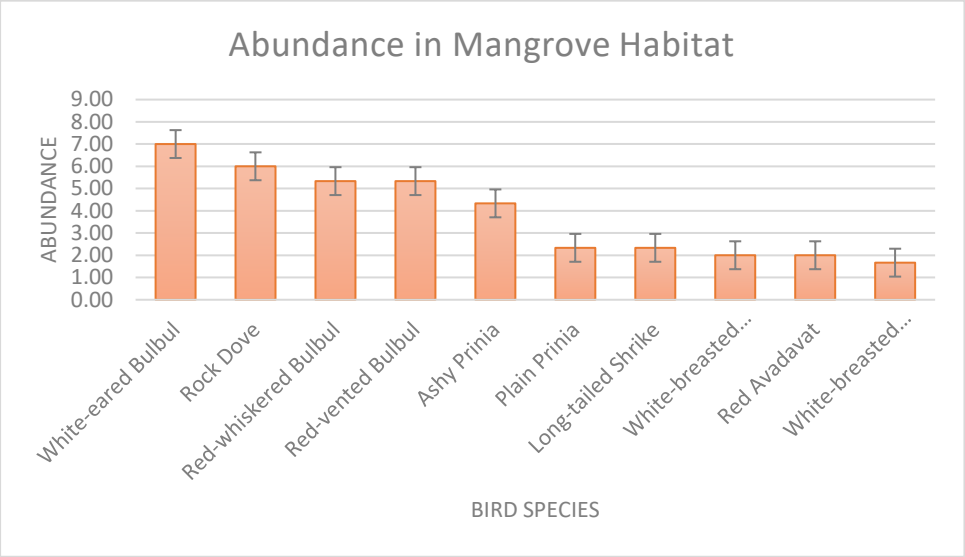


Figure 19: Bird abundance in Mangrove habitat – Post Monsoon Season

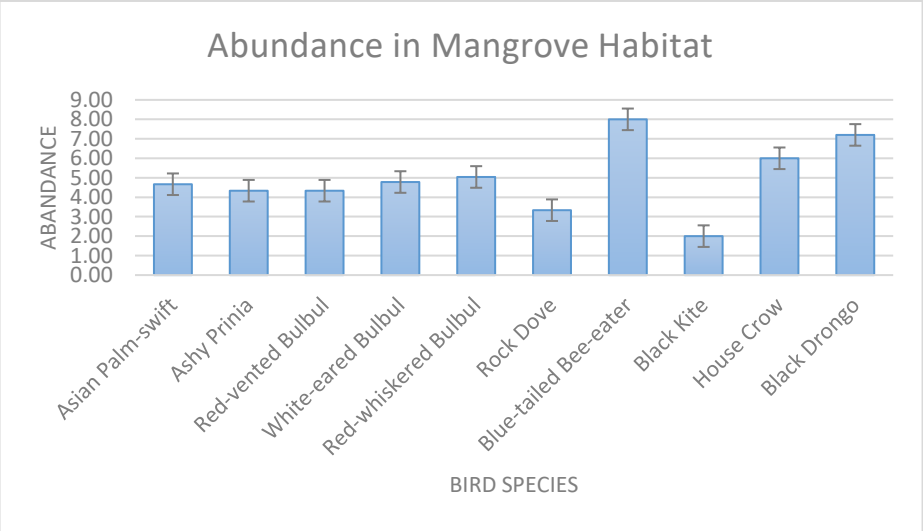


Figure 20: Bird abundance in Mangrove habitat – Winter Season

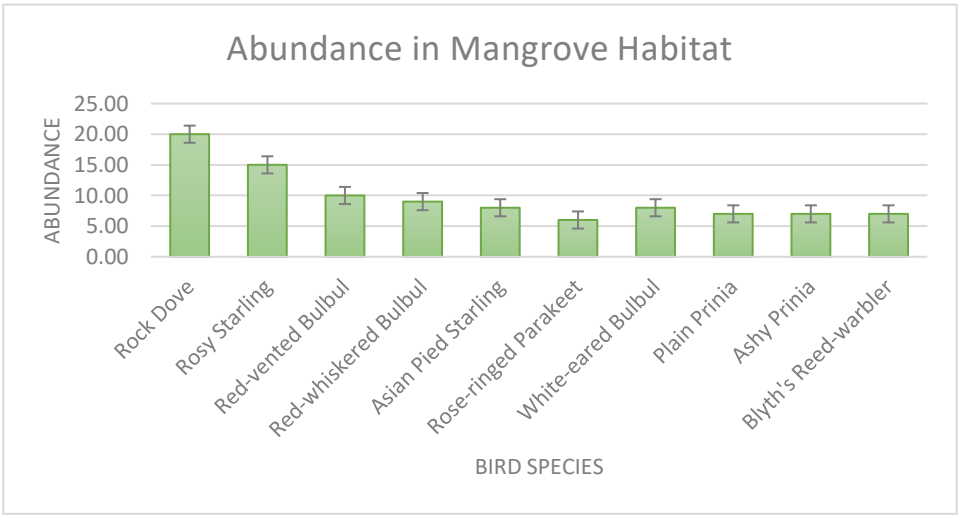


Figure 21: Bird abundance in Mangrove habitat- Summer Season

Chapter 6

Observations at the Navi Mumbai International Airport Site (NMIA)

Due to the ongoing construction activities at NMIA site and large vehicular traffic movement, the inner field of NMIA site has become inaccessible for the field work. We surveyed the border area of the construction site and adadditionally, we have surveyed the adjacent Panvel Creek area and its associated inlets to get aclear picture regarding the waterbirds present there which is just beside the construction site.

Some of the important observations during the ongoing construction activities in the NMIA site –

1) We observed Raptors like Black Kite and Western Marsh Harrier roostingand foraging at the aairport site and the adjacent creek area.

2) Grass birds like Ashy Prinia, Plain Prinia, Rufous-tailed Lark and Common Stonechat were observed in remnant vegetation in the border of the NMIA site.

3) Numerous resident and migratory aquatic birds are still seen foraging and roosting in the adjacent mangrove patches next to the creek despite ongoing work at the airport site.

4) The total number of species decreased from 80 to 60 for the consecutive seasons.

Table 5: List of bird species observed at NMIA site

1	Ashy Prinia (*Prinia socialis*)	42	Indian Pond-Heron (*Ardeola grayii*)
2	Red-vented Bulbul (*Pycnonotus cafer*)	43	Indian Robin (*Saxicoloides fulicatus*)
3	Asian Green Bee-eater (*Merops orientalis*)	44	Indian Spotted Eagle (*Clanga hastata*)
4	Asian Palm-swift (*Cypsiurus balasiensis*)	45	Intermediate Egret (*Ardea intermedia*)
5	Asian Pied Starling (*Gracupica contra*)	46	Large-billed Crow (*Corvus macrorhynchos*)
6	Black Redstart (Phoenicurus ochruros)	47	Purple Sunbird (*Cinnyris asiaticus*)
7	Barn Swallow (*Hirundo rustica*)	48	Lesser Sandplover (*Charadrius mongolus*)
8	Baya Weaver (*Ploceus philippinus*)	49	Little Cormorant (*Microcarbo niger)*
9	Western Marsh-Harrier (Circus aeruginosus)	50	Little Egret (*Egretta garzetta*)
10	Black Drongo (*Dicrurus macrocercus*)	51	Little Stint (*Calidris minuta*)
11	Black Kite (*Milvus migrans*)	52	Long-tailed Shrike (*Lanius schach*)
12	Black-headed Gull (*Larus ridibundus*)	53	Oriental Magpie-robin (*Copsychus saularis*)
13	Black-headed Ibis (*Threskiornis melanocephalus*)	54	Oriental Honey-buzzard *(Pernis ptilorhynchus)*
14	Black-tailed Godwit (*Limosa limosa*)	55	Osprey (Pandion haliaetus)
15	Black-winged Kite (*Elanus caeruleus*)	56	Paddyfield Pipit (*Anthus rufulus*)
16	Black-winged Stilt (*Himantopus himantopus*)	57	Painted Stork (*Mycteria leucocephala*)
17	Blue Rock-thrush (*Monticola solitarius*)	58	Peregrine Falcon (Falco peregrinus)
18	Red-wattled Lapwing (*Vanellus indicus*)	59	White-breasted Kingfisher (*Halcyon smyrnensis*)
19	Blyth's Reed-warbler (*Acrocephalus dumetorum*)	60	Plain Prinia (*Prinia inornata*)
20	Rufous-tailed Lark (*Ammomanes phoenicura*)		
21	Brown-headed Gull (*Larus brunnicephalus*)		
22	Caspian Tern (*Hydroprogne caspia*)		
23	Common Greenshank (*Tringa nebularia*)		
24	Common Gull-billed Tern (*Gelochelidon nilotica*)		
25	Common Myna (*Acridotheres tristis*)		
26	Common Redshank (Tringa totanus)		
27	Common Sandpiper (*Actitis hypoleucos*)		
28	Common Stonechat (*Saxicola torquatus*)		
29	Common Tailorbird (*Orthotomus sutorius*)		
30	Desert Wheatear (*Oenanthe deserti*)		
31	Dusky Crag Martin (*Ptyonoprogne concolor*)		
32	Greater Coucal (*Centropus sinensis*)		
33	Greater Spotted Eagle (*Clanga clanga)*		
34	Grey Heron (*Ardea cinerea*)		
35	House Crow (*Corvus splendens*)		
36	House Sparrow (*Passer domesticus*)		
37	India Spot-billed Duck (*Anas poecilorhyncha*)		
38	Indian Cormorant (*Phalacrocorax fuscicollis*)		
39	Indian Golden Oriole (*Oriolus kundoo*)		
40	Rock Dove (*Columba livia*)		
41	Rose-ringed Parakeet (*Psittacula krameri*)		

Abundance of bird species in the NMIA Airport site peripheral region

We have presented the top ten (10) most represented species in the airport site for all the consecutive seasons: Post-Monsoon, Winter & Summer. The highest abundance of Common Stonechat followed by Black Kite is observed in the Post-Monsoon season, highest abundance of Little Stint followed by Common Sandpiper in the Winter Season, & highest abundance of House Crow followed by Common Stonechat in the Summer Season.

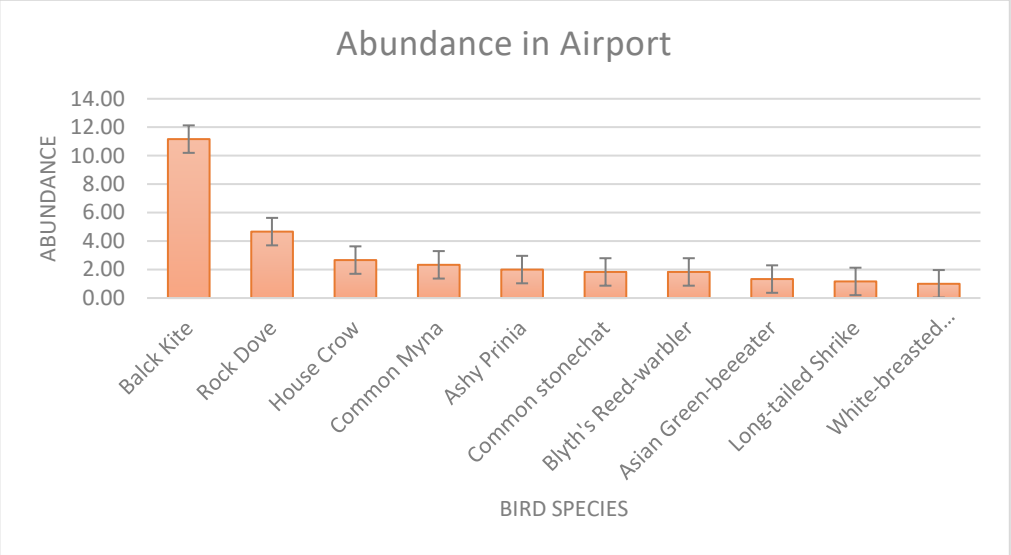


Figure 22: Bird abundance in Airport Site -Post -Monsoon Season

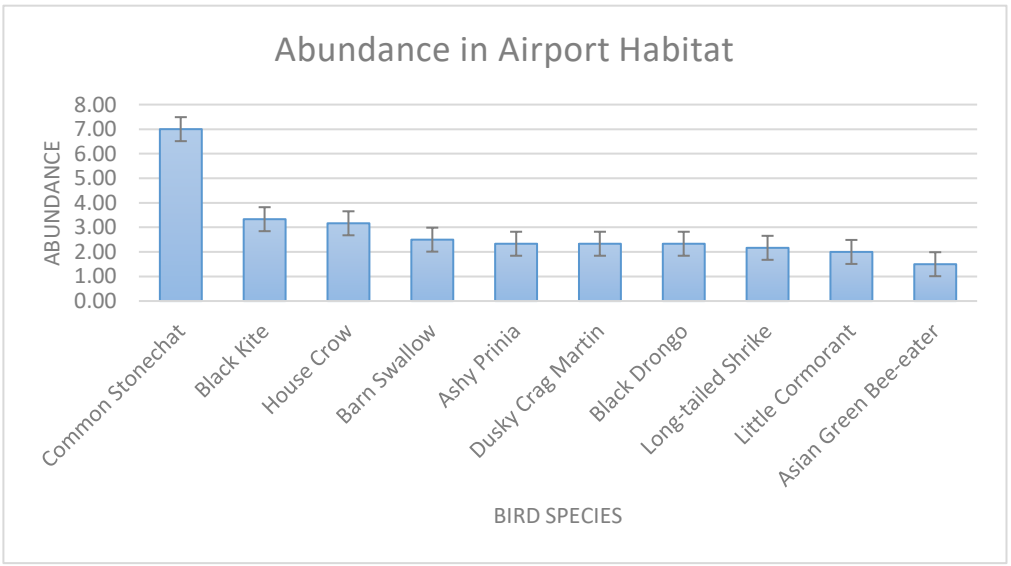


Figure 23: Bird abundance in Airport Site – Winter Season

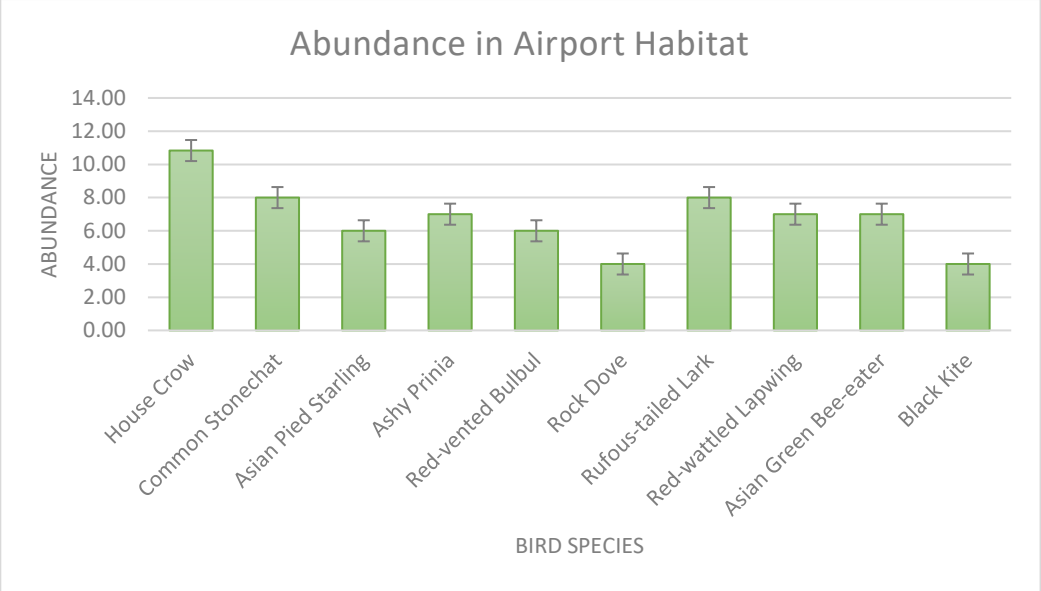


Figure 24: Bird abundance in Airport Site – Summer Season

Chapter 7

Wetland Bird Survey

Navi Mumbai wetlands had been covered with large expanses of salt pans and paddy fields till the 1970s. Eventually, the development of this region into a new metropolitan area occurred as the population of old Mumbai was reaching beyond its carrying capacity (Chatterjee and Chatterjee 2016). Thus, increasing land prices, changing hydrology and economy due to construction activities, government policies, and changing lifestyles could have made people abandon farming and fishing (Oliver-Smith 2009).

Presently, these wetlands are facing serious threats from developmental activities, especially landfilling for residential, recreational, and commercial uses. Though these wetlands occupy a small fraction of the area, they sustain a myriad of local and seasonal bird migrants. Breeding habitats are important to identify among these wetlands because they help in the successful recruitment, colonization, and long-term maintenance of bird populations. Drying the wetlands containing breeding colonies can severely reduce populations, affecting community structure, and driving extinctions in local populations (Bino et al. 2015). Habitat destruction is also considered one of the key reasons for such a decline in bird population as they have specific habitat requirements from season to season (Adhikari 2019). Hence, it is vital to assess the potential of these wetlands and the threats to them in order to understand the ecological aspects and implement suitable conservation and management actions for the long- term preservation of these habitats.

Tide- independent inland wetlands

Lotus Lake

Just behind the majestic corporation building of Navi Mumbai, Sector 27 Nerul, where a natural lake filled with lotuses (19.01763 N, 73.02587 E; 18.98513 N, 73.01924 E) of various varieties is in neglected condition. Situated in the middle of the urban colony of Nerul, this wetland with floating vegetation and weeds, houses various local migrants and other water birds, even in the presence of several anthropogenic interferences. During our regular survey to this lake, we have observed that it is a nesting ground for Little Grebe and Bronze-winged Jacana, foraging ground of Purple Swamphen, Common Moorhen, Pheasant-tailed Jacana with many other common water bird species. Necessary conservation actions should be taken to prevent the degradation of this habitat. Number of total resident and migratory water bird species present is Twenty-seven (27).

Ballaleshwar Lake or Vadale Lake

Ballaleshwar Lake (18.9940°N,73.1117°E) the oldest lake in Panvel, is located in HOC (Hindustan Organic Chemical) Colony, next to Ballaleshwar Temple, just beside the New Panvel Flyover along the Sion- Panvel Highway, Mumbai. The area of the lake is 6 acres. Historically, Ballaleshwar Lake was built by Peshwa Chimaji Appa, brother of the eminent Maharashtrian ruler, Peshwa Bajirao. Beautification of this lake was planned and executed quite recently as previously it had been gradually covered with weeds slimes, sludges, and garbage. The lake harbours a wide variety of aquatic floral and faunal diversity. The lake supports total around 42 resident and migratory water bird species.

Morbe Dam

Morbe Dam is a gravity dam on the Dhavari river near Khalapur, Raigad district in the state of Maharashtra, India (18.9261397 N,73.246285 E). The dam was constructed to supply drinking water to the Navi Mumbai and Nhava Sheva regions. Located nearly half an hour from Matheran, this dam is surrounded by the hills of northern Western Ghats. The vegetation of the area around the dam mostly includes deciduous trees of the montane rainforests and open scrublands. The habitat supports a variety of terrestrial and aquatic bird species. Due to its scenic location, there is an increased construction of hotels in the area, the natural vegetation is being cleared which can lead to a reduction of bird species in the area. A total of Twenty-eight (28) bird species were observed in Morbe Dam.

Gadeshwar Dam

Surrounded by lush green paddy fields and hilly terrains, Gadeshwar dam is treat to the visitors' eyes. The dam is perfectly nestled amidst of Chanderi, Mhaismal, Peb and Matheran Hills near Panvel (19.0327797 N, 73.2425364 E). The region around the dam mostly comprises of deciduous forests and hilly terrain. Due to its location and alluring surroundings the place attracts a lot of tourists, who come for a getaway or to enjoy activities like trekking. This is the reason why there is an increase in constructions for hotels and stays around the dam. The conversion of the natural habitat to human use lands might have a detrimental effect on the bird species which reside in the dam. A total of 44 species of resident and migratory birds were observed in Gadeshwar Dam.

Owe Dam

Owe dam, Kharghar (19.076014 N, 73.056780 E) is a serene place to experience nature with some bird activity around. However, while surveying we could not spot substantial number of bird species but sighting of some seasonal and local migratory water bird species made some important observations to be considered. We were mesmerized by the beauty of green hills all around; the calm and quiet waterbody in centre. The journey started with wide clean roads and ended with off roading on muddy ground and ultimately with a village, Owe camp. Muddy roads surrounded by rice fields accompanied us till the destination which is completely free from the hustle and bustle of the city. On our way back, it was disappointing to see that the stone quarrying activities have increased to a significant level. In the middle of such enriched biodiversity, it was alarming. Number of water bird species present is Twenty-one (21).

Tide dependent low-tide roosting sites

Ulwe Wetland

Adjacent to Nava-Sheva Creek area and associated mangroves, there are mainly two connecting wetlands which are connected through roads by Ulwe Township. We named these wetlands as 'Ulwe Wetland' (18.986034,73.020357;18.987431,73.021178). During our morning and afternoon survey, we came across many anthropogenic activities like chaos of the local people while doing morning walk and fishing activities. While doing our reconnaissance and intensive survey during January and February, we observed very less bird species except few common and migratory water birds. Although we observed many mangrove-associated bird species including some migratory species in the Ulwe mangrove area and associated creek area. More seasonal surveys, during post-monsoon and summer month, are needed to get an entire scenario of bird species present in this area. Total number of resident and migratory water bird species present is Fifty-seven (57).

Wetlands of Kharghar

The present study was conducted to identify the potential wetlands present in the Kharghar in which a long stretch of water body was identified which was segregated in two sectors namely, sector 17 and sector 25. The stretch was monitored to identify the aquatic bird species using these sites as their feeding and roosting grounds. Number of resident and migratory water bird species present in these wetlands are Sixty-six (66).

Methodology

Wetland Count:

We carried out systematic monthly surveys in six waterbodies based on the above-mentioned criteria where we selected creek-associated tide dependent wetlands in Ulwe and Kharghar, a natural lake in Nerul, Owe dam in Kharghar, Morbe and Gadeshwar Dam in Raigad district. Bird species were counted at each site, preferably from a vantage point if available, with binoculars or spotting scope (Bibby et al. 2000). The bird species were recorded based on sighting or call. Birds were identified following Birdlife International 2019.

- **Type of Count**: Total count of individual species observed one hour before and one hour after high tide in case of wetland birds. For dam & lake, total count of bird species had been taken twice for 30 minutes with a break for 30 minutes in between to avoid overcounting.
- **Condition**: In case of wetlands, we carried out survey during high tide when birds came out of the creek due to inundation of mudflats, in search of roosting sites.
- **Frequency of the survey**: Monthly Twice

Creek Survey

The Panvel Creek is a 7-km-long creek that passes through Taloja, Panvel and Ulwe, before entering the sea at Belapur. Since the Panvel Creek surrounds a major portion of the Navi Mumbai International Airport and acts as feeding ground for a number of water birds, it was extremely important to carry out monitoring of birds in this area. During the survey large flocks of Northern Shoveler, Indian Cormorant, Whiskered Tern, Black-winged Stilt and mixed flocks of many other water birds were identified in the area, which accounted to 60 species of resident and migratory water birds.

Creek Survey Methodology on Water birds

The bird species were recorded based on sighting or call. Birds were identified following BirdLife International 2019.

- **Type of Count**: The survey was conducted on the 3 km accessible stretch in peripheral pathway just beside the creek. Total count of individual species observed in the entire accessible range of 3 km by dividing it into two transects of 1 km each with a gap of 1km in between, in order to avoid over-counting. We followed the Bell Transect method where we considered vantage point count stations (total number of 3-point count stations) on the transect to count the bird species abundance and diversity from those particular points.

- **Condition**: Transect surveys were carried out during low tide when birds return to the creek due to the exposure of mudflats, in search of roosting sites. As the Panvel Creek was found to be narrow, one team of researchers simultaneously observed both the banks and recorded all the species of birds and their population using Binoculars and Spotting Scope.

- **Frequency of the survey**: Monthly twice.

Preliminary Observations

1. **Based on our year-long monthly wetland bird count in all the wetlands namely Lotus Lake, Ballaleshwar Lake, Kharghar Wetland, Ulwe Wetland, Owe Dam, Morbe Dam, Gadeshwar Dam and Panvel-Belapur Creek, we have collated the presence-absence data of all the waterbirds present in all these mentioned waterbodies and represented those in a tabular format to provide a comprehensive idea regarding the diversity of species here.**
2. **Based on the data obtained by BNHS on migratory birds it is observed that these birds fly at a high altitude when they are flying over long distances during their migration journey, and after reaching their preferred destination they descend / land into wetlands & mud flat areas. In the case of Mumbai & Navi Mumbai, they land in mudflats and the wetlands along Thane Creek.**
3. **These migratory birds prefer to stay at a preferred locations in wetlands as long as the site is sustainable for the arriving bird population, post which the birds relocate to the nearby roosting sites during high tide.**
4. **It is seen that migratory birds, being large in size, they tend to fly closer to the water surface while flying over short distances, to move from a primary site to a nearby roosting site. This phenomenon is observed from the data gathered by BNHS from the trackers around NMIA site, in Thane Creek area. The local movement of birds is observed to be commonly restricted to an altitude of less than 50 m above sea level.**
5. **The flight pattern of birds in Thane Creek, potentially including their path intersecting with the approach path of NMIA runways 08L & 08R (for westerly takeoffs/landings), has been subject to study by BNHS. According to the data visualization, it appears that aircraft taking off or landing on NMIA runways typically maintain an altitude above the observed flight elevation of birds in Thane Creek. This is also the case for Runway 09-27 of existing Mumbai airport, as its eastern approach passes near Thane Creek Flamingo Sanctuary.**
6. **The identified flight paths and patterns of flamingos in Thane Creek are presented in Appendix-2**
7. **BNHS studies in this regard shall continue further, as more data is collected on flight path of birds in Thane Creek area.**

Table 6: Presence- absence of water birds in all the wetlands of study site

Birds	Scientific Name	LOTUS LAKE	ULWE WETLAND	BALLALESHWAR LAKE	MORBE DAM	GADESHWAR DAM	OWE DAM	BELAPUR CREEK	KHARGHAR WETLAND
Asian Openbill	*Anastomus oscitans*	√	√	√	√	√	√	√	√
Black-crowned Night-heron	*Nycticorax nycticorax*	√	√	√				√	√
Black-headed Gull	*Chroicococephalus ridibundus*		√	√	√	√	√	√	√
Black-headed Ibis	*Threskiornismelano cephalus*		√	√	√	√	√	√	√
Black-tailed Godwit	*Limosa limosa*		√					√	√
Black-winged Stilt	*Himantopus himantopus*		√	√	√	√		√	√
Broad-billed Sandpiper	*Limicola falcinellus*		√					√	√
Bronze-winged Jacana	*Metopidius indicus*	√	√	√		√			√
Brown-headed Gull	*Chroicocephalus brunnicephalus*		√	√	√	√	√	√	√
Caspian Tern	*Hydroprogne caspia*	√	√	√		√	√	√	√
Cattle Egret	*Bubulcus ibis*	√	√	√	√	√	√	√	√
Common Coot	*Fulica atra*		√	√		√			√
Common Greenshank	*Tringa nebularia*		√	√		√		√	√
Common Gull-billed Tern	*Gelochelidon nilotica*		√	√	√	√		√	√
Common Kingfisher	*Alcedo atthis*	√	√	√	√	√	√	√	√
Common Moorhen	*Gallinula chloropus*	√	√	√	√	√			√
Common Redshank	*Tringa totanus*		√	√	√	√		√	√
Common Sandpiper	*Actitis hypoleucos*	√	√	√	√	√		√	√
Common Shelduck	*Tadorna tadorna*							√	√
Common Snipe	*Gallinago gallinago*		√	√		√		√	√
Cotton Pygmy-goose	*Nettapus coromandelianus*	√		√		√		√	√
Eurasian Curlew	*Numenius arquata*		√					√	√

Birds	Scientific Name	LOTUS LAKE	ULWE WETLAND	BALLALESHWAR LAKE	MORBE DAM	GADESHWAR DAM	OWE DAM	BELAPUR CREEK	KHARGHAR WETLAND
Eurasian Spoonbill	*Platalealeu corodia*		√	√		√		√	√
Garganey	*Anas querquedula*							√	√
Glossy Ibis	*Plegadis falcinellus*	√	√	√	√	√	√	√	√
Great White Egret	*Ardea alba*		√	√	√	√	√	√	√
Greater Sandplover	*Charadrius leschenaultii*		√					√	√
Green-backed Heron	*Butorides striata*		√	√				√	√
Grey Heron	*Ardeacinerea*		√	√	√	√		√	√
Grey Plover	*Pluvialis squatarola*		√					√	√
Grey Wagtail	*Motacilla cinerea*	√	√	√	√	√	√	√	√
Great Cormorant	*Phalacrocorax carbo*		√					√	√
Great crested grebe	*Podiceps cristatus*							√	√
Grey-headed Swamphen	*Porphyrio porphyrio*	√	√	√	√	√			√
Heuglin's Gull	*Larus heuglini*							√	√
Indian Cormorant	*Phalacrocorax fuscicollis*	√	√	√	√	√	√	√	√
Indian Pond-Heron	*Ardeola grayii*	√	√	√	√	√	√	√	√
Indian Spot-billed Duck	*Anas poecilorhyncha*	√	√	√	√	√		√	√
Intermediate Egret	*Mesophoyx intermedia*	√	√	√	√	√	√	√	√
Lesser Flamingo	*Phoeniconaias minor*		√					√	
Lesser Sandplover	*Charadrius mongolus*		√					√	√
Lesser Whistling-duck	*Dendrocygna javanica*	√	√	√	√	√		√	√
Little Cormorant	*Phalacrocorax niger*	√	√	√	√	√	√	√	√
Little Egret	*Egrettagarzetta*	√	√	√	√	√	√	√	√
Little Grebe	*Tachybaptusruficollis*	√	√	√	√	√	√	√	√
Little stint	*Calidris minuta*		√					√	√
Little-ringed Plover	*Charadrius dubius*		√			√		√	√
Mallard	*Anas platyrhynchos*							√	√

Birds	Scientific Name	LOTUS LAKE	ULWE WETLAND	BALLALESHWAR LAKE	MORBE DAM	GADESHWAR DAM	OWE DAM	BELAPUR CREEK	KHARGHAR WETLAND
Marsh Sandpiper	*Tringa stagnatilis*		√					√	√
Northern Pintail	*Anas acuta*							√	√
Northern Shoveler	*Spatula clypeata*							√	√
Oriental Pratincole	*Glareola maldivarum*					√			
Pacific Golden Plover	*Plover Pluvialis fulva*		√					√	√
Painted Stork	*Mycteria leucocephala*		√	√		√		√	√
Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	√	√	√		√			√
Pied Kingfisher	*Ceryle rudis*	√	√	√		√	√	√	√
Purple Heron	*Ardeapurpurea*	√	√	√		√		√	√
Red-naped Ibis	*Pseudibis papillosa*		√			√	√	√	√
Red-wattled Lapwing	*Vanellus indicus*	√	√	√	√	√	√	√	√
River Tern	*Sterna aurantia*							√	√
Ruddy Shelduck	*Tadorna ferruginea*								√
Ruff	*Philomachus pugnax*		√						√
Western Reef Egret	*Egrettagularis*		√					√	√
Whiskered Tern	*Chlidonia shybrida*		√	√		√		√	√
White-breasted Kingfisher	*Halcyon smyrnensis*	√	√	√	√	√	√	√	√
White-breasted Waterhen	*Amaurornis phoenicurus*	√	√	√	√	√		√	√
Wood Sandpiper	*Tringa glareola*		√					√	√
Yellow wagtail	*Motacilla flava*	√	√	√	√	√	√	√	√
Yellow-wattled Lapwing	*Vanellus malabaricus*					√			

Aquatic bird species abundance

While preforming our systematic surveys, we have calculated the abundance of species in all the wetlands including the creek area. Here, the ten (10) 'most represented' waterbirds are shown for all the wetlands and creek based on their year-long overall maximum abundance in all those particular sites. In the Lotus Lake, the highest abundance was seen in Lesser Whistling-duck (220), followed by Bronze-winged Jacana (200). In the Ulwe Wetland, we observed the highest abundance of Common Redshank (509) followed by Lesser Sandplover (500). In the Gadeshwar Dam, the highest abundance of Lesser Whistling-duck (90) followed by Indian Spot-billed Duck (82). In the Owe Dam, we recorded the highest abundance of Little Cormorant (60)followed by Little Egret (57). Moreover, we recorded the highest abundance of Little Cormorant (70) followed by Red-wattled Lapwing (65) in the Morbe Dam. In the Ballaleshwar Lake, we observed the highest abundance of Lesser Whistling-duck (345) followed by Common Coot (178).In the Kharghar Wetland, we recorded highest abundance of Little Stint (3200) followed by Black-tailed Godwit (2378). Additionally, in the Panvel-Belapur Creek survey, we recorded the highest abundance of Northern Shovelar (900) followed by Little Cormorant (560). Here, we provided the graphical presentation of ten 'most represented' species in all the wetlands along with the Belapur-Panvel creek:

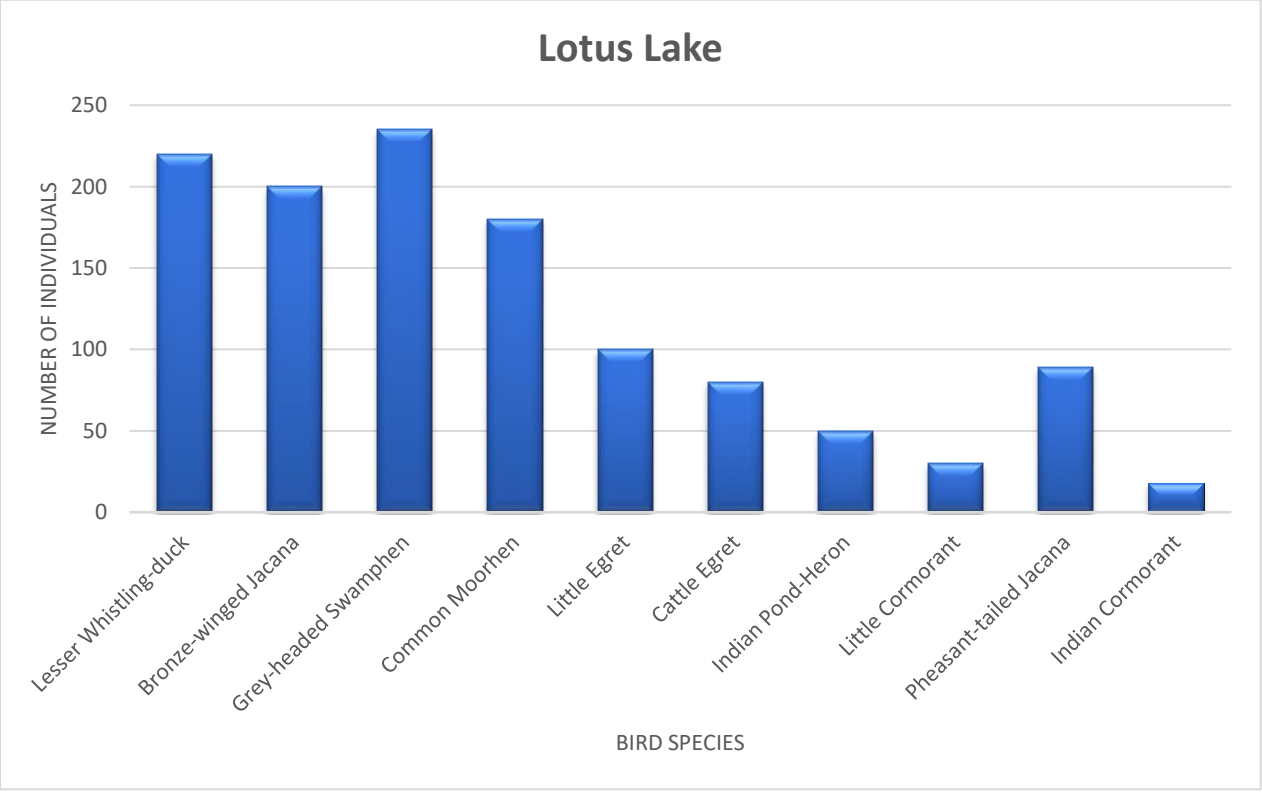


Figure 25: Most represented aquatic bird species abundance of Lotus Lake

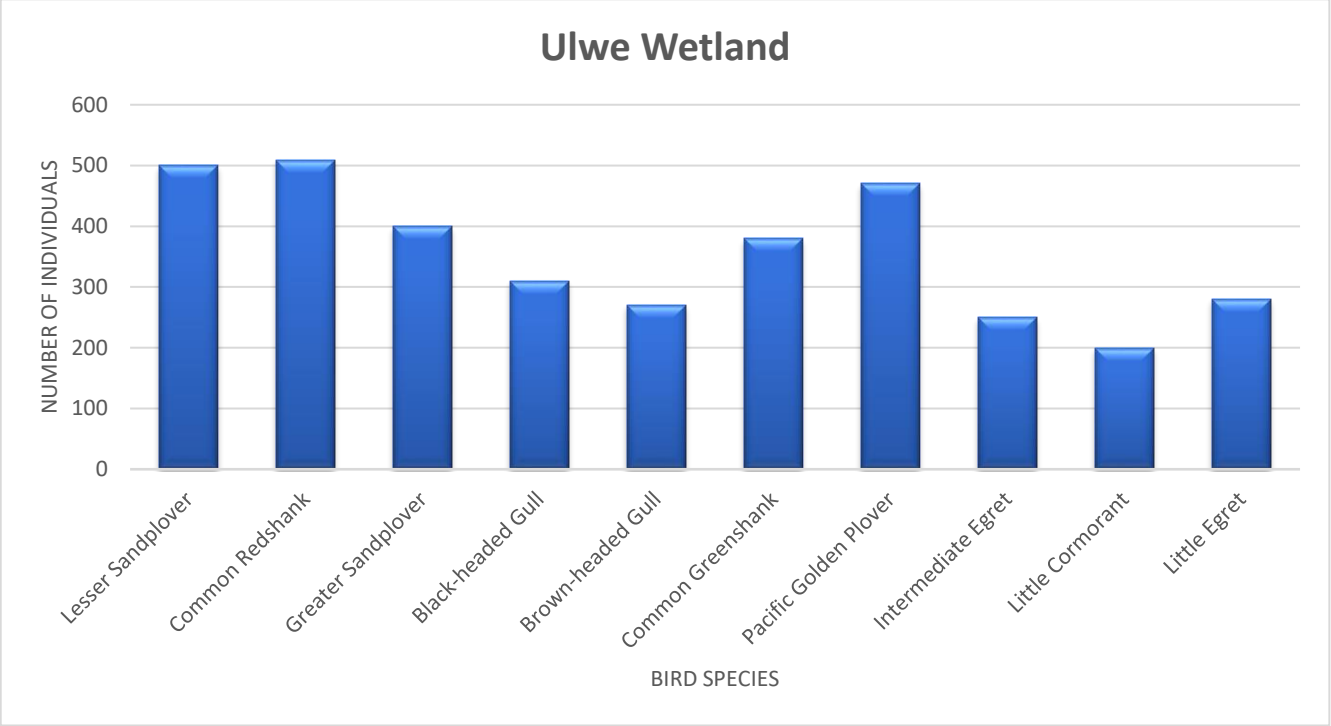


Figure 26: Most represented aquatic bird species abundance of Ulwe Wetland

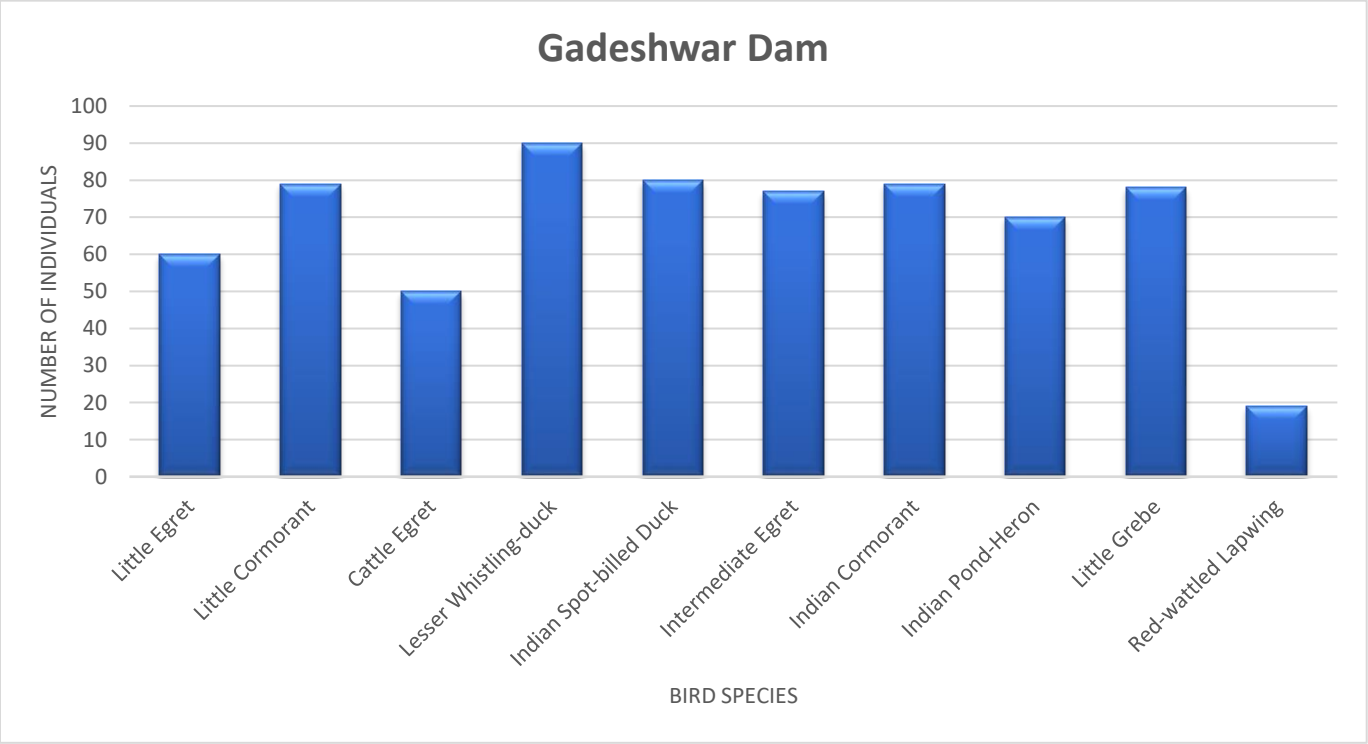


Figure 27: Most represented aquatic bird species abundance in Gadeshwar Dam

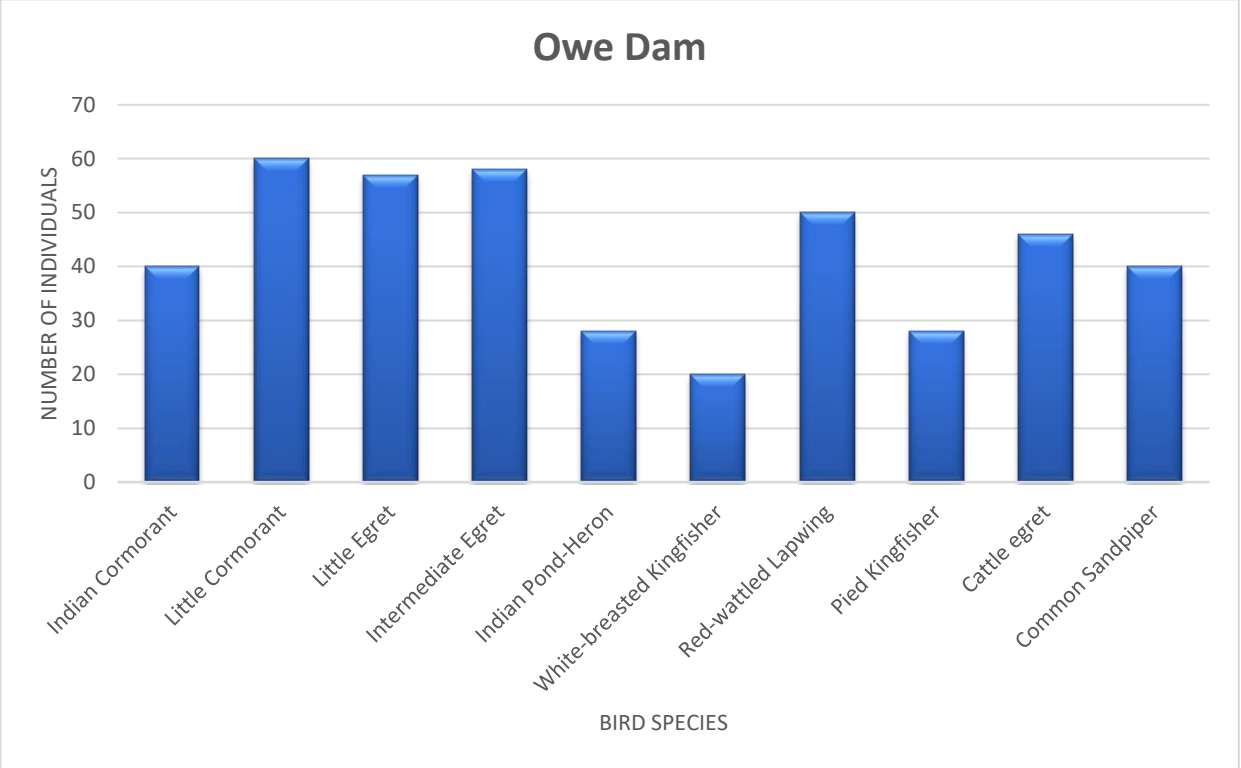


Figure 28: Most represented aquatic bird species abundance in Owe Dam

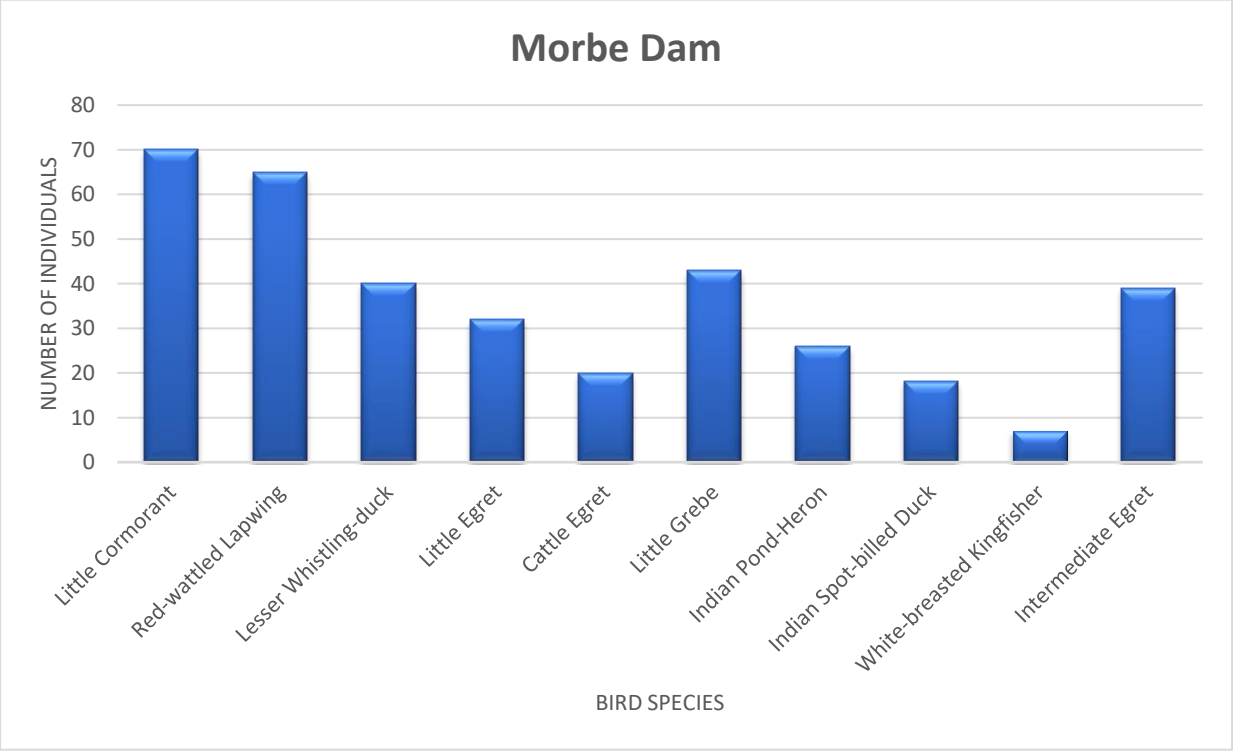


Figure 29: Most represented aquatic bird species abundance in Morbe Dam

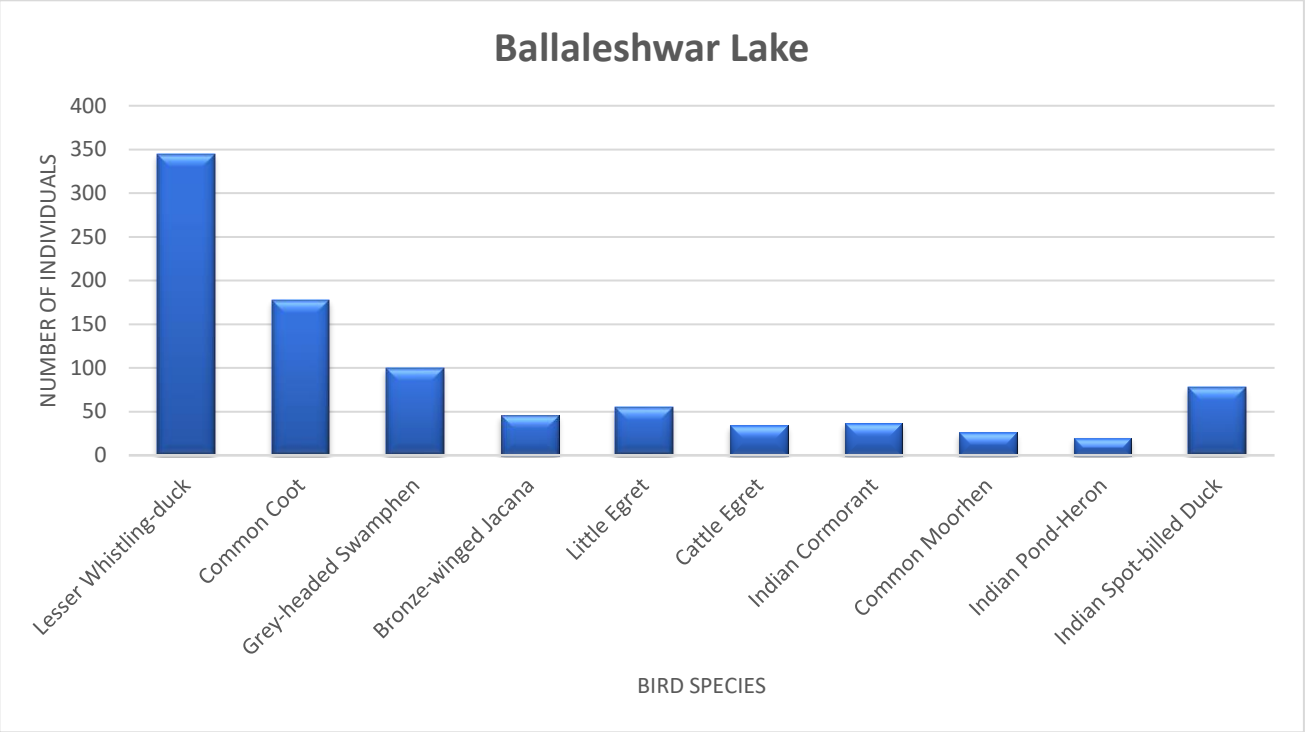


Figure 30: Most represented aquatic bird species abundance in Ballaleshwar Lake

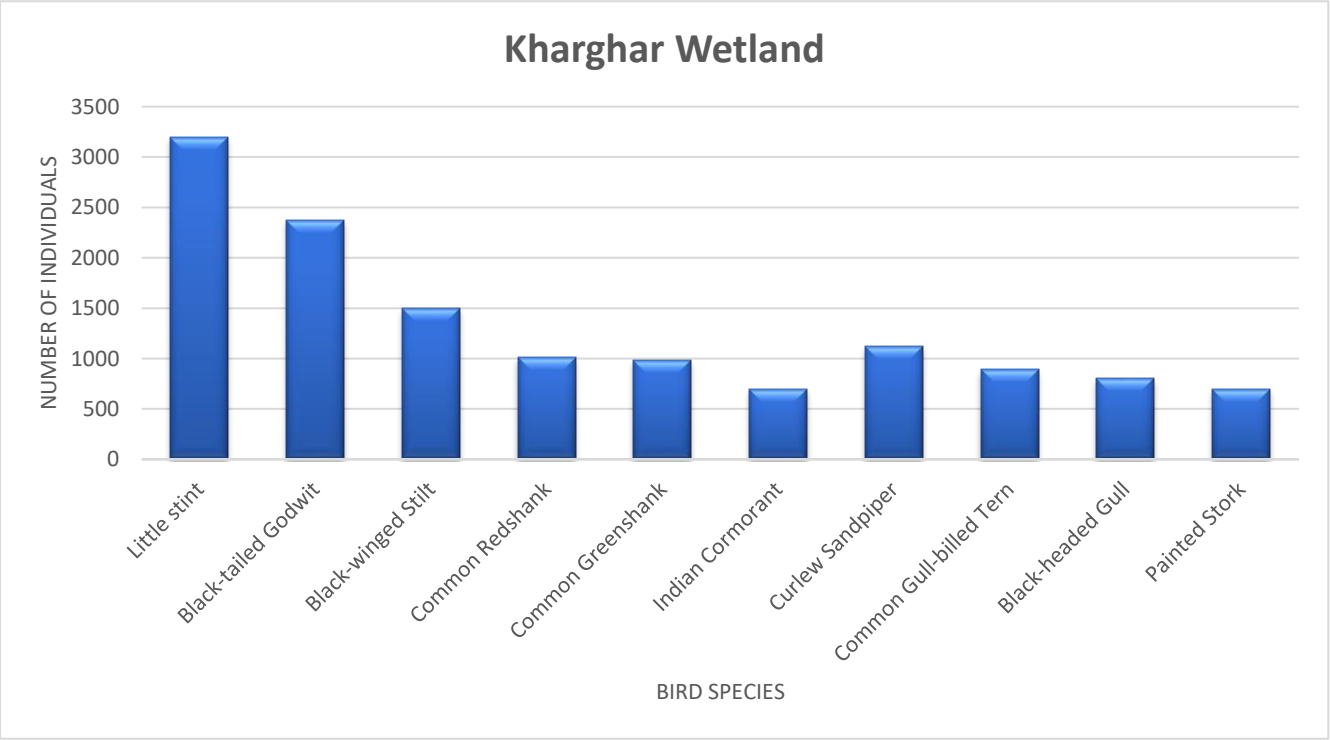


Figure 31: Most represented aquatic bird species abundance in Kharghar Wetland

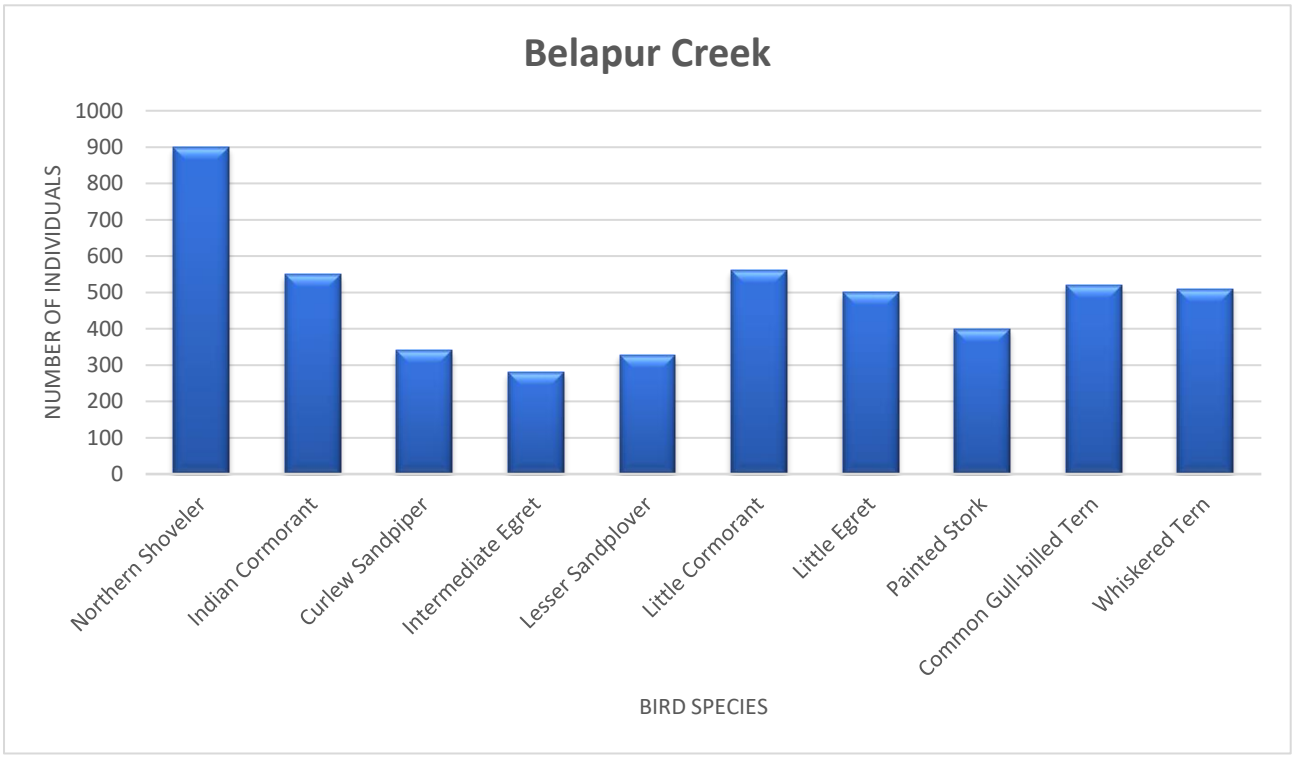


Figure 32: Most represented aquatic bird species abundance in Belpur-Panvel Creek

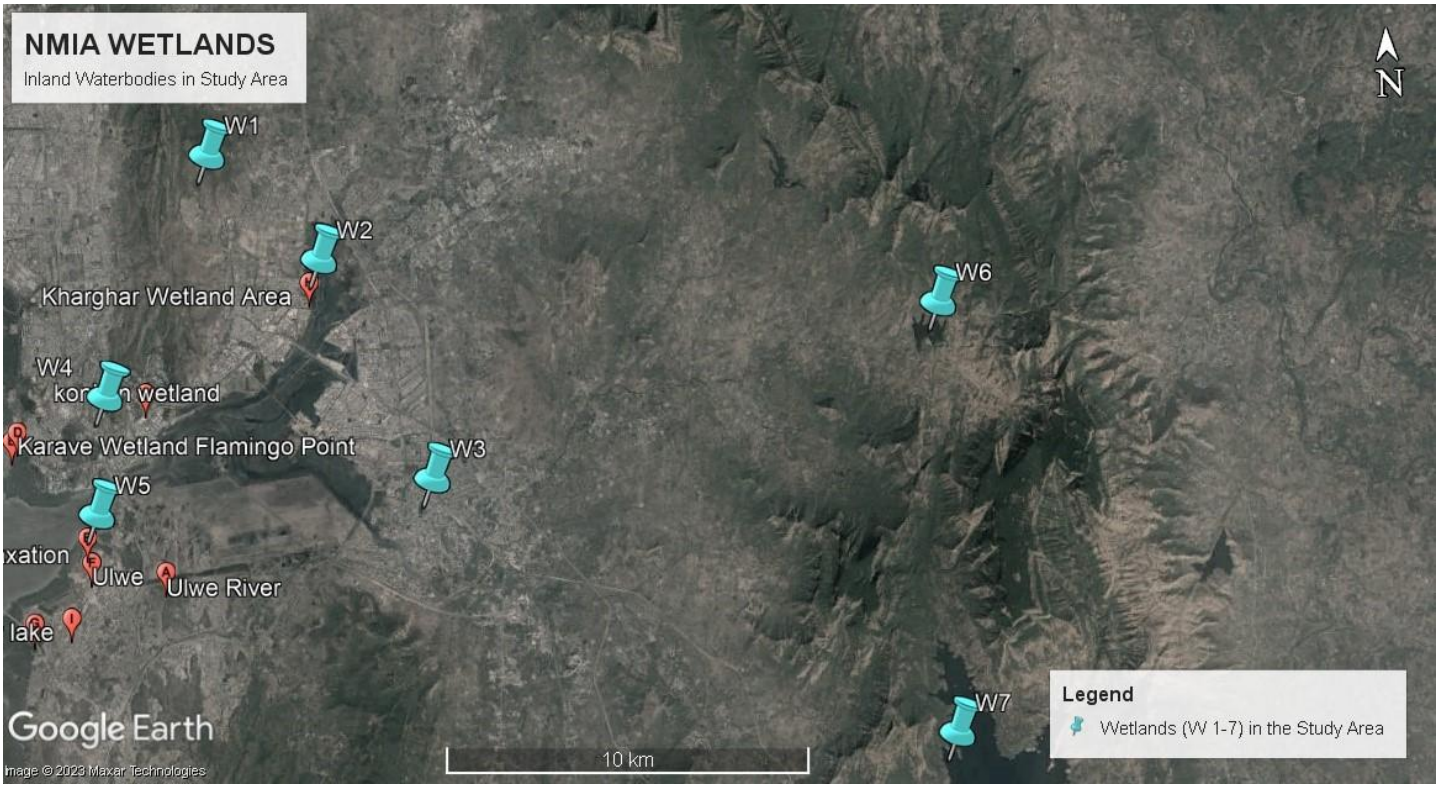


Figure 33: Wetlands in the study area

Chapter 8

Garbage Dumps and Meat Shops in the study area

Presence of the garbage dumps in the close proximity of airports can result into Bird-Aircraft Strike Hazards (BASH). Ecologically it can create problematic situations of superabundant species, which can cause severe threats to the local fauna in the area.

The plenty of meat and fish shops throughout the city can create vast food availability for opportunistic predators and facultative scavengers (Kumar et al. 2014). In the previous reports (refer 3rd and 4th annual reports), we had provided all the necessary details of meat shops in and around NMIA site within the 10 km boundary by the systematic grid sampling across habitats.

The total number of garbage dumps and meat shops across all the habitat types were 39. The total number of meat shops across urban core areas were 66. The number of meat shops keeps changing, as many of them are makeshift type. The meat shops were of two types: Permanent (inside the building) and Temporary (in the open areas). Birds were mainly observed to be associated with the temporary shops or the big open market areas. The bird species mainly associated to the meat shops are Cattle Egret and House Crow. There are considerable meet shops and bird association in Kharghar, Khanda Colony, Old Panvel and Ulwe area. The considerably active bird association with meat shops are present in the following shops:

Table 7: Meat shops and bird association in the study area

Sl. No.	Name	Area	Lattitude	Longitude	Types of Meat	Shop type	Bird Species
1	Manoj Vegetables Shop	Khanda Colony	19.00560246	73.11490048	Chicken and Mutton	Temporary	Cattle Egret
2	Near Laxmi Online	Old Panvel	18.99262107	73.11517364	Chicken	Temporary	House Crow
3	Untitled Shop	Ulwe	18.96868	73.017283	Chicken and Mutton	Temporary	House Crow
							Black Kite
4	Near Sai Ankit Residency	Ulwe	18.9750805	73.02839079	Chicken and Mutton	Temporary	House Crow
5	Near GOLDEN PAAN SHOP AND GENERAL	Ulwe	18.97823598	73.03235497	Chicken	Temporary	House Crow

Table 8: List of birds observed near slaughter shops

SL. No.	Family	Common Name	Scientific Name	Resident/Migratory
1	Accipitridae	Black Kite	*Milvus migrans*	R
2	Ardeidae	Cattle Egret	*Bubulcus ibis*	R/LM
3	Corvidae	House Crow	*Corvus splendens*	R
4	Corvidae	Large billed-Crow	*Corvus culminates*	R

Appendix 1

Checklist of birds in the study area

SL. No.	Family	Common Name	Scientific Name	Resident /Migratory	IUCN Status
1	Accipitridae	Shikra	*Accipiter badius*	R	LC
2		Besra	*Accipiter virgatus*	R	LC
3		Crested Serpent-eagle	*Spilornis cheela*	R/LM	LC
4		Black-winged Kite	*Elanus caeruleus*	R	LC
5		Black Kite	*Milvus migrans*	R	LC
6		Brahminy Kite	*Heliasturindus*	R	LC
7		Western Marsh-harrier	*Circus aeruginosus*	M	LC
8		White-bellied Sea-eagle	*Haliaeetus leucogaster*	R	LC
9		Indian Spotted Eagle	*Aquila hastata*	R	VU
10		Greater Spotted Eagle	*Aquila clanga*	M	VU
11		Black-shouldered Kite	*Elanus axillaris*	Nomadic	LC
12		Crested Goshawk	*Accipiter trivirgatus*	R	LC
13		Booted Eagle	*Hieraaetus pennatus*	M	LC
14		White-eyed Buzzard	*Butastur teesa*	R	LC
15		Oriental Honey-buzzard	*Pernis ptilorhynchus*	M	LC
16		Pied Harrier	*Circus melanoleucos*	M	LC
17	Acrocephalidae	Blyth's Reed-warbler	*Acrocephalus dumetorum*	M	LC
18		Booted Warbler	*Iduna caligata*	M	LC
19		Clamorous Reed-warbler	*Acrocephalus stentoreus*	M	LC
20	Alaudidae	Ashy-crowned Sparrow-lark	Eremopterix griseus	R	*LC*
21		Rufous-tailed Lark	*Ammomanes phoenicura*	R	LC
22		Malabar Lark	*Galerida malabarica*	R	LC
23	Alcedinidae	White-breasted Kingfisher	*Halcyon smyrnensis*	R	LC
24		Pied Kingfisher	*Ceryle rudis*	R	LC
25		Black-capped Kingfisher	*Halcyon pileata*	R	LC
26		Common Kingfisher	*Alcedo atthis*	R	LC
27	Anatidae	Lesser Whistling-duck	*Dendrocygna javanica*	R/LM	LC
28		Indian Spot-billed Duck	*Anas poecilorhyncha*	R	LC
29		Northern Shoveler	*Spatula clypeata*	M	LC
30		Northern Pintail	*Anas acuta*	M	LC
31		Garganey	*Anas querquedula*	M	LC
32		Gadwall	*Anas strepera*	M	LC
33		Common Teal	*Anas crecca*	M	LC
34		Eurasian Wigeon	*Anas penelope*	M	LC
35		Ruddy Shelduck	*Tadorna ferruginea*	M	LC
36		African Comb Duck	*Sarkidiornis melanotos*	M	LC
37		Common Shelduck	*Tadorna tadorna*	M	LC

38		Cotton Pygmy-goose	*Nettapus coromandelianus*	M	LC
39		Mallard	*Anas platyrhynchos*	M	LC
40	*Apodidae*	Little Swift	*Apus affinis*	M	LC
41		Asian Palm-swift	*Cypsiurus balasiensis*	R	LC
42	*Ardeidae*	Indian Pond-heron	*Ardeola grayii*	R/LM	LC
43		Grey Heron	*Ardea cinerea*	R/LM	LC
44		Purple Heron	*Ardea purpurea*	R/LM	LC
45		Green-backed Heron	*Butorides striata*	R	LC
46		Black-crowned Night-heron	*Nycticorax nycticorax*	R/LM	LC
47		Great White Egret	*Ardea alba*	R	LC
48		Intermediate Egret	*Mesophoyx intermedia*	R/LM	LC
49		Little Egret	*Egretta garzetta*	R/LM	LC
50		Western Reef-egret	*Egretta gularis*	R/LM	LC
51		Cattle Egret	*Bubulcus ibis*	R/LM	LC
52		Black Bittern	*Ixobrychus flavicollis*	M	LC
53		Cinnamon Bittern	*Ixobrychus cinnamomeus*	M	LC
54		Ashy Woodswallow	*Artamus fuscus*	M	LC
55	*Artamidae*	Scarlet Minivet	*Pericrocotus flammeus*	R	LC
56	Campephagidae	Small Minivet	*Pericrocotus cinnamomeus*	R	LC
57	Bucerotidae	Indian Grey Hornbill	*Ocyceros birostris*	R	LC
58	Caprimulgidae	Indian Nightjar	*Caprimulgus asiaticus*	R	LC
59		Savanna Nightjar	*Caprimulgus affinis*	R	LC
60	*Charadriidae*	Red-wattled Lapwing	*Vanellus indicus*	R	LC
61		Yellow-wattled Lapwing	*Vanellus malabaricus*	R	LC
62		Pacific Golden Plover	*Plover Pluvialis fulva*	M	LC
63		Grey Plover	*Pluvialis squatarola*	M	LC
64		Little Ringed Plover	*Charadrius dubius*	R	LC
65		Kentish Plover	*Charadrius alexandrinus*	M	LC
66		Common Ringed Plover	*Charadrius hiaticula*	M	LC
67		Greater Sandplover	*Charadrius leschenaultii*	M	LC
68		Lesser Sandplover	*Charadrius mongolus*	M	LC
69	*Ciconiidae*	Painted Stork	*Mycteria leucocephala*	R/LM	NT
70		Black Stork	*Ciconia nigra*	M	LC
71		Asian Openbill	*Anastomus oscitans*	R/LM	LC
72		Asian Woollyneck	*Ciconia episcopus*	R	VU
73	Cisticolidae	Plain Prinia	*Prinia inornata*	M	LC
74		Ashy Prinia	*Prinia socialis*	R	LC
75		Jungle Prinia	*Prinia sylvatica*	R	LC
76		Common Tailorbird	*Orthotomus sutorius*	R	LC
77		Grey-breasted Prinia	*Prinia hodgsonii*	R	LC
78	*Columbidae*	Rock Dove	*Columba livia*	R	LC
79		Laughing Dove	*Spilopelia senegalensis*	R	LC

80		Western Spotted Dove	*Spilopelia chinensis*	R	LC
81		Oriental Turtle-dove	*Streptopelia orientalis*	M	LC
82		Yellow-footed Green-pigeon	*Treron phoenicoptera*	R	LC
83	Coraciidae	Indian Roller	*Coracias benghalensis*	R	LC
84	Corvidae	House Crow	*Corvus splendens*	R	LC
85		Indian Jungle Crow (Large billed-Crow)	*Corvus culminatus*	R	LC
86		Rufous Treepie	*Dendrocitta vagabunda*	R	LC
87	Cuculidae	Greater Coucal	*Centropus sinensis*	R	LC
88		Western Koel	*Eudynamys scolopaceus*	M	LC
89		Jacobin Cuckoo	*Clamatorja cobinus*	SM	LC
90		Common Hawk-cuckoo	*Hierococcyx varius*	R	LC
91		Grey-bellied Cuckoo	*Cacomantis passerinus*	R	LC
92	Dicaeidae	Pale-billed Flowerpecker	*Dicaeum erythrorhynchos*	Resident	LC
93		Thick-billed Flowerpecker	*Dicaeum agile*	R	LC
94	Dicruridae	Black Drongo	*Dicrurus macrocercus*	R	LC
95		Ashy Drongo	*Dicrurus leucophaeus*	M	LC
96		Bronzed Drongo	*Dicrurus aeneus*	R	LC
97		White-bellied Drongo	*Dicrurus caerulescens*	R	LC
98	Estrildidae	Red Avadavat	*Amandava amandava*	R	LC
99		Scaly-breasted Munia	*Lonchura punctulata*	R	LC
100		Tricoloured Munia	*Lonchura malacca*	R	LC
101		Indian Silverbill	*Euodice malabarica*	R	LC
102		White-rumped Munia	*Lonchura striata*	R	LC
103	Falconidae	Peregrine Falcon	*Falco peregrinus*	M	LC
104		Amur Falcon	Falco amurensis	M	LC
105	Fringillidae	Common Rosefinch	*Carpodacus erythrinus*	M	LC
106	Glareolidae	Oriental Pratincole	*Glareola maldivarum*	M	LC
107	Hirudinidae	Barn Swallow	*Hirundo rustica*	M	LC
108		Wire-tailed Swallow	*Hirundo smithii*	R	LC
109		Dusky Crag Martin	*Ptyonoprogne concolor*	R	LC
110	Irenidae	Common Iora	*Aegithina tiphia*	R	LC
111	Jacanidae	Bronze-winged Jacana	*Metopidius indicus*	R	LC
112	Laniidae	Long-tailed Shrike	*Lanius schach*	M	LC
113		Brown Shrike	*Lanius cristatus*	M	LC
114	Laridae	Heuglin's Gull	*Larus heuglini*	M	LC
115		Brown-headed Gull	*Chroicocephalus brunnicephalus*	M	LC
116		Black-headed Gull	*Chroicococephalus ridibundus*	M	LV
117		Slender-billed Gull	*Chroicocephalus genei*	M	LC
118		Common Gull-billed Tern	*Gelochelidon nilotica*	M	LC
119		Caspian Tern	*Hydroprogne caspia*	M	LC
120		Common Tern	*Sterna hirundo*	M	LC

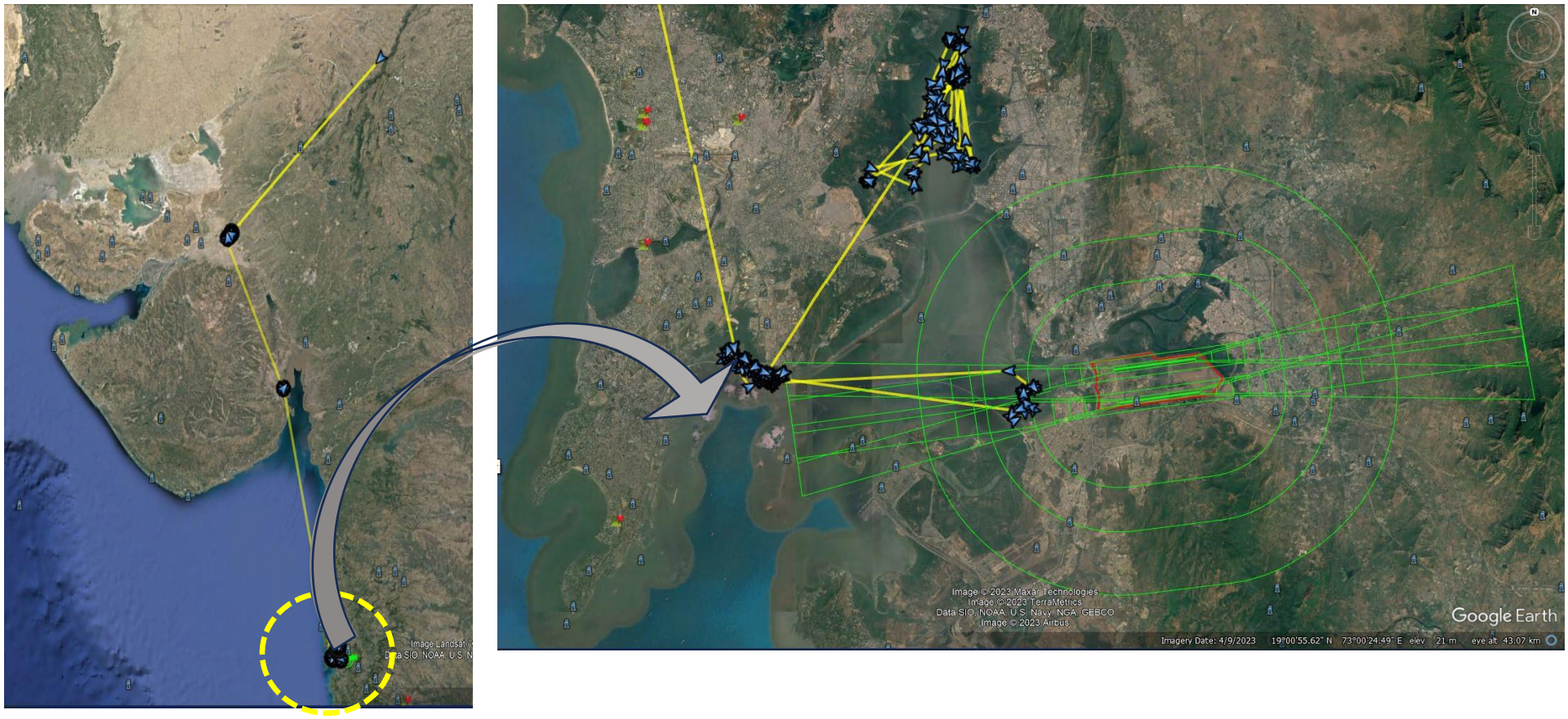
121		Little Tern	*Sternula albifrons*	M	LC
122		Whiskered Tern	*Chlidonia shybrida*	M	LC
123		River Tern	*Sterna aurantia*	R	VC
124		Indian Skimmer	*Rynchopsalbicollis*	R/LM	VU
125	Leiotrichidae	Jungle Babbler	*Argya striata*	R	LC
126	Megalaimidae	Brown-headed Barbet	*Psilopogon zeylanicus*	R	LC
127		Coppersmith Barbet	*Psilopogon haemacephalus*	R	LC
128	Meropidae	Asian Green Bee-eater	*Merops orientalis*	R	LC
129		Blue-tailed Bee-eater	*Merops philippinus*	M	LC
130	Monarchinae	Indian Paradise-flycatcher	*Terpsiphone paradise*	R/BM	LC
131	Motacillidae	Western Yellow Wagtail	*Motacilla flava*	M	LC
132		Grey Wagtail	*Motacilla cinerea*	M	LC
133		White Wagtail	*Motacilla alba*	M	LC
134		Paddyfield Pipit	*Anthus rufulus*	R	LC
135		White-browed Wagtail	*Motacilla maderaspatensis*	R	LC
136		Blyth's Pipit	*Anthus godlewskii*	M	LC
137		Forest Wagtail	*Dendronanthus indicus*	M	LC
138	Muscicapidae	Indian Robin	*Copsychus fulicatus*	R	LC
139		Oriental Magpie-robin	*Copsychus saularis*	R	LC
140		Desert Wheatear	*Oenanthe deserti*	M	LC
141		Blue Rock-thrush	*Monticola solitarius*	R	LC
142		Common Stonechat	*Saxicola torquatus*	M	LC
143		Tickell's Blue-flycatcher	*Cyornis tickelliae*	R/LM	LC
144		Bluethroat	*Cyanecula svecica*	M	LC
145		Black Redstart	*Phoenicurus ochruros*	M	LC
146		Asian Brown Flycatcher	*Muscicapa dauurica*	M	LC
147		Blue Rock-thrush	*Monticola solitarius*	M	LC
148		Isabelline Wheater	*Oenanthe isabellina*	M	LC
149	Nectariniidae	Purple-rumped Sunbird	*Leptocoma zeylonica*	R	LC
150		Purple Sunbird	*Cinnyris asiaticus*	R	LC
151		Sahyadri Sunbird	*Aethopyga vigorsii*	R	LC
152		Loten's Sunbird	*Cinnyris lotenius*	R	LC
153	*Oriolidae*	Indian Golden Oriole	*Oriolus oriolus*	R/LM	LC
154		Western Black-headed Oriole	*Oriolus brachyrynchus*	R	LC
155		Black-hooded Oriole	*Oriolus xanthornus*	R	LC
156	Pandionidae	Osprey	*Pandion haliaetus*	M	LC
157	Passeridae	House Sparrow	*Passer domesticus*	R	LC
158	Pellorneidae	Puff-throated Babbler	*Pellorneum ruficeps*	R	LC
159	Phalacrocoracidae	Little Cormorant	*Phalacrocorax niger*	R/LM	LC
160		Great Cormorant	*Phalacrocorax carbo*	M	LC
161		Indian Cormorant	*Phalacrocorax fuscicollis*	R/LM	LC
162	Phasianidae	Red Spurfowl	*Galloperdix spadicea*	R	LC

163		Common Quail	*Coturnix coturnix*	M	LC
164		Indian Peafowl	*Pavo cristatus*	R	LC
165		Jungle Bush-quail	*Perdicula asiatica*	R	LC
166	Phoenicopteridae	Greater Flamingo	*Phoenicopterus roseus*	M	LC
167		Lesser Flamingo	*Phoeniconaias minor*	M	NT
168	*Phylloscopidae*	Greenish Warbler	*Phylloscopus trochiloides*	M	LC
169		Common Chiffchaff	*Phylloscopus collybita*	M	LC
170	*Ploceinae*	Baya Weaver	*Ploceus philippinus*	R	LC
171	Podicipedidae	Little Grebe	*Tachybaptusruficollis*	R	LC
172	Psittaculidae	Rose-ringed Parakeet	*Psittacula krameri*	R	LC
173		Alexandrine Parakeet	*Psittacula eupatria*	R	NT
174		Plum-headed Parakeet	*Psittacula cyanocephala*	R	LC
175	Pycnonotidae	White-eared Bulbul	*Pycnonotus leucotis*	R	LC
176		White-browed Bulbul	*Pycnonotus luteolus*	R	LC
177		Red-vented Bulbul	*Pycnonotus cafer*	R	LC
178		Red-whiskered Bulbul	*Pycnonotus jocosus*	R	LC
179	Rallidae	White-breasted Waterhen	*Amaurornis phoenicurus*	R	LC
180		Purple Swamphen	*Porphyrio porphyrio*	R	LC
181		Common Moorhen	*Gallinula chloropus*	R	LC
182		Eurasian Coot	*Fulica atra*	R/LM	LC
183		Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	R/LM	LC
184	Recurvirostridae	Black-winged Stilt	*Himantopus himantopus*	R	LC
185		Pied Avocet	*Recurvirostra avosetta*	M	LC
186	Rhipidurinae	White-browed Fantail	*Rhipidura aureola*	R	LC
187		White-spotted Fantail	*Rhipidura albogularis*	M	LC
188	Rostratulidae	Greater Painted-snipe	*Rostratula benghalensis*	R	LC
189	Scolopacidae	Ruff	*Philomachus pugnax*	M	LC
190		Common Snipe	*Gallinago gallinago*	M	LC
191		Whimbrel	*Numenius phaeopus*	M	LC
192		Eurasian Curlew	*Numenius arquata*	M	NT
193		Dunlin	*Calidris alpina*	M	LC
194		Ruddy Turnstone	*Arenaria interpres*	M	LC
195		Black-tailed Godwit	*Limosa limosa*	M	NT
196		Bar-tailed Godwit	*Limosa lapponica*	M	LC
197		Common Greenshank	*Tringa nebularia*	M	LC
198		Common Redshank	*Tringa totanus*	M	LC
199		Marsh Sandpiper	*Tringa stagnatilis*	M	LC
200		Curlew Sandpiper	*Calidris ferruginea*	M	NT
201		Wood Sandpiper	*Tringa glareola*	M	LC
202		Terek Sandpiper	*Xenus cinereus*	M	LC
203		Common Sandpiper	*Actitis hypoleucos*	M	LC
204		Green Sandpiper	*Tringa ochropus*	M	LC

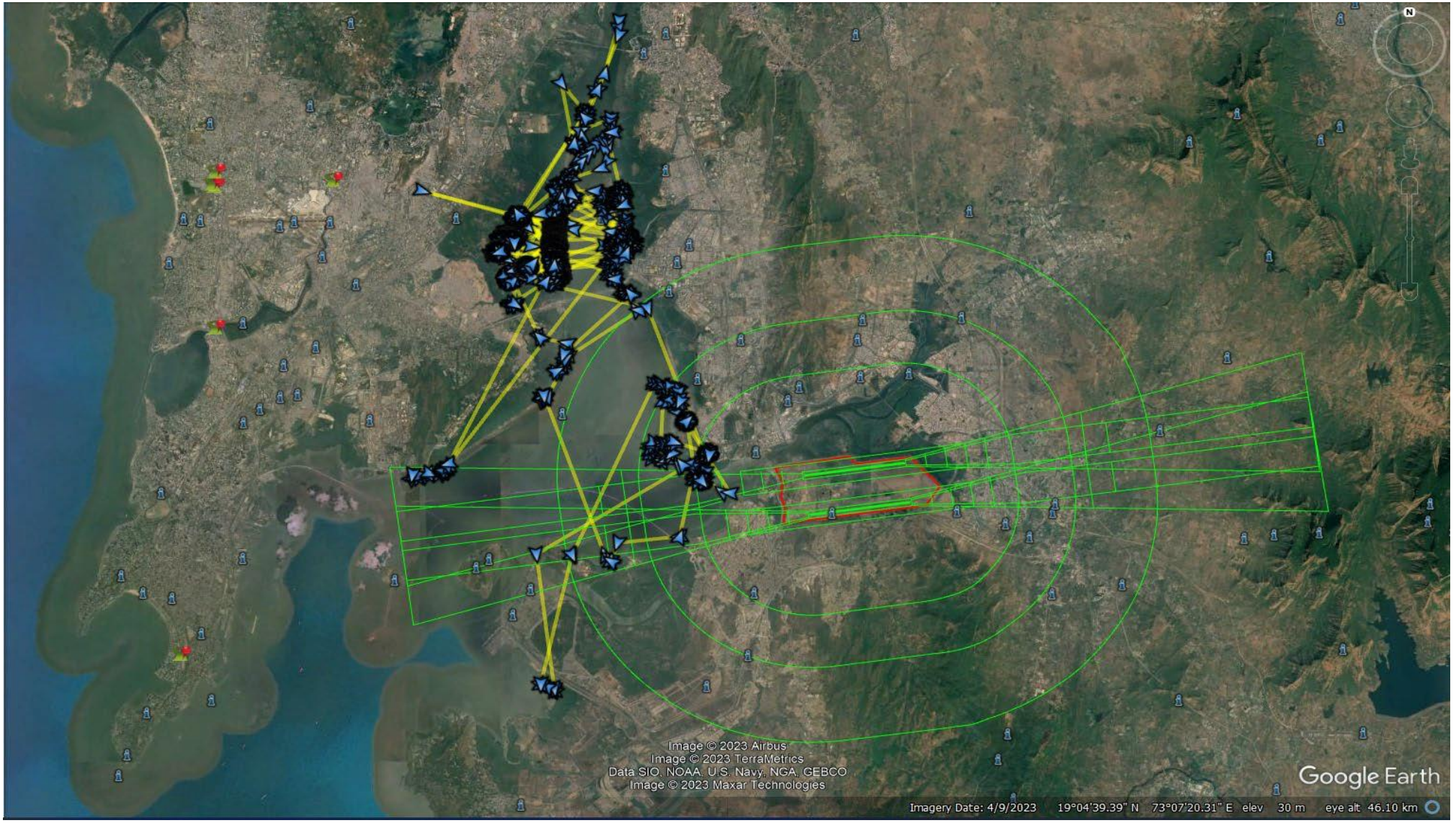
205		Broad-billed Sandpiper	*Limicola falcinellus*	M	LC
206		Little Stint	*Calidris minuta*	M	LC
207		Temminck's Stint	*Calidris temminckii*	M	LC
208	Strigidae	Spotted Owlet	*Athene brama*	R	LC
209	Sturnidae	Common Myna	*Acridotheres tristis*	R	LC
210		Jungle Myna	*Acridotheres fuscus*	R	LC
211		Asian Pied Starling	*Gracupica contra*	R	LC
212		Chestnut-tailed Starling	*Sturnia malabarica*	R	LC
213		Brahminy Starling	*Sturnia pagodarum*	R	LC
214		Rosy Starling	*Pastor roseus*	M	LC
215	Sylviidae	Yellow-eyed Babbler	*Chrysomma sinense*	R	LC
216		Lesser Whitethroat	*Sylvia curruca*	M	LC
217		Zitting Cisticola	*Cisticola juncidis*	R	LC
218	Threskiornithidae	Black-headed Ibis	*Threskiornismelano cephalus*	R/LM	NT
219		Red-naped Ibis	*Pseudibis papillosa*	R	LC
220		Glossy Ibis	*Plegadis falcinellus*	M	LC
221		Eurasian Spoonbill	*Platalealeu corodia*	R/LM	LC
222	Turdidae	Orange-headed Thrush	*Geokichla citrina*	M	LC
223		Malabar Whistling-thrush	*Myophonu shorsfieldi*	R	LC
224	Turnicidae	Yellow-legged Buttonquail	*Turnix tanki*	R/LM	LC
225		Barred Buttonquail	*Turnix suscitator*	R	LC
226	Tytonidae	Common Barn-owl	*Tyto alba*	R	LC
227	Upupidae	Common Hoopoe	*Upupa epops*	R/LM	LC
228	Vangidae	Common Woodshrike	*Tephrodornis pondicerianus*	R	LC
229	Zosteropidae	Indian White-eye	*Zosterops palpebrosus*	M	LC

Appendix-2

BNHS – Bird Flight Data (5FBC2910 – 2022-12)



BNHS – Bird Flight Data (5FBC2910 – V20-2022-06)




BNHS – Bird Flight Data (6DBC2910_V20_2022_03)
Image © 2023 Airbus
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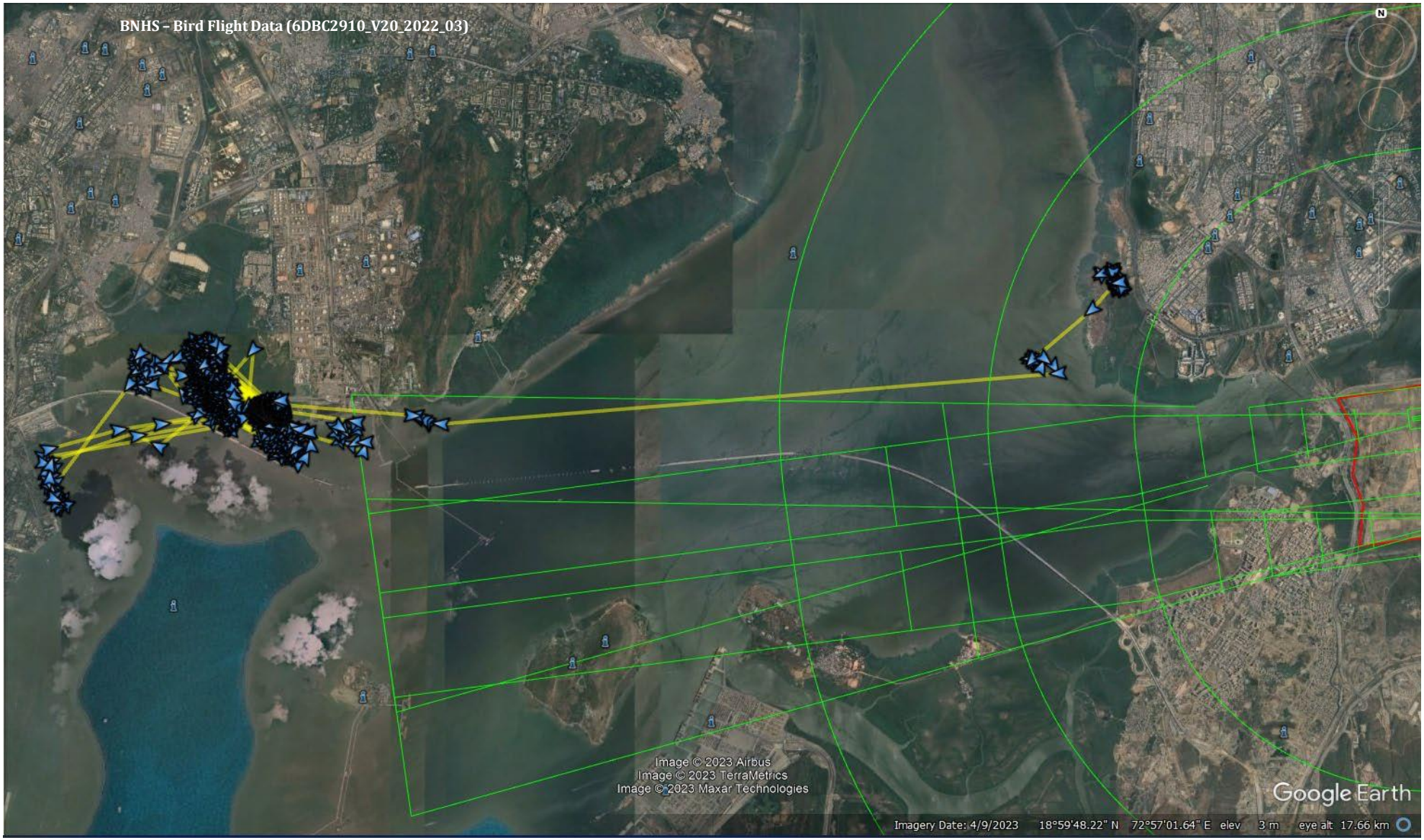
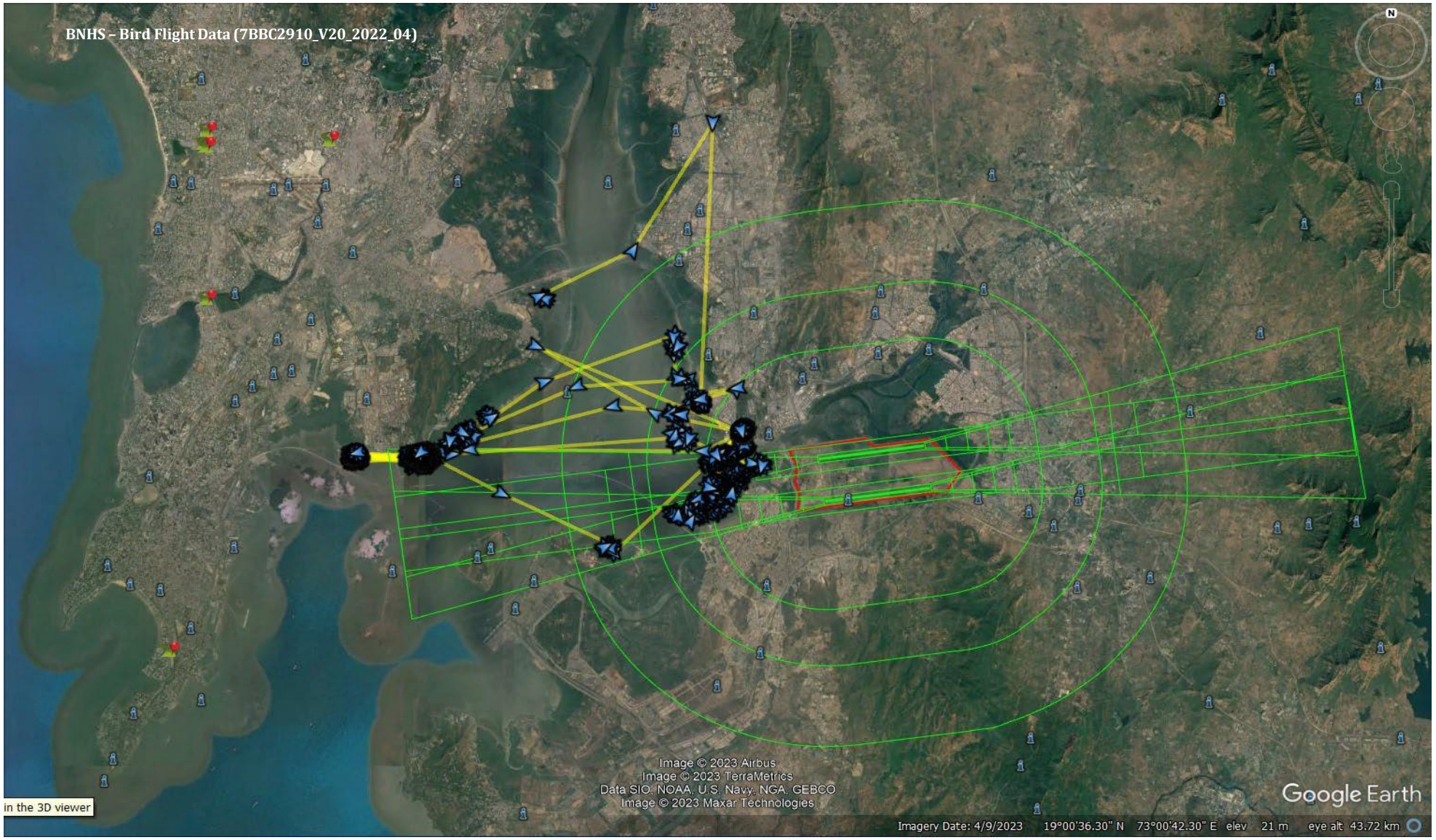
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image © 2023 Maxar Technologies
Google Earth
Imagery Date: 4/9/2023 19°00'26.15" N 73°00'32.55" E elev 19 m eye alt 43.27 km


BNHS – Bird Flight Data (6DBC2910_V20_2022_03)
N
Image © 2023 Airbus
Image © 2023 TerraMetrics
Image © 2023 Maxar Technologies
Google Earth
Imagery Date: 4/9/2023 18°59'48.22" N 72°57'01.64" E elev 3 m eye alt 17.66 km


BNHS – Bird Flight Data (7BBC2910_V20_2022_04)
Image © 2023 Airbus
Image © 2023 TerraMetrics
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image © 2023 Maxar Technologies
Google Earth
Imagery Date: 4/9/2023 19°00'36.30" N 73°00'42.30" E elev 21 m eye alt 43.72 km

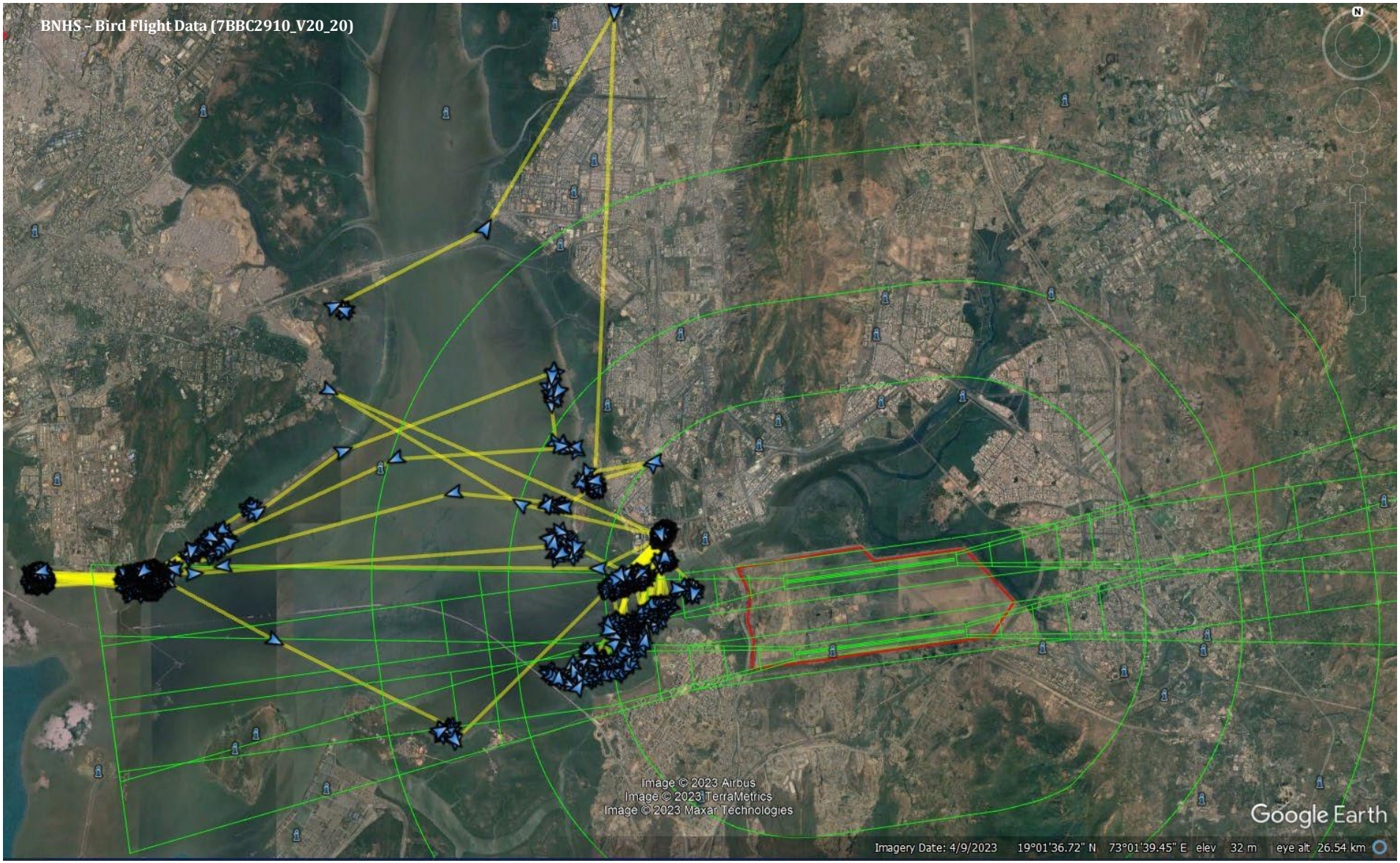

BNHS – Bird Flight Data (7BBC2910_V20_20)
Image © 2023 Airbus
Image © 2023 TerraMetrics
Image © 2023 Maxar Technologies
Google Earth
Imagery Date: 4/9/2023 19°01'36.72" N 73°01'39.45" E elev 32 m eye alt 26.54 km

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Photo Plate 1. Habitats

Greenspace habitat

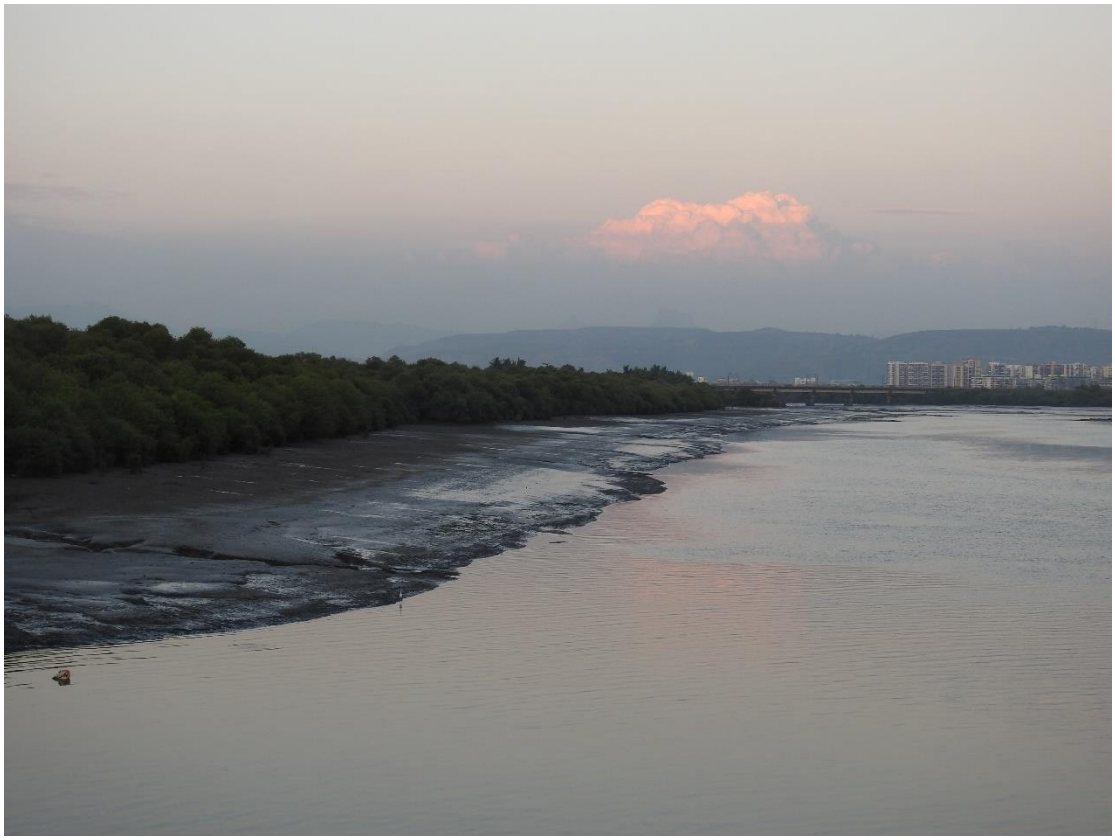
Urban habitat adjacent to Mangroves

Inland Wetland

Mangroves

NMIA Site

Degraded Habitat



Creek

Agriculture

2. Birds in different habitats

Indian Paradise-flycatcher (*Terpsiphone paradisi*)

2. Oriental Magpie-robin (*Copsychus saularis*)

Red-vented Bulbul (*Pycnonotus cafer*)

Western Marsh-harrier (*Circus aeruginosus*)

Blue-tailed Bee-eater (*Merops philippinus*)

White Wagtail (*Motacilla alba*)

Scaly-breasted Munia (*Lonchura punctulata*)

Blyth's Pipit (*Anthus godlewskii*)

Indian Roller (*Coracias benghalensis*)

Jungle Myna (*Acridotheres fuscus*)

Black-winged Kite (*Elanus caeruleus*)

White-bellied Drongo (*Dicrurus caerulescens*)

Common Rosefinch (*Carpodacus erythrinus*)

Nest of male Baya Weaver (*Ploceus philippinus*)

Malabar Whistling-thrush (*Myophonus horsfieldii*)

Malabar Lark (*Galerida malabarica*)

Amur Falcon (*Falco amurensis*)

Common Kestrel (*Falco tinnunculus*)

Common Stonechat female (*Saxicola torquatus*)

Laughing Dove (*Spilopelia senegalensis*)

Wire-tailed Swallow (*Hirudo smithii*)

Loten's Sunbird (*Cinnyris lotenius*)

Common Kingfisher (*Alcedo atthis*)

Alexandrine Parakeet (*Palaeornis eupatria*)

Indian Grey Hornbill (*Ocyceros birostris*)

Jungle Babbler (*Argya striata*)

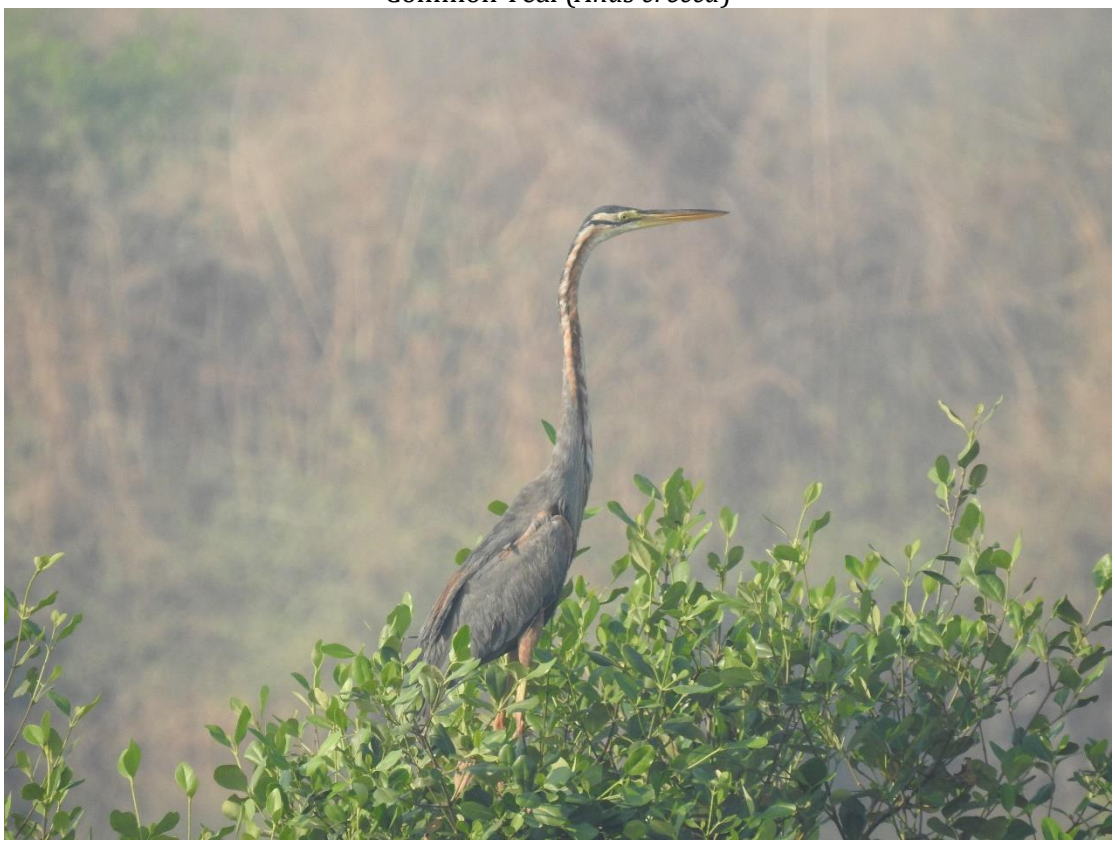
Plain Prinia (*Prinia inornata*)

Black Kite (*Milvus migrans*)

3. Birds in wetlands and creek

Grey Heron (*Ardea cinerea*)

Common Teal (*Anas crecca*)



Purple Heron (*Ardea purpurea*)

Northern Pintail (*Anas acuta*)

Gadwall (*Mareca strepera*)

Purple Swamphen (*Porphyrio porphyrio*)

Yellow-wattled Lapwing (*Vanellus malabaricus*)

Indian Pond-heron (*Ardeola grayii*)

Intermediate Egret (*Ardea intermedia*)

Eurasian Spoonbill (*Platalea leucorodia*)

Western Reef-egret (*Egretta gularis*)

Flock of Black-tailed Godwit (*Limosa limosa*)

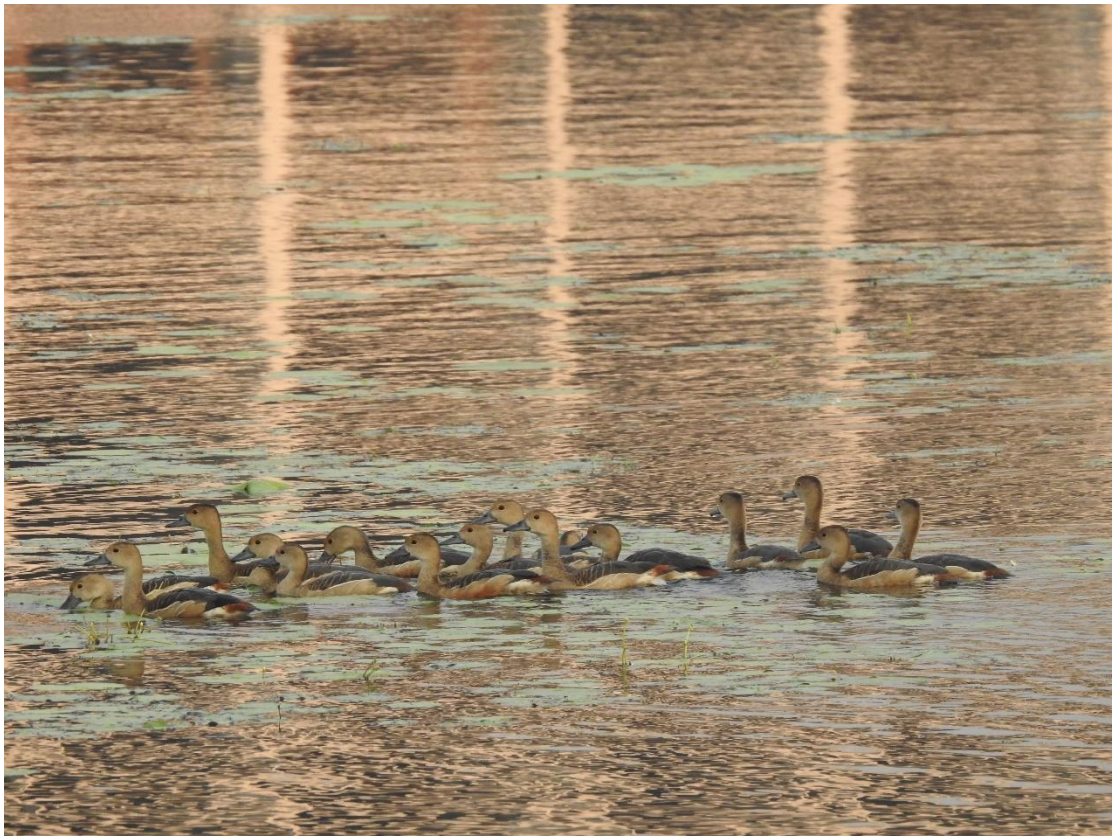
Flock of Little Cormorant (*Microcarbo niger*)

Common Coot (*Fulica atra*)

African Comb Duck (*Sarkidiornis melanotos*)

Grey Plover (*Pluvialis squatarola*) with other migrants

Asian Openbill (*Anastomus oscitans*) & Black-headed Ibis (*Threskiornis melanocephalus*)



Flock of Lesser Whistling-duck (*Dendrocygna javanica*)

Ruddy Shelduck (*Tadorna ferruginea*)

Flock of Curlew Sandpiper (*Calidris ferruginea*) & Little Stint (*Calidris minuta*)

Flock of various migratory small waterbirds

Little Grebe (*Tachybaptus ruficollis*) with its offspring

Bronze-winged Jacana (*Metopidius indicus*) with its subadult

Glossy Ibis (*Plegadis falcinellus*) with Bronze-winged Jacana

Flock of Common Redshank (*Tringa totanus*)

Flock of Lesser Flamingo (*Phoeniconaias minor*)

Mixed Flock of Painted Stork (*Mycteria leucocephala*) with Eurasian Spoonbill & Intermediate Egret

Flock of Cattle Egret (*Bubulcus ibis*) in the meat shop